Energy Statement

3no. New Flats

170-175 High Street, Teddington.

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1. Executive Summary

This document is in response to the London Borough of Richmond Upon Thames Council planning policy in respect of energy consumption and carbon dioxide emissions relating to the new development at 170 – 175 High Street, Teddington.

It has been produced with reference to the Council's planning policy and the methodology used for any calculations is consistent with the London Renewables Toolkit and Part L of the Building Regulations. Figures used in the Energy calculations are taken from current SAP calculations.

Proposed Development

The proposed development consists of the construction of an additional floor at 170-175 High Street to create 3no new self-contained flats.

Energy saving measures are proposed to be integrated into the design by the appointed design team, to reduce the Developments' Carbon Dioxide Emissions and energy consumption; in doing so, helping to achieve Part L1A compliance.

London Borough of Richmond Upon Thames Council seeks to minimize energy use and promote energy from renewable sources. Developments should aim to achieve a minimum reduction in carbon dioxide emissions of 20% from onsite renewable energy generation (which can include sources of decentralised renewable energy).

There is no district heating system close to the Site, therefore the proposed development cannot be connected to a district heating scheme.

It is proposed that the development will include the following renewable technology:

• 3.2KWp PV Array (23m²)

The predicted annual saving in energy for the development has been calculated as **3349.7 kWh** which equates to a saving of **1599.7 kg CO2/yr.**

This represents a reduction of **32.9%** CO2 emissions from energy efficiency measures and onsite renewable technologies.

The Energy Demand summary & predicted carbon dioxide emissions are shown in Figure 1 below.

A detailed breakdown of the energy demands and carbon emissions for the site can be seen in Appendix A - Energy Demand Assessment, 170-175 High Street.

	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO ₂ emissions (kg pa)	Saving achieved on re sidual CO ₂ emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand & emissions)	16291.2		4520.7	
Proposed scheme after energy efficiency measures a nd CHP ("Residual" energy demand & emissions)	15612.7	4.2%	4350.0	
Proposed scheme after on-site renewables	12941.5	20.6%	2921.0	32.9%
Proposed scheme offset for financial contribution or other "allowable solution"			0	0
Total savings on residual emissions				32.9%

Fig 1. Energy statement sheet

Key energy efficient design measures

The Proposed Development features the following key energy efficient design measures:

High levels of insulation in building fabric and high specification energy efficiency measures including:

- 1. "A" Rated combination boiler
- 2. Delayed start Thermostat
- 3. Time & Temperature Zone Control
- 4. Flue gas heat recovery system
- 5. Air Permeability of 5m³hm²
- 6. 100% low energy lighting
- 7. 100% draft proofed
- 8. External walls U-value of 0.25 W/m²K
- 9. Roof U-value of 0.16 W/m²K
- 10. Glazing U-value of 1.5 W/m²K
- 11. Y value of 0.04 through the use of Accredited Construction Details

Summary of proposed heating and cooling systems

Proposed heating and hot water by efficient Gas boilers.

Choice and impact of renewable energy technologies

3.2 KWp PV array.

2 Feasibility assessment of renewable energy technologies

Solar Hot Water (Thermal)

Solar water heating systems are one of the more familiar renewable technologies used at the moment. They use the energy from the sun to heat water, most commonly for hot water needs. Solar heating systems use a heat collector that is usually mounted on a roof in which a fluid is heated by the sun. This fluid is used to heat water that is stored in either a separate hot water cylinder or in a twin-coil hot water cylinder (the second coil is used to provide additional heating from a boiler or other heat source).

Solar panels would be feasible for this development however the amount is limited due to the water demand and so the saving is not as great as that with PV.

Wind

Wind turbines convert the kinetic energy in wind into mechanical energy that is then converted to electricity. Turbines are available in a range of sizes and designs and can either be free-standing, mounted on a building or integrated into a building structure.

For a development of this size and location only a building mounted turbine could be considered, however due to the building design and location the wind would be very turbulent and the average wind speed in the area is below the recommended level therefore this technology was not deemed feasible.

Photovoltaic (PV) Panels

Photovoltaic (PV) modules convert sunlight directly to DC electricity. The solar cells consist of a thin piece of semiconductor material, in most cases of silicon. Through a process called doping, a very small amount of impurities are added to the semiconductor, which creates two different layers called n-type and p-type layers.

Certain wavelengths of light are able to ionise the silicon atoms, which separates some of the positive charges (holes) from the negative charges (electrons). The holes move into the positive or p-layer and the electrons into the negative or n-layer. These opposite charges are attracted to each other, but most of them can only re-combine by the electrons passing through an external circuit, due to an internal potential energy barrier. This flow of electrons produces a DC current.

PV would be suitable for the development and would provide the necessary saving required. The panels would have to be frame mounted on the flat roof south facing.

Biomass Heating

Biomass is any plant-derived organic material that renews itself over a short period.

Biomass energy systems are based on either the direct or indirect combustion of fuels derived from those plant sources. The most common form of biomass is the direct combustion of wood in treated or untreated forms. The use of biomass is becoming increasingly common in some European countries (some countries such as Austria are heavily dependent on biomass).

The environmental benefits relate to the significantly lower amounts of energy used in biomass production and processing compared to the energy released when they are burnt. This can range from a four-fold return for biodiesel to an approximate 20-fold energy return for woody biomass. Biomass-fuels can be used to produce energy on a continuous basis (unlike renewables such as wind or solar energy) and it can be an economic alternative to fossil fuels as it is a potential source of both heat and electricity.

However Biomass systems have particular design management and maintenance requirements associated with sourcing, transportation and storage and are therefore more commonly used in commercial developments rather than domestic installations. It can be less convenient to operate than mains-supplied fuels such as natural gas and are more management intensive and require expertise in facilities management. Sources of biomass can also fluctuate, so boilers should be specified to operate on a variety of fuels without risk of overheating or tripping out.

A communal biomass system would not be feasible for this development due to use, space and maintenance issues. The system would be quite large and there is no space around the property to locate the boiler, hopper and fuel store that is suitable for deliveries but also appropriate for feeding the boiler.

Ground Source Heat pumps

A heat pump is a device that takes up heat at a certain temperature and releases it at a higher temperature. The essential components of a heat pump are heat exchangers (through which energy is extracted and emitted) and a means of pumping heat between the exchangers. The effectiveness of the heat pump is measured by the ratio of the heating capacity to the effective power input, usually known as the coefficient of performance (COP).

Ground-source heat pumps (GSHP) extract heat from the ground. They are classified as either waterto-air or water-to-water units depending on whether the heat distribution system in the building uses air or water. Ground source heat pumps either use long shallow trenches or deep vertical boreholes to take low grade heat from the ground and then compress it to create higher temperatures.

Ground source heat pumps would not be suitable due to the lack of land space around the property.

Air Source Heat pumps

Air source heat pumps absorb heat from the outside air. This is usually used to heat radiators, underfloor heating systems, or warm air convectors and hot water in your home. An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside.

The system performs down to air temperatures of -20°c which means that they are more than suitable for installations within the UK. Hot water and Heating can be provided 365 days a year. The hot water is produced without the aid of electrical immersions and at 55°c is more than hot enough for baths and showers.

There are two main types of air source heat pump system:

- An air-to-water system distributes heat via your wet central heating system. Heat pumps work much more efficiently at a lower temperature than a standard boiler system would. So they are more suitable for under-floor heating systems or larger radiators, which give out heat at lower temperatures over longer periods of time.
- An air-to-air system produces warm air which is circulated by fans to heat your home. They are unlikely to provide you with hot water as well.

Air source heat pumps would not be deemed suitable due to the lack of space around the property, the size and noise of the systems could also have a detrimental effect on the property and surrounding area.

3 Energy Demand Assessment Summary

A detailed breakdown of the energy demands and carbon emissions for the site can be seen in Appendix A - Energy Demand Assessment, 170-175 High Street.

This document draws on figures from draft Baseline SAP reports for the development to ensure accurate figures. Example SAP report can be seen in:

- Appendix B Baseline SAP Calculations
- Appendix C Improved SAP Calculations
- Appendix D Final SAP Calculations

A summary of all stages of the energy demand assessment from baseline figures to final carbon reduction is shown in Figure 1 earlier in this report.

3.1 Baseline energy demand

'Standard Assessment Procedure - SAP 2009' was used to produce SAP reports for the residential units. The baseline figure was taken from the minimum Part L Buildings Regulation levels of specification for each property.

The excel document shows how the energy efficiency measures proposed reduce the predicted CO2 emissions from baseline levels and section 1 of this report details how this is achieved with high specification building materials.

Baseline energy demand (kWh pa)	16,291.2
Regulated emissions (kg pa)	4520.7

3.2 Heating

The heating and cooling hierarchy has been applied to the design process of the development. It has resulted in large focus on energy efficiency measures as can be seen in Figure 1.

Combined Heat and Power / Tri-generation summary

Energy savings from the use of CHP systems (kWh pa)	0
Emission savings from the use of CHP systems (kg pa)	0
Total regulated emissions after CHP savings (kg pa)	4520.7

3.3 Energy efficiency

The following table demonstrates how the development achieves the reduction in carbon dioxide emissions from energy efficiency measures.

Energy savings from energy efficiency measures (kWh pa)	678.5
Emission savings from energy efficiency measures (kg pa)	170.7
Total regulated emissions after CHP savings and energy efficiency measure s (kg pa) ("residual emissions")	4350.0

3.4 On-site renewables

This development is predicted to achieve a reduction in carbon dioxide emissions of 32.9% from onsite renewables incorporated after energy efficient measures have been taken into account.

Saving on residual emissions from the use of renewables (kg pa)	1429
Saving on residual emissions from the use of renewables (%)	32.9

4 Sustainability Statement

The following section summarises the sustainability approach to the development.

Climate Change adaption, mitigation & Energy

- Y value of 0.04 through the use of Accredited Construction Details
- 100% of new internal fixed lighting and external lighting will be dedicated low-energy.
- Where supplied, white goods will be energy efficient (A+ or A rated).
- Smart meters will be installed to each dwelling to display current consumption data.
- "A" Rated combination boilers with extra low NOx emissions.
- Delayed start Thermostat
- Time & Temperature Zone Control
- Air Permeability of 5m³hm²
- 100% draft proofed
- External walls U-value of 0.25 W/m²K
- Roof U-value of 0.16 W/m²K
- Glazing U-value of 1.5 W/m²K
- No additional 'run off' in to public watercourses.

Materials

- Consideration will be given to using materials and construction that have a low environmental impact, such as those achieving an A+ or A rated under BRE's Green Guide.
- Where possible, materials will be chosen that are responsibly sourced (such as FSC timber), recycled or reclaimed.
- All insulation materials will have a GWP (Global Warming Potential) of 5 or less.

Water Use

• Indoor water use will be restricted by use of fittings with lower flow rates, baths with smaller capacity, dual-flush toilets, and (where applicable) washing machines and dishwashers with low water usage.

Waste

- The contractor will be obligated to produce a Site Waste Management Plan (SWMP) to set targets and monitor to reduce waste and divert from landfill.
- The dwelling will incorporate dedicated internal and external general waste and recyclable storage in accordance with the LA collection.

Health & Wellbeing

- Key rooms have good levels of day lighting, and décor will enhance this (the need for artificial lighting will also be reduced).
- Materials with low VOC emissions will be used.
- Improved acoustic performance between dwellings.

Management

• A robust Home User Guide (HUG) will be provided to the end owner/occupier of the dwelling, providing information on the correct and efficient use of their home and the surrounding area to make the most of nearby amenities.

Ecology

• Any existing features of ecological value will be protected during construction.

Appendix A - 20% Energy Demand Assessment 170-175 High Street, Teddington.

Flat	Flat 1	Flat 2	Flat 3		TOTAL (kWh/yr)		TOTAL (kgCO2/yr)
Summary of BASELINE Energy Demand	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor	Associated Total CO2 (kgCO2/yr)
Hot Water	2122.9	1990.7	1568.8		5682.4	0.198	1125.1
Space Heating	2614.3	1980.2	1954.8		6549.3	0.198	1296.8
Secondary Heating	0.0	0.0	0.0		0.0	0.517	0.0
Pumps & Fans	175.0	175.0	175.0		525.0	0.517	271.4
Lighting	347.6	302.4	169.4		819.3	0.517	423.6
Appliances/Non-regulated	1052.0	889.7	773.6	0.0	2715.2	0.517	1403.8
	6311.8	5337.9	4641.5	0.0			
TOTAL	6311.8	5337.9	4641.5	0.0	16291.2		4520.7
Summary of Energy Demand After Energy Efficiency	Total Energy Demand		Total Energy Demand	Total Energy Demand	Total Energy Demand	Carbon Emission	Associated Total CO2
Measures	(kWh/yr)	Total Energy Demand (kWh/yr)	(kWh/yr)	(kWh/yr)	(kWh/yr)	Factor	(kgCO2/vr)
Hot Water	2122.9	1990.7	1568.8		5682.4	0.198	1125.1
Space Heating	2272.0	1932.3	1780.1		5984.4	0.198	1184.9
Secondary Heating	0.0	0.0	0.0		0.0	0.517	0.0
Pumps & Fans	175.0	175.0	175.0		525.0	0.517	271.4
Lighting	347.0	302.4	169.4		818.7	0.517	423.3
Appliances/Non-regulated	983.4	880.1	738.7	0.0	2602.1	0.517	1345.3
	5900.3	5280.5	4431.9	0.0			
TOTAL	5900.3	5280.5	4431.9	0.0	15612.7		4350.0
Summary of Energy Demand After Renewables	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor (kgCO2/kWh)	Associated Total CO2 (kgCO2/yr)
Hot Water	2122.9	1990.7	1568.8		5682.4	0.198	1125.1
Space Heating	2272.0	1980.2	1780.1		6032.3	0.198	1194.4
Secondary Heating	0.0	0.0	0.0		0.0	0.517	0.0
Pumps & Fans	175.0	175.0	175.0		525.0	0.517	271.4
1 Selection at					010 7	0.517	423.3
Lighting	347.0	302.4	169.4		818.7	0.517	
PV Elec Generated	347.0 -1011.8	302.4 -1030.1	169.4 -686.7		-2728.6	0.529	-1443.5
PV Elec Generated Appliances/Non-regulated	347.0 -1011.8 983.4	302.4 -1030.1 889.7	-686.7 738.7	0.0	-2728.6 2611.7	0.529	-1443.5 1350.2
PV Elec Generated Appliances/Non-regulated	347.0 -1011.8 983.4 4888.4	302.4 -1030.1 889.7 4307.8	169.4 -686.7 738.7 3745.2	0.0	-2728.6 2611.7	0.517 0.529 0.517	-1443.5 1350.2

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	4520.7
Improved emissions (after application of energy efficiency measures)	4350.0
Improved emissions (after incorporation of efficient energy supply)	4350.0
Improved emissions (after incorporation of renewable energy technology) % CO2 displaced in total	2921.0
% CO2 displaced in total	35.39%
% CO2 displaced by energy efficiency measures	3.77%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	31.6%

	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO ₂ emissions (k g pa)	Saving achieved on re sidual CO2 emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand & emissions)	16291.2		4520.7	
Proposed scheme after energy efficiency measures and CHP ("Residual" energy demand & emissions)	15612.7	4.2%	4350.0	
Proposed scheme after on-site renewables	12941.5	20.6%	2921.0	35.4%
Proposed scheme offset for financial contribution or oth er "allowable solution"			0	0
Total savings on residual emissions				35.4%

User Details:											
Assessor Name: Software Name:	Dan Watt Stroma FSAP 200	9		Stroma Softwa	a Num are Ver	STRO Versio	000002 n: 1.4.0.76				
		Pro	operty A	ddress:	Flat 8 B	Baseline					
Address :	172 High St, Teddin	gton, TW	'11 8HU	ļ							
1. Overall dwelling dimer	ISIONS:		A	(A	:) (a la una a (una 2)		
Ground floor			Area 6	3.2	(1a) x	2.	67	(2a) =	168.74	(3a)	
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 63.2 (4)											
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	168.74	(5)	
2. Ventilation rate:		_									
	main Se heating h	econdary eating	/	other		total			m ³ per hour	,	
Number of chimneys	0 +	0] + [0] = [0	x 4	40 =	0	(6a)	
Number of open flues	0 +	0	i + Г	0] = [0	x 2	20 =	0	(6b)	
Number of intermittent fan	IS		J <u>L</u>		л <u>с</u>	2	x 1	0 =	20	(7a)	
Number of passive vents						0	x 1	0 =	0	(7b)	
Number of flueless gas fire	es					0	x 4	40 =	0	(7c)	
					L			l Air ab			
					_			Air Ch	anges per no	ur ¬	
Infiltration due to chimney	s, flues and fans = (6)	a)+(6b)+(7a ed. proceed	to (17). o	′c) = therwise c	ontinue fro	20 0 <i>m (9) to (</i>	-	÷ (5) =	0.12	(8)	
Number of storeys in the	e dwelling (ns)	a, p. 0000a	,,			(0) (0 ([0	(9)	
Additional infiltration	- · ·						[(9)-	1]x0.1 =	0	(10)	
Structural infiltration: 0.2	25 for steel or timber f	rame or (0.35 for	masonr	y constr	uction		ĺ	0	(11)	
if both types of wall are pre deducting areas of opening	esent, use the value corres rs): if equal user 0.35	ponding to a	the greate	er wall area	a (after						
If suspended wooden flo	oor, enter 0.2 (unseal	ed) or 0.1	l (seale	d), else (enter 0			[0	(12)	
If no draught lobby, ente	er 0.05, else enter 0							ĺ	0	(13)	
Percentage of windows	and doors draught st	ripped						ĺ	0	(14)	
Window infiltration			(0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)	
Infiltration rate			((8) + (10) -	+ (11) + (1	2) + (13) +	- (15) =		0	(16)	
Air permeability value, o	50, expressed in cub	ic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	6.5	(17)	
If based on air permeabilit	ty value, then (18) = [(1	7) ÷ 20]+(8)), otherwis	se (18) = (16)				0.44	(18)	
Air permeability value applies	if a pressurisation test has	been done	e or a deg	ree air per	meability i	is being us	sed	r			
Shelter factor	shellered		((20) = 1 - [0.075 x (1	9)] =			0.78	(19)	
Infiltration rate incorporati	ng shelter factor		((21) = (18)	x (20) =			l	0.34	$(21)^{(20)}$	
Infiltration rate modified fo	r monthly wind speed	l						l	0.04		
Jan Feb I	Mar <u>Apr</u> May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind spe	ed from Table 7										
(22)m= 5.4 5.1 5	5.1 4.5 4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1			
Wind Factor (222)m - (22)m ÷ 4										
(22a)m= 1.35 1.27 1	.27 1.12 1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27			
					-						

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	elter an	d wind s	peed) =	(21a) x	(22a)m	_			_	
<u> </u>	0.46	0.44	0.44	0.39	0.35	0.34	0.32	0.32	0.36	0.39	0.41	0.44		
Calcula If ma	ate ette	<i>Ctive air</i> al ventila	change	rate for ti	he appli	cable ca	se							(220)
lf exh	aust air h	eat pump	using Appe	endix N. (2	3b) = (23a	i) x Fmv (e	equation (1	N5)), othe	rwise (23b) = (23a)			0	(23a)
lf bala	anced wit	h heat reco	overv: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =) = (200)			0	(230)
a) If					with hor				$(2)^{m} - (2)^{m}$	2b) m i (22h) v [1 (220)		(230)
a) II (24a)m-									$\frac{1}{1} = \frac{2}{1}$	$\frac{20}{1}$		1 - (230)) - 100j]	(24a)
(24a)III-					without	boot roc)m (2)	26)m (22h)	0	J	(210)
0) II (24b)m-					o			1 0 (24L	D = (22)	$\frac{20}{1}$	230)	0	1	(24b)
(240)III-										0	0	0	J	(210)
C) II	if (22b)r	n < 0.5	(23b) t	then (24c	(23b)). other	ventilatio vise (24	c) = (22b)	(1) m + 0	$5 \times (23^{1})$)			
(24c)m=	0	0	0	0	0	0	0		0	0	0	0	1	(24c)
d) If	natural	I ventilatio	I on or wh	ole hous	e positiv	l /e input :	I ventilatio	I on from l	l oft				1	
u) ii	if (22b)r	n = 1, th	en (24d)	m = (22k))m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.61	0.6	0.6	0.57	0.56	0.56	0.55	0.55	0.57	0.57	0.59	0.6]	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)		-	-	-	
(25)m=	0.61	0.6	0.6	0.57	0.56	0.56	0.55	0.55	0.57	0.57	0.59	0.6]	(25)
2 40	ot looog	o and he		ooromoto	N. 11			•	•	•			-	
					។. ៣០	Not Ar	200	LL-val		A Y 11		k_volu	<u> </u>	
		area	ss (m²)	m	2	A,r	ea n²	W/m2	2K	(W/	K)	kJ/m ² ·	- K	kJ/K
Doors						2.08	x	1.5	=	3.12				(26)
Windo	ws					4.8		/[1/(1.5)+	0.04] =	6.79	=			(27)
Walls ⁻	Type1	53	3	0		53	x	0.25		13.25	= r			(29)
Walls -	Type2	24	4	2.08		21.92	2 X	0.23	− _	4.95	= i		\dashv	(29)
Walls ⁻	Type3	9.6	3	4.8		4.8	x	0.25		1.2	= 1		\dashv	(29)
Roof 7		50	<u> </u>	0		50	×	0.16		8			\dashv	(30)
Roof 7	Type2		2			23		0.16	<u> </u>	0.37	╡╏		\dashv	(30)
Total a	area of e	elements	, m ²			129.0		0.10		0.07	L			(31)
Party	wall		,			130.8	, 			0	r			(31)
Party f	loor					20		0		0	L r		\dashv	(32)
Dorty						03.2					L		\dashv	(32a)
* for win		l roof wind		footivo wi	adow II vr			formula 1	1/1/1/1/10/	(0) (0) (0) (0)	L Se divon in	paragrap		(320)
** includ	le the are	as on both	sides of in	nternal wall	s and part	titions	aleu using	nonnula i	/[(1/0-vait	<i>le)</i> +0.04j c	as given in	parayrapi	1 3.2	
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				37.68	3 (33)
Heat c	apacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	3841.4	16 (34)
Therm	al mass	parame	eter (TMF	- = Cm ÷	TFA) in	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For desi can be ι	ign asses Jsed inste	sments wh ad of a de	nere the de tailed calc	tails of the ulation.	constructi	ion are noi	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	. x Y) cal	culated u	using Ap	pendix l	<						11.11	(36)
if details	of therm	al bridging	are not kn	nown (36) =	0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			48.79) (37)

Ventila	tion hea	at loss ca	alculated	d monthly	у				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	33.84	33.19	33.19	32.01	31.3	30.97	30.66	30.66	31.47	32.01	32.58	33.19		(38)
Heat ti	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	82.63	81.98	81.98	80.8	80.09	79.76	79.45	79.45	80.26	80.8	81.37	81.98		
							-	-	/	Average =	Sum(39)1.	12 /12=	80.88	(39)
Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.31	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.27	1.28	1.29	1.3	4.00	(40)
Numbe	er of day	/s in mo	nth (Tab	le 1a)					/	<pre>Average =</pre>	Sum(40)1.	12/12=	1.28	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			•	•			-	-			•			
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ar:	
A			NI											(10)
if TF	A > 13.9	ipancy, 9, N = 1	N + 1.76 x	(1 - exp	(-0.0003	349 x (TF)2)] + 0.(0013 x (⁻	ΓFA -13.	<u>2.</u> 9)	07		(42)
if TF	A £ 13.	9, N = 1				,		, ,.	,		,			
Annua Reduce	l averag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	e tarnet o	87	.76		(43)
not more	e that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)		a water ut	ic larger o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	000	000	1101	200		
(44)m=	96.54	93.03	89.52	86.01	82.5	78.99	78.99	82.5	86.01	89.52	93.03	96.54		
									-	Fotal = Su	m(44) ₁₁₂ =	=	1053.15	(44)
Energy	content of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	oth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	143.51	125.51	129.52	112.92	108.35	93.49	86.64	99.42	100.6	117.24	127.98	138.98		
										Total = Su	m(45) ₁₁₂ =	= [1384.16	(45)
if instan	taneous w	ater neati.	ng at point T	t of use (no T	not water I	r storage), I	enter 0 in I	DOXES (46) to (61)					(10)
(46)m= Water	21.53 storage	18.83 Joss:	19.43	16.94	16.25	14.02	13	14.91	15.09	17.59	19.2	20.85		(46)
a) If m	anufacti	urer's de	clared lo	oss facto	or is knov	vn (kWh	/dav):					0		(47)
Tempe	erature f	actor fro	m Table	2b		X X	, , ,					0		(48)
Enera	/ lost fro	m water	r storage	. kWh/ve	ear			(47) x (48) =			0		(49)
If man	ufacture	r's decla	ared cyli	nder loss	s factor is	s not kno	own:					<u> </u>		()
Cylind	er volun	ne (litres) includi	ng any s	olar stor	age with	nin same	•				0		(50)
If con	nmunity h	eating and	l no tank ir	n dwelling,	enter 110	litres in bo	ох (50) Більсііства		h (50)					
Othe	rwise if no	storea no	ot water (th	is includes	s instantan	eous comi	bi bollers)	enter '0' in	DOX (50)					
Hot wa	ater stor	age loss	actor fi	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
Volum Tompo	e factor	from Ta	ble 2a	26								0		(52)
Tempe En anno				: ZU				((50) (54		(50)		0		(53)
Energy	/ 10St frc (49) or (4	m watei 54) in (5	r storage	e, KVVN/ye	ear			((50) X (51	I) x (52) x ((53) =		0		(54)
Wator	storade	3) ۱۱۱ (۲ اوم موا	Culated	for each	month			((56)m - (55) × (41)	m		U		(55)
								((00))) – (0			
(oc)m= If cvlind	er contain	U s dedicate	d solar sto	0 prage. (57)	m = (56)m	$\frac{0}{x[(50)-6}$	U H11)1 - (5	0), else (5	$\frac{0}{7}m = (56)$	U m where (U H11) is fro	m Appendi	хН	(50)
(57)					. (00)				, (00)					(F7)
(<i>ST</i>)m=	0									U		U U		(37)

Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	49.2	42.82	45.62	42.41	42.04	38.95	40.25	42.04	42.41	45.62	45.88	49.2		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	192.7	168.33	175.14	155.33	150.39	132.45	126.89	141.46	143.02	162.86	173.86	188.17		(62)
Solar DH	W input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0'	' if no sola	r contribut	ion to wate	er heating)	•	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix G	S)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter							•			•	
(64)m=	192.7	168.33	175.14	155.33	150.39	132.45	126.89	141.46	143.02	162.86	173.86	188.17		
								Outp	out from wa	ater heate	r (annual)₁	12	1910.59	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	60.02	52.44	54.47	48.15	46.53	40.82	38.87	43.57	44.05	50.39	54.02	58.51	Ī	(65)
inclu	de (57)	m in calo	culation	u of (65)m	only if c	vlinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	e Table 5	5 and 5a):	,		U				,	U U	
Motob		c (Table	5) Wot	te) -									
Metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23		(66)
Liahtin	a aains	ı (calcula	ted in Ar	pendix	L. equat	ion L9 oi	r L9a), a	lso see ⁻	Table 5		<u></u>	<u></u>	1	
(67)m=	49.14	43.65	35.5	26.87	20.09	16.96	18.33	23.82	31.97	40.6	47.38	50.51	l	(67)
Applia	nces da	ins (calc	L ulated ir	I Append	l lixlea	L Lation L	1.3 or I 1	3a) also	see Ta	ble 5			ł	
(68)m=	270.06	272.86	265.8	250.77	231.79	213.95	202.04	199.23	206.3	221.33	240.31	258.14	I	(68)
Cookir	n aains	l (calcula	L Ited in A	l nnendiv		ion 15	or 15a	l also se	L Do Tablo	5			I	
(69)m=	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	l	(69)
Pumps	and fai	ns gains	(Table /	[5a)									ł	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	I	(70)
				tivo valu	es) (Tab	- ¹⁰							i	(- /
(71)m=	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	I	(71)
Wotor	booting		- 02.02 	02.02	02.02	02.02	02.02	02.02	02.02	02.02	02.02	02.02	i	(11)
				66.97	62.55	56.7	ED 04	E9 E6	61 10	67 72	75.02	79.64	1	(72)
(72)m=	00.07	/8.03	13.21	00.07	02.00	30.7	JZ.24	30.30	(60)	(70) m $+$ (7)	13.03	78.04	l	(12)
	nternal	gains =	475 44	445 40	445.00	(00)			400.00		1)11 + (72)	400.0	1	(72)
(73)m=	500.77	495.45	4/5.41	445.42	415.33	388.52	3/3.51	382.51	400.36	430.55	403.62	468.2		(13)
0. Solar o	ar gains	o.		r flux from	Table 6a	and associ	iated equa	itions to co	nvert to th	e applicat		ion		
			aony suid			בוים משפטטט בויי	v			applicat		.011.	Gains	
Unerita	auon. <i>F</i>	100835 F	acioi	Alea			^	-	9_	-			Gailis	

	Ta	able 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
South	0.9x	0.9x 0.77 × 4.8				47.32	x	0.63	x	0.7	=	69.42	(78)
South	0.9x	0.77	x	4.8	x	77.18	x	0.63	x	0.7	=	113.22	(78)

South	0.9x	0.77	x	4.	8	x	9	4.25	x		0.63	×	0.7	=	138.25	(78)
South	0.9x	0.77	x	4.	8	x	1(05.11	x		0.63		0.7	=	154.2	(78)
South	0.9x	0.77	x	4.	8	x	1(08.55	x		0.63		0.7	=	159.24	(78)
South	0.9x	0.77	x	4.	8	x	1	08.9	x		0.63		0.7	=	159.75	(78)
South	0.9x	0.77	x	4.	8	x	1(07.14	x		0.63		0.7	=	157.16	(78)
South	0.9x	0.77	x	4.	8	x	1(03.88	x		0.63	x	0.7	=	152.39	(78)
South	0.9x	0.77	x	4.	8	x	9	9.99	x		0.63	×	0.7	=	146.68	(78)
South	0.9x	0.77	x	4.	8	x	8	5.29	x		0.63	x	0.7	=	125.12	(78)
South	0.9x	0.77	x	4.	8	x	5	6.07	x		0.63	x	0.7	=	82.25	(78)
South	0.9x	0.77	x	4.	8	x	4	0.89	x		0.63	×	0.7	=	59.98	(78)
Solar g	pains in	watts, ca	alculated	d for eac	h month				(83)m	= Su	ım(74)m .	(82)m	1		I	(00)
(83)m=	69.42	113.22	138.25	154.2	159.24		59.75	157.16	152.	.39	146.68	125.12	82.25	59.98		(83)
10tar g	570 10			[(04)[[] =	= (73)m	+ (0	19.26	, walls	524		547.04	555 67	545.97	5/9/19		(84)
(04)111=	570.19	000.07	013.07	399.01	574.50	1.5	+0.20	550.07	554	.9	347.04	555.07	545.87	540.10		(04)
7. Me	an inter	nal temp	perature	(heating	seasor	1)		wana Tak		T L 4						
I emp	erature	auring r	ieating p	beriods II		ng v (a	area 1	rom Tar	Die 9,	INI	r (°C)				21	(85)
Utilisa			ains ior		ea, n1,n	i (s T			<u></u>		Son	Oct	Nov	Doc		
(86)m-	0.93	0.91	0.89	0.86	0.8		Jun 1 69	0.53		2 2	0.7	0.83	0.91	0.93		(86)
(00)	0.00		0.00			<u> </u>		0.00		<u>~</u>		0.00	0.01	0.00		()
Mean	interna	I temper	ature in	living ar	ea T1 (f		w ste	ps 3 to 7	in T	able	9C)	20.02	10.00	10.00		(87)
(07)11=	10.70	18.90	19.33	19.71	20.22	<u> </u>	0.03	20.87	20.0	00	20.59	20.02	19.20	10.02		(07)
Temp	erature	during h	heating p	periods in	n rest of	dw	elling	from Ta	able 9), Th	12 (°C)				l	(00)
(88)m=	19.84	19.85	19.85	19.86	19.87	1	9.87	19.88	19.8	88	19.87	19.86	19.85	19.85		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)				-		I	()
(89)m=	0.91	0.9	0.87	0.84	0.76	(0.61	0.41	0.4	1	0.64	0.8	0.89	0.92		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing	T2 (f	ollow ste	eps 3	to 7	in Tabl	e 9c)	_	r	I	
(90)m=	16.91	17.2	17.74	18.27	18.99	1	9.54	19.8	19.	8	19.47	18.72	17.64	17		(90)
											f	LA = Liv	ing area ÷ (4) =	0.38	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	_A × T1	+ (1 -	– fL/	A) × T2					
(92)m=	17.61	17.87	18.34	18.82	19.46	1	9.95	20.21	20.2	21	19.9	19.22	18.26	17.69		(92)
Apply	adjustr	nent to t	he mear	n interna	l tempei	ratu T	re fro	m Table	4e, \	whe	re appro	opriate	1		I	(00)
(93)m=	17.46	17.72	18.19	18.67	19.31		19.8	20.06	20.0	06	19.75	19.07	18.11	17.54		(93)
8. Sp	ace nea i to thou	ting requ moon int	urremen formal to	(mporatu	ro obtoir	aad	ot ct	on 11 of	Tabl	0 0h	co tha	t Tim-	(76)m an	d ro colo	vulato	
the ut	tilisation	factor fo	or gains	using Ta	able 9a	ieu	al Si	эрттог	Table	6 90	, so ina	t 11,111=	(70)11 an	u ie-cai	ulate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	י ו:	. <u> </u>											
(94)m=	0.88	0.87	0.84	0.81	0.73	(0.61	0.43	0.4	.3	0.63	0.77	0.86	0.89		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8	4)m	-									l	
(95)m=	504.44	527.24	514.16	483.11	420.42	3	33.05	228.55	228.	.96	343.36	428.96	469.07	486.14		(95)
Mont	hly aver	age exte	ernal terr	nperature	e from T	abl T		10.0	40	<u> </u>	14.0	40.0	-	4.0	l	(00)
(90)m=	4.5	5	6.8	8.7	11.7		14.0	16.9	16.	Э	14.3	10.8		4.9		(90)

Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	_	-		
(97)m=	1071.04	1042.91	933.98	805.42	609.42	414.98	250.98	251.09	437.15	667.79	903.68	1036.12		(97)
Spac	e heatin	g require	ement fo	or each n	nonth, k	Wh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m		L	
(98)m=	421.55	346.53	312.34	232.06	140.61	0	0	0	0	177.69	312.92	409.18		-
								Tota	l per year	(kWh/yeai	r) = Sum(9	8)15,912 =	2352.89	(98)
Spac	e heatin	g require	ement in	ı kWh/m²	²/year								37.23	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												1
Fract	ion of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fract	ion of sp	ace hea	at from n	nain syst	em(s)			(202) = 1	– (201) =				1	(202)
Fract	ion of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90	(206)
Effici	ency of s	seconda	ry/suppl	ementar	y heatin	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	(r
Spac	e heatin	g require	ement (o	alculate	d above)							1	
	421.55	346.53	312.34	232.06	140.61	0	0	0	0	177.69	312.92	409.18	ł	
(211)n	n = {[(98)m x (20	4)] + (2	10)m } x	100 ÷ (2	206)		1					1	(211)
	468.39	385.03	347.05	257.85	156.24	0	0	0	0	197.44	347.69	454.64		1
								Tota	il (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2614.33	(211)
Spac	e heatin	g fuel (s	econdar	y), kWh/	month									
$= \{[(98) (215)m = ($	s)m x (20	01)] + (2	14) m } >	(100÷()	208)	0	0	0	0	0	0	0		
(210)11-		0	0	0	0	0	0	Tota	l (kWh/vea	ar) =Sum(2	215)	=	0	1(215)
Wator	hosting									,	7 15,1012	2	0](210)
Output	t from w	i ater hea	ter (calc	ulated a	bove)									
1 -	192.7	168.33	175.14	155.33	150.39	132.45	126.89	141.46	143.02	162.86	173.86	188.17		
Efficie	ncy of w	ater hea	iter	•		•	•			•			90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)n (219)m=	n = (64)	m x 100) ÷ (217 194.59)m 172.59	167.1	147.16	140,99	157,17	158.91	180.96	193,18	209.08		
()		101100	10 1100					Tota	I = Sum(2	19a) _{1 12} =	100110		2122.88] (219)
Annua	al totals									k'	Wh/vear	•	kWh/vear](=:=)
Space	heating	fuel use	ed, main	system	1						, ,		2614.33]
Water	heating	fuel use	d										2122.88	1
Electri	city for r	oumos fa	ans and	electric	keen-ho	t							L	1
contr	ol bootin			cicotrio		·						400		(2200)
Centra		g pump.										130		(2300)
IOIIOD	with a f	an-assis	sted flue									45		(230e) 1
Total e	electricity	/ for the	above,	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electri	city for li	ghting											347.16	(232)
100		to indiv	idual be	oting ou	atomor									

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1 × 0.01	= 81.04	(240)
Space heating - main system 2	(213) x	0 × 0.01	= 0	(241)
Space heating - secondary	(215) x	0 × 0.01	= 0	(242)
Water heating cost (other fuel)	(219)	3.1 × 0.01	= 65.81	(247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.01	= 20.06	(249)
(if off-peak tariff, list each of (230a) to (230 Energy for lighting)g) separately as applicable and ap (232)	pply fuel price according t 11.46 × 0.01	to Table 12a = 39.78	(250)
Additional standing charges (Table 12)			106	(251)
Appendix Q items: repeat lines (253) and	(254) as needed			
Total energy cost (2	245)(247) + (250)(254) =		312.69	(255)
11a. SAP rating - individual heating syste	ems			
Energy cost deflator (Table 12)			0.47	(256)
Energy cost factor (ECF)	255) x (256)] ÷ [(4) + 45.0] =		1.36	(257)
SAP rating (Section 12)			81.05	(258)
12a. CO2 emissions - Individual heating	systems including micro-CHP			
	_	Emission footon	Emissions	
	Energy kWh/year	kg CO2/kWh	kg CO2/yea	r
Space heating (main system 1)	Energy kWh/year (211) x	kg CO2/kWh	kg CO2/yea	r](261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	$\frac{\text{Emission factor}}{\text{kg CO2/kWh}} = 0.198 = 0$	517.64	r (261) (263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission factor kg CO2/kWh $0.198 = 0$ $0.198 = 0$	kg CO2/yea 517.64 0 420.33	r](261)](263)](264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	Emission factor kg CO2/kWh $0.198 = 0$ $0.198 = 0$	kg CO2/yea 517.64 0 420.33 937.97	r](261)](263)](264)](265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x	Emission factor kg CO2/kWh $0.198 = 0$ $0.198 = 0$ $0.198 = 0$	kg CO2/yea 517.64 0 420.33 937.97 90.48	r](261)](263)](264)](265)](267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48	r](261)](263)](264)](265)](267)](268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92	r](261)](263)](264)](265)](267)](268)](272)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m²	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su (21)	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = $72) \div (4) =$	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11	r](261)](263)](264)](265)](267)](268)](272)](273)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14)	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su (21) (23)	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = 72) ÷ (4) =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85	r](261)](263)](264)](265)](267)](268)](272)](273)](274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = p-hot (231) x (232) x su (21) (232) (23)	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = $72) \div (4) =$	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85	r](261)](263)](264)](265)](267)](268)](272)](272)](274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su (212) Energy kWh/year	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = 72) ÷ (4) = Primary factor	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85 P. Energy kWh/year	r (261) (263) (264) (265) (267) (268) (272) (272) (273) (274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1)	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su (21) Energy kWh/year (211) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = 72) ÷ (4) = Primary factor 1.02 =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85 P. Energy kWh/year 2666.61	r (261) (263) (264) (265) (267) (272) (272) (273) (274) (261)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su (232) x su (215) x (215) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = 72) ÷ (4) = Primary factor 1.02 = 0 =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85 P. Energy kWh/year 2666.61 0	r](261)](263)](264)](265)](267)](272)](272)](274)](261)](263)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = ep-hot (231) x (232) x su (21) Energy kWh/year (211) x (215) x (215) x (219) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = 72) ÷ (4) = Primary factor 1.02 = 0 = 1.02 =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85 P. Energy kWh/year 2666.61 0 2165.33	<pre>r (261) (263) (264) (265) (267) (268) (272) (272) (274) (274) (264) (263) (263)</pre>
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric kee Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = p-hot (231) x (232) x su (232) x su (21) Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = m of (265)(271) = 72) ÷ (4) = Primary factor 1.02 = 0 = 1.02 =	kg CO2/yea 517.64 0 420.33 937.97 90.48 179.48 1207.92 19.11 85 P. Energy kWh/year 2666.61 0 2165.33 4831.95	r](261)](263)](264)](267)](268)](272)](272)](273)](274)](261)](263)](264)](265)

Electricity for lighting	(232)	x		0	=	1013.7	(268)
'Total Primary Energy			sum of (265).	(271) =	[6356.65	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =			100.58	(273)

		Us	er Details:						
Assessor Name: Software Name:	Dan Watt Stroma FSAP 2009)	Stroma Softwa	a Numl are Ver	ber: sion:		STRO Versio	000002 n: 1.4.0.76	
		Prope	erty Address:	Flat 9 B	aseline				
Address :	172 High St, Tedding	ton, TW11	8HU						
1. Overall dwelling dimen	sions:								
Ground floor			Area(m²) 55.5	(1a) x	Ave He 2.	ight(m) ⁶⁷	(2a) =	Volume(m ³) 148.19	(3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e)	+(1n)	55.5	(4)					
Dwelling volume		L		(3a)+(3b)	+(3c)+(3d))+(3e)+	.(3n) =	148.19	(5)
2. Ventilation rate:									
	main Se heating he	condary eating	other		total			m ³ per hour	•
Number of chimneys	0 +	0 1	+ 0	=	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 4	+ 0	ī = Г	0	x 2	20 =	0	(6b)
Number of intermittent fan	s				2	x 1	10 =	20	(7a)
Number of passive vents					0	x 1	10 =	0](7b)
Number of flueless das fire	26				0	x 4	40 =	0	
					0			0	(70)
							Air ch	anges per ho	ur
Infiltration due to chimneys	s, flues and fans = $(6a)$)+(6b)+(7a)+(⁻	7b)+(7c) =	Г	20	<u> </u>	÷ (5) =	0 13	(8)
If a pressurisation test has be	<i>.</i> en carried out or is intended	l, proceed to ((17), otherwise d	continue fro	om (9) to (16)		0.10	
Number of storeys in the	e dwelling (ns)							0	(9)
Additional infiltration						[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber fr	ame or 0.3	5 for masonr	y constru	uction			0	(11)
If both types of wall are pre deducting areas of opening	sent, use the value corresp is); if equal user 0.35	onding to the	greater wall are	a (atter					
If suspended wooden flo	oor, enter 0.2 (unseale	ed) or 0.1 (s	sealed), else	enter 0			[0	(12)
If no draught lobby, ente	er 0.05, else enter 0						ĺ	0	(13)
Percentage of windows	and doors draught stri	ipped					Ī	0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 10	= [00		[0	(15)
Infiltration rate			(8) + (10)	+ (11) + (12	2) + (13) +	· (15) =		0	(16)
Air permeability value, q	50, expressed in cubi	c metres pe	er hour per so	quare me	etre of e	nvelope	area	6	(17)
If based on air permeability	y value, then (18) = [(17)) ÷ 20]+(8), ot	herwise (18) = (16)				0.43	(18)
Air permeability value applies	it a pressurisation test has i shaltarad	been done or	a degree air pei	meability is	s being us	ed	ſ	2	
Shelter factor	Shellered		(20) = 1 -	0.075 x (19	9)] =			0.78	(19)
Infiltration rate incorporatir	ng shelter factor		(21) = (18)	x (20) =			[0.34	(21)
Infiltration rate modified for	r monthly wind speed						L	0.01	
Jan Feb M	Apr May	Jun J	lul Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7	I	¥	· · I]		
(22)m= 5.4 5.1 5	.1 4.5 4.1	3.9 3	3.7 3.7	4.2	4.5	4.8	5.1		
		I		L			L]		
Wind Factor $(22a)m = (22)$)m ÷ 4								
(22a)m= 1.35 1.27 1.	27 1.12 1.02	0.98 0.	.92 0.92	1.05	1.12	1.2	1.27		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sl	nelter ar	nd wind s	peed)	= (21a) x	(22a)m		-	_	_		
	0.46	0.43	0.43	0.38	0.35	0.33	0.31	0.31	0.35	0.38	0.4	0.43			
Calcula	ate effe	<i>ctive air</i>	change	rate for t	he appli	icable ca	se								
lf evb	aust air b		using Ann	andix N (2	(23) – (23)	a) v Emv (e	auation	(N5)) oth	orwiso (23	b) - (23a)					$\int_{(23a)}$
If bala	anced with	h heat reco		iency in %	allowing t	for in-use f	actor (fr	m Table /	h) _	5) = (254)			0	, 	
									() — (((00k) [4 (00~)			(23C)
a) II								/HR) (24	a)m = (2	220)m + ((230) × [1 - (23C)) ÷ 100]]		(24a)
(24a)III=							0		b) m ((0]		(244)
D) IT	balance		anical ve					(101 V) (24	∠) = m(d	22b)m + (23D)		1		(24b)
(240)m=		0	0		0	0	0			0	0	0]		(240)
c) IT i	wnole r f (22b)r	iouse ex n < 0.5 ×	tract ver < (23b), t	tilation (24)	or positiv c) = (23ł	/e input \ c); other\	ventilat vise (2	4c) = (22)	outsiae 2b) m + ().5 × (23l	c)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]		(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positi	ve input	ventila	tion from	loft	-			1		
i	f (22b)r	n = 1, th	en (24d)	m = (22	o)m othe	erwise (2	4d)m =	= 0.5 + [(22b)m² :	x 0.5]			-		
(24d)m=	0.6	0.59	0.59	0.57	0.56	0.55	0.55	0.55	0.56	0.57	0.58	0.59			(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24	b) or (24	c) or (2	4d) in bo	ox (25)			-	_		
(25)m=	0.6	0.59	0.59	0.57	0.56	0.55	0.55	0.55	0.56	0.57	0.58	0.59			(25)
3. Hea	at losse	s and he	eat loss i	paramet	er:										
ELEN	IENT	Gros area	ss (m²)	Openin rr	lgs 1 ²	Net Ar A ,r	ea n²	U-va W/m	lue 2K	A X U (W/	K)	k-value kJ/m²•	e K	A X kJ/ł	∶k ≺
Doors						2.08)	1.5	=	3.12					(26)
Window	ws Type	e 1				1.6	,	(1/[1/(1.5)	+ 0.04] =	2.26					(27)
Window	ws Type	e 2				3.2	,	(1/[1/(1.5)	+ 0.04] =	4.53					(27)
Walls 7	Гуре1	41		0		41	>	0.2	5 =	10.25					(29)
Walls 7	Гуре2	6		2.08	3	3.92)	0.2	3 =	0.88					(29)
Walls 7	Гуре3	9.6	6	4.8		4.8	>	0.2	5 =	1.2					(29)
Roof T	Type1	44	L I	0		44		0.10	6 =	7.04			<u> </u>		(30)
Roof T	Type2	2.3	3	0		2.3		0.10	3 =	0.37			Ξ F		(30)
Total a	rea of e	elements	s, m²			102.9)								(31)
Party v	vall					28		0	=	0					(32)
Party fl	loor					63.2]		ΞĒ		(32a)
Party c	eiling					0					Ī		- 7		(32b)
* for wind ** includ	dows and e the area	l roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-v Is and par	alue calcul titions	ated usii	ng formula	1/[(1/U-va	lue)+0.04] a	as given in	n paragrapl	h 3.2		_
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(3	0) + (32) =	:			29.	66	(33)
Heat ca	apacity	Cm = S((A x k)						((28)	(30) + (3	2) + (32a)	(32e) =	335	5.46	(34)
Therma	al mass	parame	eter (TMF	- Cm -	: TFA) ii	n kJ/m²K			Indic	ative Value	: Low		10	0	(35)
For desi can be u	gn asses ised inste	sments wh ad of a de	nere the de tailed calc	tails of the ulation.	construct	tion are not	t known j	precisely ti	ne indicativ	/e values o	f TMP in T	able 1f			-
Therma	al bridg	es : S (L	x Y) cal	culated	using Ap	opendix ł	<						4.1	2	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	31)							•		

Total fa	abric hea	at loss							(33) +	(36) =		[33.77	(37)
Ventila	tion hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	29.51	28.97	28.97	27.97	27.37	27.09	26.83	26.83	27.51	27.97	28.45	28.97		(38)
Heat tr	ansfer c	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	63.29	62.74	62.74	61.74	61.14	60.86	60.6	60.6	61.29	61.74	62.22	62.74		
							-	-	1	Average =	Sum(39)1	12 /12=	61.81	(39)
Heat Ic	oss para	meter (H	HLP), W/	/m²K			4.00	4.00	(40)m	= (39)m ÷	(4)	4.40		
(40)m=	1.14	1.13	1.13	1.11	1.1	1.1	1.09	1.09	1.1	1.11	1.12	1.13	4 4 4	(40)
Numbe	er of day	s in mo	nth (Tab	le 1a)						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)
4. Wa	iter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF	ed occu A > 13.9	ipancy, i 9. N = 1	N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.()013 x (1	ГFA -13.	9) 1.	85		(42)
if TF	A £ 13.9	9, N = 1			(/_/]			-)			
Annua	l averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	a tarrat a	82	2.3		(43)
not more	e that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)	lo acriieve	a waler us	e largel o	I			
	lan	Eab	Mar	Apr	May	lup		Δυσ	Son	Oct	Nov	Dec		
Hot wate	er usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	Sep	001	INUV	Dec		
(44)m=	90.53	87 24	83.95	80.65	77.36	74 07	74 07	77.36	80.65	83 95	87 24	90.53		
()	00.00	01.24	00.00	00.00	11.00	14.01	74.07	11.00	00.00	Total = Su	m(44)1 42 =	00.00	987.6	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600) kWh/mon	th (see Ta	ables 1b, 1	c, 1d)	001.0	
(45)m=	134.57	117.7	121.46	105.89	101.6	87.67	81.24	93.23	94.34	109.95	120.01	130.33		
			1	1			1	<u>I</u>		Fotal = Su	m(45) ₁₁₂ =	=	1298	(45)
lf instan	taneous w	ater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)					
(46)m=	20.19	17.65	18.22	15.88	15.24	13.15	12.19	13.98	14.15	16.49	18	19.55		(46)
a) If m	storage	1055: Iror's de	clared la	nes facto	r is know	wn (k\//h	(dav).					0		(47)
Tompo	anulacio raturo fe	actor fro	m Tabla	2h			/udy).					0		(47)
Enorm	loct fro	m wator			oor			$(17) \times (18)$	_			0		(40)
If man	ufacture	r's decla	ared cylir	nder loss	s factor is	s not kno	own:	(47) × (40)	-			0		(49)
Cylind	er volum	ne (litres) includii	ng any s	olar stor	age with	in same)				0		(50)
lf con	nmunity he	eating and	l no tank ir	n dwelling,	enter 110	litres in bo	ox (50)							
Other	wise if no	stored ho	t water (th	is includes	instantan	eous comi	bi boilers)	enter '0' in	box (50)					
Hot wa	iter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature fa	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	· storage	e, kWh/y€	ear			((50) x (51) x (52) x ((53) =		0		(54)
Enter (49) or (8	54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)r	n				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primar	y circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	46.13	40.15	42.78	39.77	39.42	36.53	37.75	39.42	39.77	42.78	43.02	46.13		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	180.71	157.85	164.23	145.66	141.02	124.2	118.99	132.65	134.12	152.72	163.04	176.46		(62)
Solar DH	W input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter							•	-			
(64)m=	180.71	157.85	164.23	145.66	141.02	124.2	118.99	132.65	134.12	152.72	163.04	176.46		
								Outp	out from w	ater heate	r (annual)₁	12	1791.66	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	56.28	49.17	51.08	45.15	43.64	38.28	36.45	40.85	41.31	47.25	50.66	54.87		(65)
inclu	Ide (57)	m in calc	culation	• of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal da	ains (see	a Table 5	5 and 5a):	,		5				,	5	
Motob		o (Toblo	E) Mot	to) -									
Melab	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(66)m=	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12		(66)
Liahtin	u dains	(calcula	ted in Ar	opendix	L. equat	ion L9 o	r L9a), a	llso see ⁻	r Table 5					
(67)m=	42.8	38.01	30.92	23.41	17.5	14.77	15.96	20.75	27.84	35.36	41.26	43.99		(67)
Applia	nces da	ins (calc	L ulated ir	I Append	l dixlea	uation L	13 or I 1	i 3a) also) see Ta	l ble 5				
(68)m=	241	243.51	237.2	223.79	206.85	190.93	180.3	177.8	184.1	197.52	214.45	230.37		(68)
Cookir	L	l (calcula	L Ited in A	I npendix	L equat	ion I 15	or I 15a') also se	I ee Table	5	Į	Į		
(69)m=	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96		(69)
Pumps	and fa	l ns dains	(Table !	I 5a)				ļ	1		1			
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses		l vaporatio	n (nega	L tive valu	L es) (Tab	l le 5)								
(71)m=	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08		(71)
Water	L heating	L dains (T	able 5)		ļ				ļ		ļ	<u> </u>		
(72)m=	75.64	73.17	68.65	62.71	58.65	53.17	48.99	54.91	57.38	63.51	70.36	73.75		(72)
Total i	ntornal	aaine –				(66)	m + (67)m	1 + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		. ,
(73)m-	454 45	94113 – 449 7	431 78	404 91	378	353.88	340.26	348.46	364 33	301 30	421.08	443 11	l	(73)
6_Se	ar gaing	3:							001.00		1.00			(=)
Solar o	ains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	ations to co	onvert to th	e applicab	ole orientat	ion.		
Orienta	ation: /	Access F	actor	Area		Flu	X No Go	т	g_ Jabla 6b	 т.	FF		Gains	

	Та	able 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
North	0.9x	0.77	x	1.6	x	10.73	x	0.63	x	0.7	=	5.25	(74)
North	0.9x	0.77	x	1.6	x	20.36	x	0.63	x	0.7	=	9.96	(74)

North	0.9x	0.77	x	1.	6	x	3	3.31	x	0.63		× [0.7		=	16.29	(74)
North	0.9x	0.77	x	1.	6	x	5	4.64	x	0.63		× [0.7		=	26.72	(74)
North	0.9x	0.77	x	1.	6	x	7	5.22	x	0.63		× [0.7		=	36.78	(74)
North	0.9x	0.77	x	1.	6	x	6	4.09	x	0.63		× [0.7		=	41.12	(74)
North	0.9x	0.77	x	1.	6	x	7	'9.12	x	0.63		× [0.7		=	38.69	(74)
North	0.9x	0.77	x	1.	6	x	6	51.56	x	0.63		× [0.7		=	30.1	(74)
North	0.9x	0.77	x	1.	6	x	4	1.09	x	0.63		× [0.7		=	20.09	(74)
North	0.9x	0.77	x	1.	6	x	2	4.81	x	0.63		× [0.7		=	12.13	(74)
North	0.9x	0.77	x	1.	6	x	1	3.22	x	0.63		x [0.7		=	6.46	(74)
North	0.9x	0.77	x	1.	6	x		8.94	x	0.63		× [0.7		=	4.37	(74)
East	0.9x	1	x	3.	2	x	1	9.87	x	0.63		× [0.7		=	19.43	(76)
East	0.9x	1	x	3.	2	x	3	8.52	x	0.63		x [0.7		=	37.67	(76)
East	0.9x	1	x	3.	2	x	6	51.57	x	0.63		x [0.7		=	60.21	(76)
East	0.9x	1	x	3.	2	x	9	1.41	x	0.63		x [0.7		=	89.4	(76)
East	0.9x	1	x	3.	2	x	1	11.22	x	0.63		× [0.7		=	108.77	(76)
East	0.9x	1	x	3.	2	x	1	16.05	x	0.63		x [0.7		=	113.49	(76)
East	0.9x	1	x	3.	2	x	1	12.64	x	0.63		× [0.7		=	110.16	(76)
East	0.9x	1	x	3.	2	x	9	8.03	x	0.63		× [0.7		=	95.87	(76)
East	0.9x	1	x	3.	2	x		73.6	x	0.63		x [0.7		=	71.98	(76)
East	0.9x	1	x	3.	2	x	4	6.91	x	0.63		×	0.7		=	45.87	(76)
East	0.9x	1	x	3.	2	x	2	4.71	x	0.63		×	0.7		=	24.16	(76)
East	0.9x	1	x	3.	2	x	1	6.39	x	0.63		x	0.7		=	16.03	(76)
Solar (gains in	watts, ca		for eac	h mont	h T₁	E4 61	110.05	(83)m	n = Sum(74)r	m(82	2)m	20.62	20/	11		(83)
Total c	24.00 nains – i	nternal a	nd sola	r (84)m :	= (7.3)m	+ (83)m	watts	125	.90 92.07	50	5.01	30.03	20.4	• 1		(00)
(84)m=	479.13	497.32	508.27	521.02	523.55	5	08.49	489.1	474	.44 456.4	4 44	9.4	451.71	463.	52		(84)
7 140	on inter	rnal tamp	oroturo	(booting		(n)			1		-			I			
Temr	erature	during h	eating r	eriods i	n the liv	n) vina	area	from Tal	nle 9	Th1 (°C)						21	(85)
l Itilis:	ation fac	tor for a	ains for	living an	≏a h1 r	"'y n (s	ee Ta	hle 9a)	010 0	, (0)					l	<u> </u>	
Cuno	Jan	Feb	Mar		Mav	<u>, </u>	Jun	Jul	A	ua Ser		Dct	Nov	De	ec		
(86)m=	0.93	0.91	0.89	0.85	0.76		0.63	0.46	0.4	18 0.69	0.	.84	0.91	0.9	3		(86)
Mear	interna	l temper:	ature in	living ar	ea T1 (follo	w ste	ns 3 to 7	ı 7 in T	able 9c)							
(87)m=	19.06	19.22	19.57	19.96	20.44		20.77	20.93	20.	93 20.68	3 20).17	19.5	19.1	12		(87)
Tomr			eating r	I Ariode i	n rest o	 f_dw	Alling	from Ta		 D			1				
(88)m=	19.97	19.98	19.98	19.99	20		20.01	20.01	20.	01 20	-) 19	9.99	19.99	19.9	98		(88)
Litilio	L	tor for a	ning for	L		 h2	m (or	L									
(89)m=	0.92		0.87	0.82	0.72	, nz	,III (Se		(9a)	38 0.63	0	81	0.89	0.9	2		(89)
				44 0 10 0 0 0								-)	0.00	010			
	17.41	17.65	18 16	18 71	01 GWE	iiing J	1∠ (t 19.79	19 97	+ps 3	96 1 19 69		C) 0 0 1	18.06	17	5		(90)
(00)11-		11.00	10.10		10.07			10.97	1.3.	19.08	 fLA =	: Liv	ing area ÷ (4	1 4) =		0.54	(91)
	•	1.6.	- 1					· · · ·		(I A) —	-		C (l	0.0-1	
Mear	interna		ature (fo	$\frac{10.20}{10.20}$		ellin	(g) = f	LA × T1	+ (1	- tLA) × T	2	64	10.01	10	<u>,</u>		(02)
(32)11=	10.3	10.0	10.92	19.39	19.90	1 4	20.02	20.49	I ^{∠∪.}	-0 20.23	' ' ^s	.04	10.04	l ^{10.3}	~		(52)

Apply	adjustr	nent to t	he mean	interna	I temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.15	18.35	18.77	19.24	19.8	20.17	20.34	20.33	20.08	19.49	18.69	18.23		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	i to the i	mean int	ernal ter	nperatu	re obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:										
(94)m=	0.89	0.88	0.85	0.8	0.71	0.57	0.4	0.41	0.63	0.79	0.87	0.89		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (8	4)m							-		
(95)m=	427.63	437.21	430.96	417.9	370.46	289.96	195.76	194.75	287.82	354.08	392.98	414.18		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9		(96)
Heat	loss rate	e for mea	an intern	al temp	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	_			
(97)m=	864.05	837.43	751.17	650.51	494.98	338.86	208.26	208.03	354.17	536.39	727.24	836.06		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97])m – (95)m] x (4	1)m			
(98)m=	324.7	268.94	238.23	167.48	92.64	0	0	0	0	135.64	240.66	313.88		
								Tota	l per year	(kWh/yeai	-) = Sum(9	8)15,912 =	1782.18	(98)
Space	e heatin	a require	ement in	kWh/m ²	²/vear								32 11	 (99)
opuot	onoaan	groquire			, jour								02.111	
9a. En	ergy red	quiremer	its – Indi	vidual n	eating sy	ystems I	ncluding	micro-C	HP)					
Spac Fracti	e heatil on of sp	1g: bace hea	at from se	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sy	stem 1			(204) = (2	02) × [1 – ((203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of a	seconda	ry/supple	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec	kWh/ve	_l ar
Space	e heatin	a require	ement (c	alculate	d above)	oui	, tug	Cop	000		200		
opao	324.7	268.94	238.23	167.48	92.64	0	0	0	0	135.64	240.66	313.88		
(011)m) m x (20		0) m 1 v	100 . (2									(211)
(211)11	$1 = \{[(90)]$)III X (20	4)] + (21	U)III } X	$100 \div (2)$	06)	0	0	0	150 71	267.4	249 75		(211)
	300.78	290.02	204.7	100.09	102.94	0	0	U Tota		r = Sum(207.4	340.75	1000.10	
								1014	i (kwii/yee	ar) =00111(2	- 1 1,5,1012	-	1980.19	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	(month									
= {[(98)m x (20	$[1,1] + (2^{-1})$	14) m } x	(100 ÷ (208)		0	0	0	0		0		
(215)m=	0	0	0	0	0	0	0	U				0		
								Tota	r (kvri/yea	ar) =5um(2	213) _{15,1012}	=	0	(215)
Water	heating	3												
Output	from w	ater hea	ter (calc	ulated a	bove)	404.0	440.00	400.05	404.40	450.70	400.04	470.40		
	180.71	157.85	164.23	145.66	141.02	124.2	118.99	132.65	134.12	152.72	163.04	176.46		
Efficier	ncy of w	ater hea			1								90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	r water	heating,	kWh/mo	onth										
(219)m	1 = (64) 200 70	175 30) ÷ (217) 182 48	161 85	156.69	138	132 21	147 30	149 02	169 69	181 15	196.07		
(213)11=	200.13	110.09	102.40	101.00	100.09	100	102.21	Tota	I = Sum(2)	19a) -	101.13	130.07	1000 70	
								1010		112			1990.73	(219)

Annual totals		kWh/yea	ır	kWh/year	1
Water beating fuel used				1900.19	J
Electricity for pumps fans and electric kee	n-hot			1000.70	
central heating pump:			130	1	(230c)
boiler with a fan-assisted flue			45]	(230e)
Total electricity for the above kWh/year		sum of (230a)(230g) =		175	T(231)
Electricity for lighting				302 35]()](232)
10a. Fuel costs - individual heating system	ms:			002.00](/
	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 =	61.39	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 =	61.71	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	20.06	(249)
(if off-peak tariff, list each of (230a) to (230 Energy for lighting	g) separately as applica (232)	ble and apply fuel price acco	ording to x 0.01 =	Table 12a 34.65	(250)
Additional standing charges (Table 12)				106	(251)
Appendix Q items: repeat lines (253) and (254) as needed 45)(247) + (250)(254) =			283.8	- T(255)
11a. SAP rating - individual heating syste	ms			200.0	
Epergy cost deflator (Table 12)				0.47	
Energy cost factor (ECF) [(4	255) x (256)] ÷ [(4) + 45.0] =			1.33	(250)
SAP rating (Section 12)				81.49	(258)
12a. CO2 emissions – Individual heating	systems including micro	-CHP			<u> </u>
	Energy kWh/year	Emission fa kg CO2/kWh	ctor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.198	=	392.08	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	394.16	(264)
Space and water heating	(261) + (262) + (2	63) + (264) =		786.24	(265)
Electricity for pumps, fans and electric kee	p-hot (231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	156.31	(268)
Total CO2, kg/year		sum of (265)(271) =		1033.03	(272)
CO2 emissions per m ²		(272) ÷ (4) =		18.61	(273)

El rating (section 14)			86 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.02 =	2019.8 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Energy for water heating	(219) x	1.02 =	2030.55 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4050.35 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92 =	511 (267)
Electricity for lighting	(232) x	0 =	882.86 (268)
'Total Primary Energy	sum	of (265)(271) =	5444.2 (272)
Primary energy kWh/m²/year	(272)	÷ (4) =	98.09 (273)

		User D	Details:					
Assessor Name: Software Name:	Dan Watt Stroma FSAP 2009)	Stroma Nu Software V	mber: ersion:		STRO Versio	000002 n: 1.4.0.76	
		Property	Address: Flat	10 Ba <u>selin</u>	е			
Address :	172 High St, Tedding	ton, TW11 8H	J					
1. Overall dwelling dime	nsions:							
Ground floor		Are	a(m²) 29 (1a) x	Ave He	eight(m) .67	(2a) =	Volume(m³) 77.43	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)	+(1n)	29 (4)					
Dwelling volume			(3a)+((3b)+(3c)+(3d	l)+(3e)+	.(3n) =	77.43	(5)
2. Ventilation rate:								
	main Se heating he	condary ating	other	total			m ³ per hour	
Number of chimneys		0 +	0 =	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0 =	0	x 2	20 =	0	(6b)
Number of intermittent far	I L L L L L			2	x 1	0 =	20	(7a)
Number of passive vents				0	x 1	0 =	0	(7b)
Number of flueless gas fir	es			0	x 4	40 =	0] (7c)
								J
						Air ch	anges per hou	ur
Infiltration due to chimney	vs, flues and fans = $(6a)$)+(6b)+(7a)+(7b)+((7c) =	20	(16)	÷ (5) =	0.26	(8)
Number of storevs in th	e dwelling (ns)	, proceed to (<i>11)</i> ,	ounerwise continue	<i>e ii0iii (9) i</i> 0 (10)	ſ	0	
Additional infiltration	e an em 19 (1.e)				[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber fr	ame or 0.35 fo	r masonry con	struction			0	(11)
if both types of wall are producting areas of openin	esent, use the value corresp gs); if equal user 0.35	onding to the grea	ter wall area (after					_
If suspended wooden fl	oor, enter 0.2 (unseale	d) or 0.1 (seale	ed), else enter	0			0	(12)
If no draught lobby, ent	er 0.05, else enter 0						0	(13)
Percentage of windows	and doors draught stri	pped	0.05 [0.0(1.1)	. 4001			0	(14)
Window infiltration			$0.25 - [0.2 \times (14)]$	$\div 100] =$	(45)		0	(15)
Inflitration rate			(8) + (10) + (11) +	+ (12) + (13) +	+ (15) =		0	(16)
If based on air nermeabili	450, expressed in cubic ty value, then $(18) = [(17)]$	$\rightarrow 201+(8)$ otherw	Sur per square ise $(18) = (16)$	metre or e	nvelope	area	9.3	$ \begin{bmatrix} (17) \\ (10) \end{bmatrix} $
Air permeability value applies	s if a pressurisation test has	been done or a de	oree air permeabil	itv is beina us	sed	l	0.72	
Number of sides on which	n sheltered		gree an permeasu			[3	(19)
Shelter factor			(20) = 1 - [0.075 x	k (19)] =			0.78	(20)
Infiltration rate incorporati	ng shelter factor		(21) = (18) x (20)	=		[0.56	(21)
Infiltration rate modified for	or monthly wind speed							_
Jan Feb	Mar Apr May	Jun Jul	Aug Se	p Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7							
(22)m= 5.4 5.1	5.1 4.5 4.1	3.9 3.7	3.7 4.2	4.5	4.8	5.1		
Wind Factor $(22a)m = (22a)m $?)m ÷ 4							
(22a)m= 1.35 1.27	I.27 1.12 1.02	0.98 0.92	0.92 1.05	1.12	1.2	1.27		
· · · ·	· · · ·	•	• •					

Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m	_		-	_		
	0.76	0.71	0.71	0.63	0.57	0.55	0.52	0.52	0.59	0.63	0.67	0.71			
Calcula	ate ette	ctive air al ventila	change	rate for t	he applic	cable ca	se								7(220)
lf exh	aust air h	eat pump i	using App	endix N. (2	3b) = (23a) x Fmv (e	equation (N	N5)), othe	rwise (23b) = (23a)					(23a)
lf bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =) = (200)					$\int_{(220)}^{(230)}$
a) If	bolonoc	d moob			with box) = (2)	2b)m i (f	226) v [1 (22a)	· 1001	J	(230)
a) II					with hea				(22)	$\frac{20}{0}$		$\frac{1-(230)}{1-0}$	- 100j		(24a)
(24a)III-	balanaa				without	boot roo)m (2)) 226)	0			(210)
0) II (24b)m-					without				0 $11 = (22)$		230)	0	1		(24b)
(240)III-			tractiver		o r pocitiv		(ontilatio			0	0	0	J		(210)
c) II i	f (22b)n	ouse ex n < 0.5 ×	(23b), t	hen (24c	r positiv c) = (23b	e input v): otherv	vise (24	c) = (22b	outside b) m + 0.	5 x (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	n or wh	ole hous	e positiv	ve input v	ventilatio	on from l	oft				1		
í	f (22b)n	n = 1, th	en (24d)	m = (22b)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]					
(24d)m=	0.79	0.76	0.76	0.7	0.67	0.65	0.63	0.63	0.67	0.7	0.73	0.76			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (240	c) or (24	d) in boy	(25)	-			_		
(25)m=	0.79	0.76	0.76	0.7	0.67	0.65	0.63	0.63	0.67	0.7	0.73	0.76			(25)
3 He	at losse	s and he	eat loss i	paramete	۹r.										
FLEN	IENT	Gros	SS	Openin	as	Net Ar	ea	U-valı	Je	AXU		k-value)	ΑX	k
		area	(m²)	m	2	A ,n	n²	W/m2	K	(W/ł	<)	kJ/m²·l	K	kJ/ł	<
Doors						2.08	x	1.5	=	3.12					(26)
Window	WS					3.2	x1.	/[1/(1.5)+	0.04] =	4.53					(27)
Walls 7	Гуре1	38	;	0		38	x	0.25	=	9.5					(29)
Walls 7	Гуре2	22		2.08		19.92	x	0.23	=	4.5					(29)
Walls 7	ГуреЗ	6.4	ļ	3.2		3.2	x	0.25	=	0.8					(29)
Roof 1	Гуре1	25	;	0		25	x	0.16	=	4					(30)
Roof 1	Гуре2	1.5	;	0		1.5	x	0.16	=	0.24					(30)
Total a	rea of e	lements	, m²			92.9									(31)
Party v	vall					28	x	0	=	0					(32)
Party f	loor					63.2					[(32a)
Party c	eiling					0					Ī		_		(32b)
* for win ** includ	dows and e the area	roof wind as on both	ows, use e sides of ir	effective wil aternal wall	ndow U-va Is and part	alue calcula itions	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	n 3.2		_
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				26	.68	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	342	3.86	(34)
Therma	al mass	parame	ter (TMF	P = Cm ÷	- TFA) in	ı kJ/m²K			Indica	tive Value:	Low		1()0	(35)
For desig can be u	gn assess ised inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	constructi	on are not	⁻ known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f			
Therma	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix k	<						3.	72	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)									-
Total fa	abric he	at loss							(33) +	(36) =			30	1.4	(37)

Ventila	ation hea	at loss ca	alculated	d monthl	у				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	20.09	19.3	19.3	17.86	16.99	16.59	16.21	16.21	17.2	17.86	18.56	19.3		(38)
Heat t	ransfer o	coefficie	nt, W/K	-				-	(39)m	= (37) + (3	38)m			
(39)m=	50.49	49.7	49.7	48.26	47.39	46.99	46.61	46.61	47.6	48.26	48.96	49.7		
								•		Average =	Sum(39)1.	12 /12=	48.36	(39)
Heat lo	oss para	meter (I	HLP), W	/m²K				<u> </u>	(40)m	= (39)m ÷	(4)			
(40)m=	1.74	1.71	1.71	1.66	1.63	1.62	1.61	1.61	1.64	1.66	1.69	1.71	4.07	
Numb	er of day	/s in mo	nth (Tab	ole 1a)					/	Average =	Sum(40)₁.	12/12=	1.67	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ar:	
Accur			NI											(42)
if TF	A > 13.9	9, N = 1	+ 1.76 x	([1 - exp	(-0.0003	849 x (TF)2)] + 0.0	0013 x (⁻	ΓFA -13.	<u>1.</u> 9)	15		(42)
if TF	A £ 13.	9, N = 1			·	·					·			
Annua Reduce	l averag	e hot wa	ater usa	ge in litre	es per da 5% if the c	ay Vd,av Iwelling is	erage =	(25 x N)	+ 36 a water us	se target o	64	.86		(43)
not mor	e that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)		a mator ac	io larget e				
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	000	000		200		
(44)m=	71.34	68.75	66.15	63.56	60.97	58.37	58.37	60.97	63.56	66.15	68.75	71.34		
		I	!	1	!	!	ļ	1	-	Fotal = Su	m(44) ₁₁₂ =	=	778.28	(44)
Energy	content of	hot water	used - ca	lculated m	onthly = 4.	190 x Vd,ı	m x nm x E	OTm / 3600) kWh/mor	oth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	106.05	92.75	95.71	83.44	80.07	69.09	64.02	73.47	74.35	86.64	94.58	102.7		
lf instan	taneous v	vater heati	na at poin	t of use (no	o hot wate	r storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	-	1022.88	(45)
(46)m-	15.91	13.01	14.36	12 52	12.01	10.36	96	11.02	11 15	13	14 19	15.41		(46)
Water	storage	loss:	14.00	12.02	12.01	10.00	0.0	11.02	11.10	10	14.10	10.41		(10)
a) If m	anufactu	urer's de	clared lo	oss facto	or is knov	wn (kWh	/day):					0		(47)
Tempe	erature f	actor fro	m Table	e 2b								0		(48)
Energ	y lost fro	m water	r storage	e, kWh/y	ear			(47) x (48)) =			0		(49)
If man	ufacture	r's decla	ared cyli	nder loss	s factor is	s not kno	own:							(50)
Cylina If cor	er volun	le (illies) INCIUUI I no tank ii	ng any s n dwelling	ontor 110	litres in br	IIII Same	;				0		(50)
Othe	rwise if no	stored ho	t water (th	nis includes	instantan	eous com	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a		,		• /					0		(52)
Tempe	erature f	actor fro	m Table	e 2b								0		(53)
Energ	y lost fro	m watei	r storage	e, kWh/y	ear			((50) x (51	l) x (52) x	(53) =		0		(54)
Enter	(49) or (54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contain	s dedicate	d solar sto	brage, (57)	m = (56)m	x [(50) – ((H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primar	y circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	olar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	36.36	31.64	33.71	31.34	31.07	28.79	29.75	31.07	31.34	33.71	33.9	36.36		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	142.41	124.4	129.42	114.79	111.13	97.88	93.77	104.54	105.69	120.35	128.48	139.06		(62)
Solar DH	W input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter					•		•	•			
(64)m=	142.41	124.4	129.42	114.79	111.13	97.88	93.77	104.54	105.69	120.35	128.48	139.06		
								Outp	but from w	ater heate	r (annual)₁	12	1411.92	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	44.35	38.75	40.25	35.58	34.39	30.17	28.72	32.19	32.56	37.24	39.92	43.24		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal da	ains (see	Table 5	5 and 5a):	•		-				•	-	
Motab		s (Table	5) Wat	te) -									
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26		(66)
Liahtin	a aains	(calcula	ted in Ar	pendix	L. equat	ion L9 o	r L9a). a	lso see ⁻	Table 5	1			I	
(67)m=	23.98	21.3	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.81	23.12	24.64		(67)
Applia	nces da	ins (calc	ulated ir	Append	lixlea	uation L	13 or I 1	i 3a) also	i See Ta	l ble 5				
(68)m=	142.02	143.49	139.78	131.87	121.89	112.51	106.25	104.77	108.49	116.39	126.37	135.75		(68)
Cookin	n dains	(calcula	L Ited in A	l ppendix	L equat	ion I 15	l or I 15a') also se	l e Table	5	I			
(69)m=	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08		(69)
Pumps	and fai	ns dains	(Table /	[5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
		anoratio		tivo valu	es) (Tab	lo 5)								
(71)m=	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17		(71)
Wator	booting	goine (T	ablo 5)	10.11	10.11	10.11	10.11	10.11	10.11	10.11	10.11	10.11		()
(72)m-	50 61	9aii 15 (1	able 5)	10 12	46.22	/1 0	38.61	13.27	15 22	50.05	55 45	58 12		(72)
Tetel:		57.07	04.1	40.42	40.22	(66)	00.01	+0.27	(60)m	(70)m L (7)	1)m + (72)	00.12		()
(72)m-	201 77	gains =	207.27	270 57	254.00	220.05	220.06	225.92	245 47	262.44	201 1	204.69	l	(73)
(13)III=	ar gaing	230.02	207.37	210.01	204.00	230.00	229.90	233.03	243.47	202.41	201.1	294.00		(10)
Solar o	ains are o	alculated	usina sola	r flux from	Table 6a	and assoc	iated equa	ations to co	nvert to th	e applicat	le orientat	ion.		
Orient	ation: 4	Access F	actor	Area		Flu	X		a		FF		Gains	
								-	<u> </u>	-			(140)	

	Та	able 6d	m²			Table 6a	Table 6b			Table 6c	(W)		
North	0.9x	0.77	x	3.2	x	10.73	x	0.63	x	0.7	=	10.49	(74)
North	0.9x	0.77	x	3.2	x	20.36	x	0.63	x	0.7	=	19.91	(74)

North	0.9x	0.77	x	3	.2	x	3	3.31	x		0.63	x	0.7	=	32.57	(74)
North	0.9x	0.77	x	3	.2	x	5	4.64] x		0.63	- x	0.7	=	53.44	(74)
North	0.9x	0.77	x	3	.2	x	7	5.22	x		0.63	×	0.7	=	73.56	(74)
North	0.9x	0.77	x	3	.2	x	8	4.09	x		0.63	×	0.7	=	82.24	(74)
North	0.9x	0.77	x	3	.2	x	7	9.12	x		0.63	×	0.7	=	77.38	(74)
North	0.9x	0.77	x	3	.2	x	6	1.56	×		0.63	×	0.7	=	60.21	(74)
North	0.9x	0.77	x	3	.2	x	4	1.09	x		0.63	×	0.7	=	40.18	(74)
North	0.9x	0.77	x	3	.2	x	2	4.81	x		0.63	×	0.7	=	24.27	(74)
North	0.9x	0.77	x	3	.2	x	1	3.22	x		0.63	x	0.7	=	12.93	(74)
North	0.9x	0.77	x	3	.2	x	8	3.94	x		0.63	×	0.7	=	8.75	(74)
	-								-	-						
Solar g	gains in	watts, ca	alculated	d for eac	ch month	<u>۱</u>			(83)m	1 = SI	um(74)m .	(82)m				
(83)m=	10.49	19.91	32.57	53.44	73.56	8	32.24	77.38	60.	21	40.18	24.27	12.93	8.75		(83)
Total g	jains – i	nternal a	and sola	r (84)m	= (73)m	+ (83)m	, watts						r	1	
(84)m=	312.26	318.53	319.94	324	327.64	3	21.09	307.34	296	.04	285.65	286.68	294.03	303.42		(84)
7. Me	an inter	nal temp	perature	(heating	g seasor	ר)										
Temp	erature	during h	neating p	periods	n the liv	ing	area f	from Tab	ole 9,	, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living ar	ea, h1,n	n (s	ee Ta	ble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	0.91	0.9	0.88	0.85	0.77		0.66	0.51	0.5	53	0.72	0.84	0.9	0.91		(86)
Mean	interna	l temper	ature in	living a	rea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)					
(87)m=	18.2	18.39	18.82	19.34	20.01	2	20.53	20.82	20.	81	20.4	19.68	18.81	18.3		(87)
Temp	erature	during h	neating p	periods	in rest of	dw	elling	from Ta	able §	9. Tł	ם. 12 (°C)		-			
=m(88)	19.52	19.54	19.54	19.57	19.59		19.6	19.61	19.	, 61	19.59	19.57	19.55	19.54		(88)
Utilis	ation fac	tor for a	ains for	rest of a	Iwelling	h2	m (se	e Table	9a)				-1		1	
(89)m=	0.9	0.89	0.86	0.82	0.72		0.57	0.37	0.3	88	0.64	0.8	0.88	0.9		(89)
Moon		l tompor	Iin	the rest		ling	T2 (f				7 in Tabl		-1		1	
(90)m=	15.97	16 24	16.86	17.6	18.54	T -	12 (IC	19.52	193 J	52	19.05	18.09	16.85	16 12]	(90)
(00)	10.01	10.21	10.00				10.2	10.02	10.		f	LA = Liv	ing area ÷ (4	4) =	1 03	(91)
							\ (·			A) T O					
Mean			ature (fo			ellin Ta	g = fl	_A × 11	+ (1	- tL	A) × 12	10.72	10.00	10.20	1	(92)
		10.40	ho moo		20.06		uro fro	20.07 m Tabla	20.		20.45		10.00	10.30		(32)
(93)m=	18.12	18.31	18.74	19.25	19.91		20.42	20.72	20.	71	20.3	19.58	18.73	18.23		(93)
8. Sp	ace hea	tina rea	uiremen	t									1			
Set T	i to the i	mean int	ternal te	mperatu	ire obtai	ned	at ste	ep 11 of	Tabl	e 9t	o, so tha	t Ti.m=	:(76)m an	d re-calo	culate	
the ut	tilisation	factor fo	or gains	using T	able 9a						,		(-)		•	
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hn	ו:		-							-1		1	
(94)m=	0.88	0.87	0.85	0.81	0.74		0.63	0.49	0.	5	0.68	0.8	0.86	0.88		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8	34)m	-									1	(0-)
(95)m=	275.59	278.19	272.01	263.94	241.58	2	00.99	149.79	147	.95	194.25	229	253.69	267.82		(95)
Mont	nly aver	age exte	ernal ten	nperatur	e trom T	abl	e 8	16.0	40		14.0	10.0		4.0	1	(06)
(ອບ)ເມ=	4.5	Э	٥.٥	o./	11.7		14.0	10.9	10	.ฮ	14.3	10.8	1	4.9		(90)

Heat	loss rate	e for mea	an interr	al temp	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	687.97	661.6	593.39	509.01	389.33	273.68	177.91	177.45	285.41	423.92	574.07	662.49		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Wh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	306.81	257.66	239.1	176.45	109.92	0	0	0	0	145.02	230.68	293.63		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1759.28	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								60.66	(99)
9a. En	ergy rec	uiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:			, .									٦
Fracti	ion of sp	ace hea	it from s	econdar	y/supple	mentary	system	(000) 4	(004)				0	(201)
Fracti	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =	(222)]			1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 –)	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)								
	306.81	257.66	239.1	176.45	109.92	0	0	0	0	145.02	230.68	293.63		
(211)m	1 = {[(98)m x (20	4)] + (21	10)m } x	100 ÷ (2	206)	0	0	0	161 14	056.04	226.26		(211)
	340.9	200.29	200.07	196.06	122.14	0	0	Tota	U I (kWh/vea	r) = Sum(2)	200.01	320.20	1054.76	7(211)
Snac	o hoatin	a fuol (e	econdar	w) k\//b/	month				. (· · /15,1012		1954.76	
= {[(98)m x (20)1)] + (2 [,]	14) m } >	y), KVVII/ (100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
				1				Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating	I												-
Output	from wa	ater hea	ter (calc	ulated a	bove)							1		
- <i>tt</i> :-:	142.41	124.4	129.42	114.79	111.13	97.88	93.77	104.54	105.69	120.35	128.48	139.06		
Efficier		ater nea		00	00	00	00	00	00	00	00	00	90	(216)
(217)m=		90	90	90 onth	90	90	90	90	90	90	90	90		(217)
(219)m	n = (64)	m x 100) ÷ (217))m										
(219)m=	158.23	138.22	143.8	127.54	123.48	108.75	104.19	116.15	117.43	133.73	142.76	154.51		_
								Tota	I = Sum(2'	19a) ₁₁₂ =			1568.8	(219)
Annua	al totals									k\	Wh/year	•	kWh/year	7
Space	heating	fuel use	ed, main	system	1								1954.76	
Water	heating	fuel use	d										1568.8	
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatin	g pump	:									130		(230c)
boiler	with a f	an-assis	ted flue									45		(230e)
Total e	electricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electric	city for li	ghtina		-									169.38] (232)
100	Eucl coo	to indiv	vidual be	opting ou	otomo:									<u> </u>

Space heating - main system 1(211) x3.1 $x 0.01 =$ 0.06 (240) Space heating - main system 2(213) x0 $x 0.01 =$ 0 (242) Space heating - secondary(215) x0 $x 0.01 =$ 0 (242) Water heating cost (other fuel)(219) 3.1 $x 0.01 =$ 0 (242) Pumps, fans and electric keep-hot(231)114.6 $x 0.01 =$ 20.06 (242) (10f) cpack tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a (245) (245) (245) Energy for lighting(232) (245) (247) (253) (254) (245) Additional standing charges (Table 12)108 $(253) \times (254) + (250) \times (254) =$ $(254) \times (255) \times (256) + (264) =$ Energy cost factor (ECF) $(225) \times (226) + 1(4) + 45.0) =$ $(262) \times (276) + (262) \times (276) + (262) $		Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 2 (213) x 0 $x 0.01 =$ 0 (241) Space heating - secondary (216) x 0 $x 0.01 =$ 0 (242) Water heating cost (dther fuel) (219) 3.1 $x 0.01 =$ 0 (242) Pumps, fans and electric keep-hot (231) 11.46 $x 0.01 =$ 0 (242) (107) repat tariff, list each of (230a) to (230g) separately as applicable and apply tuel price according to Table 12a 10.06 (261) Additional standing charges (Table 12) 10.06 (261) 11.46 $x 0.01 =$ 10.41 (260) Additional standing charges (Table 12) 10.06 (261) 11.40 $x 0.01 =$ 10.41 (260) Additional standing charges (Table 12) 10.06 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 (261) 10.02 <td>Space heating - main system 1</td> <td>(211) x</td> <td>3.1 × 0.01</td> <td>= 60.6</td> <td>(240)</td>	Space heating - main system 1	(211) x	3.1 × 0.01	= 60.6	(240)
Space heating - secondary (215) x 0 x 0.01 = 0 (242) Water heating cost (other fuel) (219) 3.1 x 0.01 = (242) Pumps, fans and electric keep-hot (31) 11.46 x 0.01 = (242) Renery for lighting (32) 11.46 x 0.01 = (242) Additional standing charges (Table 12) 11.46 x 0.01 = (242) Additional standing charges (Table 12) 11.46 x 0.01 = (245) Additional standing charges (Table 12) (245)(247) + (250)(254) = (251.7	Space heating - main system 2	(213) x	0 × 0.01	= 0	(241)
Water heating cost (other fuel) (219) 3.1 \times 0.01 = (48.83 (247) Pumps, fans and electric keep-hot (231) 11.46 \times 0.01 = (20.06 (249) Energy for lighting (230) 11.46 \times 0.01 = Table 12a (240) Additional standing charges (Table 12) (252) 11.46 \times 0.01 = Table 12a (250) Appendix Q items: repeat lines (253) and (254) as needed Total energy cost (245)(247) + (250)(254) = 254.7 (255) 11a. SAP rating - individual heating systems (245)(247) + (250)(254) = 0.47 (256) 12a. CO2 emissions - Individual heating systems including micro-CHP 0.47 (256) 77.43 (258) 22a. CO2 emissions - Individual heating systems including micro-CHP 0.47 (256) 77.43 (256) 23a code eating (main system 1) (211) × 0.198 = 0.623) (261) (263) (263) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264) (264	Space heating - secondary	(215) x	0 × 0.01	= 0	(242)
Pumps, fans and electric keep-hot (231) 11.44 \times 0.01 = 20.06 (249) (if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a 13.41 (250) Additional standing charges (Table 12) (245).(232) 11.46 \times 0.01 = 13.41 (250) Appendix Q items: repeat lines (253) and (254) as needed Total energy cost (245).(247) + (250)(254) = 254.7 (255) 11.3. SAP rating - individual heating systems (245).(250).(254) = 0.47 (256) 12. SAP rating (Section 12) 0.47 (256) 1.62 (257) SAP rating (Section 12) 77.43 (268) 77.43 (268) 12. CO2 emissions – Individual heating systems including micro-CHP Emission factor kg CO2/year kg CO2/year Space heating (main system 1) (211) × 0.198 = 387.04 (261) Space heating (secondary) (215) × 0 = 0 (262) Space heating (secondary) (215) × 0.198 = 310.62 (264) Space heating (secondary) (215) × 0.517 = 0	Water heating cost (other fuel)	(219)	3.1 × 0.01	= 48.63	(247)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a Energy for lighting (232) 11.46 x 0.01 = 19.41 (280) Additional standing charges (Table 12) 106 (251) Appendix Q items: repeat lines (253) and (254) as needed 254.7 (255) Total energy cost (245)(247) + (250)(254) = 254.7 (255) 11a. SAP rating - individual heating systems 0.47 (256) (257) SAP rating (Section 12) 0.47 (256) (257) 12a. CO2 emissions – Individual heating systems including micro-CHP Emission factor Emissions Space heating (main system 1) (211) × 0.198 = 0.263) Water heating (261) + (262) + (263) + (264) = 697.66 (265) Electricity for pumps, fans and electric keep-hot (231) × 0.517 = 0.273 Total (Section 14) (212) × 0.517 = 0.302 (273) Electricity for lighting (232) × 0.517 = 0.22 (273) CO2 emissions per m ² (272) + (4) = 0.22 (273) (272) + (4) =<	Pumps, fans and electric keep-hot	(231)	11.46 × 0.01	= 20.06	(249)
Additional standing charges (Table 12) 106 (251) Appendix Q items: repeat lines (253) and (254) as needed 254.7 (255) Total energy cost (245)(247) + (250)(254) = 254.7 (255) 11a. SAP rating - individual heating systems 0.47 (256) (256) Energy cost deflator (Table 12) 0.47 (256) (257) SAP rating (Section 12) 0.47 (256) 12a. CO2 emissions – Individual heating systems including micro-CHP Emission factor Emissions factor Emissions factor Kg CO2/kWh Kg CO2/kWh Kg CO2/kWh Kg CO2/kWh Kg CO2/kWh (261) </td <td>(if off-peak tariff, list each of (230a) to (Energy for lighting</td> <td>(230g) separately as applicable an (232)</td> <td>nd apply fuel price according t</td> <td>o Table 12a =</td> <td>(250)</td>	(if off-peak tariff, list each of (230a) to (Energy for lighting	(230g) separately as applicable an (232)	nd apply fuel price according t	o Table 12a =	(250)
Appendix Q items: repeat lines (253) and (254) as needed 254.7 (255) 11a. SAP rating - individual heating systems 0.47 (256) Energy cost deflator (Table 12) 0.47 (256) Energy cost factor (ECF) $(255) \times (256)$] + $[(4) + 45.0] =$ 1.62 (257) SAP rating (Section 12) 77.43 (258) Energy Emission factor KWh/year Emission factor Kg CO2/kWh Space heating (main system 1) (211) \times 0.198 = 0.162 (257) Space heating (secondary) (215) \times 0.198 = 0.262 /kWh Space heating (secondary) (219) \times 0.517 = 90.48 (267) Electricity for jumps, fans and electric keep-hot (231) \times 0.517 = 87.57 (268) CO2 emissions per m ² (272) + (4) = 837.67 (272) 273 El rating (section 14) 93.22 (273) 81.27 93.85 (261) Space heating (main system 1) (211) \times 1.02 = 193.85 (261) CO2 emissions per m ² (272) + (4) = 92.2 (273) 81.27 Electricity for lighting (232) \times 0.517 = $92.57.7$ (268) $83.27.7$	Additional standing charges (Table 12)			106	(251)
Total energy cost $(245)(247) + (250)(254) =$ 254.7 (255) 11a. SAP rating - individual heating systems	Appendix Q items: repeat lines (253) a	nd (254) as needed			
11a. SAP rating - individual heating systems Energy cost deflator (Table 12) 0.47 (266) Energy cost factor (ECF) [(255) × (256)] + [(4) + 45.0] = 1.62 (257) SAP rating (Section 12) $7.7.43$ (258) Energy KWh/year Emission factor kWh/year $g CO2/kWh$ Emissions Space heating (main system 1) (211) × 0.198 = 0.2633 Water heating (219) × 0.198 = 310.62 (264) Space heating (secondary) (215) × 0.517 = 90.48 (267) Space heating (261) + (262) + (263) + (264) = 87.57 (268) 6265 Electricity for pumps, fans and electric keep-hot (231) × 0.517 = 87.57 (268) Total CO2, kg/year sum of (265)(271) = 87.57 (268) 87.57 (268) 87.57 (272) 87.57 (272) CO2 emissions per m ² (272) + (4) = 30.2 (273) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272) 87.57 (272	Total energy cost	(245)(247) + (250)(254) =		254.7	(255)
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SAP rating (Section 12) 77.43 (259) 12a. CO2 emissions – Individual heating systems including micro-CHP Emergy kWh/year Emission factor kg CO2/kWh Emissions kg CO2/kWh Space heating (main system 1) (211) x 0.198 = 387.04 (261) Space heating (secondary) (215) x 0 = 0 (263) Water heating (219) x 0.198 = 310.62 (264) Space and water heating (261) + (262) + (263) + (264) = 697.66 (266) Electricity for pumps, fans and electric keep-hot (231) x 0.517 = 90.48 (267) Total CO2, kg/year sum of (265)(271) = 875.71 (272) 602 87.571 (272) CO2 emissions per m² $(272) \div (4) =$ 30.2 (273) 84 (274) I3a. Primary Energy KWh/year Primary Factor 1.02 93.85 (261) Space heating (main system 1) (211) \times 1.02 = 193.85 (261) Space heating (main system 1) (211) \times 1.02 = 0 (263) Space heating (secondary) (215) \times 0 = 0 (263)	Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =		1.62	(257)
12a. CO2 emissions – Individual heating systems including micro-CHPEmission factor kWh/yearEmission factor kg CO2/kWhEmissions kg CO2/kWhSpace heating (main system 1) $(211) \times$ 0.198 = 387.04 (261) Space heating (secondary) $(215) \times$ 0 = 0 (263) Water heating $(219) \times$ 0.198 = 310.62 (264) Space and water heating $(261) + (262) + (263) + (264) =$ 697.66 (226) Electricity for pumps, fans and electric keep-hot $(231) \times$ 0.517 = 90.48 (267) Electricity for lighting $(232) \times$ 0.517 = 875.71 (272) CO2 emissions per m² $(272) \div (4) =$ 30.2 (273) El rating (section 14) 84 (274) 84 (274) Tal. Primary EnergyKWh/year $factor$ p <energy </energy kWh/year p <energy </energy kWh/yearSpace heating (main system 1) $(211) \times$ 1.02 = 0 (263) Space heating (secondary) $(215) \times$ 0 = 0 (263) Space heating (secondary) $(219) \times$ 1.02 = 0 (263) Space and water heating $(261) + (262) + (263) + (264) =$ 0 263 Energy for water heating $(261) + (262) + (263) + (264) =$ 0 (265) Electricity for pumps, fans and electric keep-hot $(231) \times$ 2.92 = 511 (267)	SAP rating (Section 12)			77.43	(258)
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(272) \div (4) =30.2 (273)El rating (section 14)30.2 (273)Bat (274)13a. Primary EnergyPrimary factorP. Energy KWh/yearSpace heating (main system 1)(211) \times 1.02=1993.85 (261)Space heating (secondary)(215) \times 0(263)Energy for water heating(219) \times 1.02=1600.17(264)Space and water heating(261) + (262) + (263) + (264) =3594.02(265)Electricity for pumps, fans and electric keep-hot(231) \times 2.92=511(267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting	kvvn/year (211) x (215) x (219) x (261) + (262) + (263) + (2 keep-hot (231) x (232) x	$ \begin{array}{c} $	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57	ar (261) (263) (264) (265) (267) (268)
El rating (section 14) 84 (274) 13a. Primary Energy KWh/year Primary factor P. Energy KWh/yearSpace heating (main system 1)(211) x 1.02 = 1993.85 (261)Space heating (secondary)(215) x 0 = 0 (263)Energy for water heating(219) x 1.02 = 1600.17 (264)Space and water heating(261) + (262) + (263) + (264) = 3594.02 (265)Electricity for pumps, fans and electric keep-hot(231) x 2.92 = 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year	kvvn/year (211) x (215) x (219) x (261) + (262) + (263) + (2 keep-hot (231) x (232) x	$\begin{array}{c} \text{Kg CO2/KVVh} \\ \hline 0.198 \\ = \\ \hline 0 \\ \hline 0.198 \\ = \\ \hline 0.198 \\ = \\ \hline 0.517 \\ = \\ \hline 0.517 \\ = \\ \hline 0.517 \\ = \\ \hline \text{sum of } (265)(271) = \\ \end{array}$	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71	ar (261) (263) (264) (265) (267) (268) (272)
Energy kWh/year Primary factor P. Energy kWh/yearSpace heating (main system 1) $(211) \times$ $1.02 =$ 1993.85 (261)Space heating (secondary) $(215) \times$ $0 =$ 0 (263)Energy for water heating $(219) \times$ $1.02 =$ 1600.17 (264)Space and water heating $(261) + (262) + (263) + (264) =$ 3594.02 (265)Electricity for pumps, fans and electric keep-hot $(231) \times$ $2.92 =$ 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m²	kvvn/year (211) x (215) x (219) x (261) + (262) + (263) + (2 keep-hot (231) x (232) x	$\begin{array}{rcr} \text{Kg CO2/KVVh} \\ \hline 0.198 & = \\ \hline 0 & = \\ \hline 0.198 & = \\ \hline 0.198 & = \\ \hline 0.517 & = \\ \hline (272) \div (4) = \\ \end{array}$	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71 30.2	ar (261) (263) (264) (265) (267) (268) (272) (273)
Energy kWh/yearPrimary factorP. Energy kWh/yearSpace heating (main system 1) $(211) \times$ 1.02 = 1993.85 (261)Space heating (secondary) $(215) \times$ 0 = 0 (263)Energy for water heating $(219) \times$ 1.02 = 1600.17 (264)Space and water heating $(261) + (262) + (263) + (264) =$ 3594.02 (265)Electricity for pumps, fans and electric keep-hot $(231) \times$ 2.92 = 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14)	(211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x	$\begin{array}{r} \text{Kg CO2/KVVh} \\ \hline 0.198 \\ = \\ \hline 0 \\ \hline 0.198 \\ = \\ \hline 0.517 \\ = \\ \hline (272) \div (4) = \\ \end{array}$	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71 30.2 84	ar (261) (263) (264) (265) (267) (268) (272) (273) (274)
Space heating (main system 1) $(211) \times$ 1.02 = 1993.85 (261) Space heating (secondary) $(215) \times$ 0 = 0 (263) Energy for water heating $(219) \times$ 1.02 = 1600.17 (264) Space and water heating $(261) + (262) + (263) + (264) =$ 3594.02 (265) Electricity for pumps, fans and electric keep-hot $(231) \times$ 2.92 = 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	(211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x	$\begin{array}{r} \text{Kg CO2/KVVh} \\ \hline 0.198 \\ = \\ \hline 0 \\ 0.198 \\ = \\ \hline 0.517 \\ = \\ \hline 0.517 \\ = \\ \hline 0.517 \\ = \\ \text{sum of } (265)(271) = \\ (272) \div (4) = \end{array}$	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71 30.2 84	ar (261) (263) (264) (265) (267) (268) (272) (273) (274)
Space heating (secondary) $(215) \times$ 0 = 0 (263) Energy for water heating $(219) \times$ 1.02 = 1600.17 (264) Space and water heating $(261) + (262) + (263) + (264) =$ 3594.02 (265) Electricity for pumps, fans and electric keep-hot $(231) \times$ 2.92 = 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	(211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year	$ \begin{array}{c} 0.198 \\ 0 \\ 0 \\ 0 \\ 0.198 \\ 0 \\ 0.198 \\ 0 \\ 0.517 \\ 0.$	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71 30.2 84	ar (261) (263) (264) (265) (267) (268) (272) (272) (273) (274)
Energy for water heating $(219) \times$ 1.02 = 1600.17 (264) Space and water heating $(261) + (262) + (263) + (264) =$ 3594.02 (265) Electricity for pumps, fans and electric keep-hot $(231) \times$ 2.92 = 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1)	(211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year (211) x	Rg CO2/KVVN = 0.198 = 0 = 0.198 = 0.198 = 0.198 = 0.198 = 0.517 = 0.	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71 30.2 84 P. Energy kWh/year 1993.85	ar (261) (263) (264) (265) (267) (268) (272) (272) (273) (274)
Space and water heating $(261) + (262) + (263) + (264) =$ 3594.02 (265) Electricity for pumps, fans and electric keep-hot $(231) \times$ 2.92 $=$ 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary)	Kvvn/year (211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year (211) x (215) x	$Rg CO2/KVVh$ $\boxed{0.198} = \\ 0 = \\ 0.198 = \\ 0.198 = \\ 0.517 = \\ 0.517 = \\ 0.517 = \\ (272) \div (4) = \\ Primary \\ factor \\ \boxed{1.02} = \\ 0 = \\ $	Kg CO2/yea 387.04 0 310.62 697.66 90.48 87.57 875.71 30.2 84 P. Energy kWh/year 1993.85 0	ar (261) (263) (264) (265) (267) (268) (272) (272) (273) (274) (261) (263)
Electricity for pumps, fans and electric keep-hot (231) x 2.92 = 511 (267)	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating	Kvvn/year (211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy KWh/year (211) x (215) x (219) x	$Rg CO2/KVVh$ $0.198 = 0$ $0.198 = 0$ $0.198 = 0$ $0.198 = 0$ $0.517 = 0$ $0.517 = 0$ $0.517 = 0$ $(272) \div (4) = 0$ $Frimary$ factor $1.02 = 0$ $0 = 0$ $1.02 = 0$	Kg CO2/yea 387.04 0 310.62 697.66 90.48 875.71 30.2 84 P. Energy kWh/year 1993.85 0 1600.17	ar (261) (263) (264) (265) (267) (268) (272) (272) (273) (273) (274) (261) (261) (263) (264)
	Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	Kvvn/year (211) x (215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy KWh/year (211) x (215) x (219) x (261) + (262) + (263) + (2	$Rg CO2/KVVN$ $\boxed{0.198} = \\ 0 = \\ 0.198 = \\ 0.198 = \\ 0.198 = \\ 0.517 = \\ 0.517 = \\ 0.517 = \\ 0.517 = \\ (272) \div (4) = \\ Primary \\ factor \\ \boxed{1.02} = \\ 0 = \\ 1.02 = \\ 0 = \\ 0 = \\ 1.02 = \\ 0 = $	Kg CO2/yea 387.04 0 310.62 697.66 90.48 875.71 30.2 84 P. Energy kWh/year 1993.85 0 1600.17 3594.02	ar (261) (263) (264) (265) (267) (268) (272) (272) (273) (274) (274) (261) (263) (264) (265)

Electricity for lighting	(232)	x		0	= [494.59	(268)			
'Total Primary Energy			sum of (265).	(271) =	[4599.61	(272)			
Primary energy kWh/m²/year			(272) ÷ (4) =		[158.61	(273)			
			User D	etails:						
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Assessor Name:	Dan Watt			Strom	a Num	ber:		STRO	000002	
Software Name:	Stroma FSAP 200)9		Softwa	are Ver	sion:		Versio	n: 1.4.0.76	
		Pro	operty A	Address:	Flat 8					
Address :	172 High St, Teddir	ngton, TW	'11 8HL	J						
1. Overall dwelling dimen	isions:									
Ground floor			Area 6	1 (m²) i3.2	(1a) x	Ave He	e ight(m) 67	(2a) =	Volume(m ³) 168.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e	e)+(1n)) 6	3.2	(4)					-
Dwelling volume			L]	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	168.74	(5)
2. Ventilation rate:								-		_
	main S	econdary	y i	other		total			m ³ per hour	
Number of chimneys		0	+ [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0] + [_	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fan	s		J L_		- _	2	x	10 =	20	(7a)
Number of passive vents						0	x ′	10 =	0	(7b)
Number of flueless gas fire	es				Γ	0	x 4	40 =	0	(7c)
								Air ch	anges per hou	Jr
Infiltration due to chimney	s flues and fans – (6	a)+(6b)+(7a	a)+(7b)+(7	7c) =	Г			. (5) -	0.40	
If a pressurisation test has be	en carried out or is intende	ed, proceed	to (17), o	otherwise o	continue fro	20 om (9) to (16)	÷ (0) –	0.12	
Number of storeys in the	e dwelling (ns)								0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber	frame or (0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pre	sent, use the value corres	ponding to	the greate	er wall area	a (after					
If suspended wooden flo	oor, enter 0.2 (unsea	led) or 0.1	l (seale	d), else	enter 0			[0	(12)
If no draught lobby, ente	er 0.05, else enter 0	,	,	,.					0	(13)
Percentage of windows	and doors draught st	ripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00		Ì	0	(15)
Infiltration rate				(8) + (10) ·	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, c	50, expressed in cut	oic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8)), otherwis	se (18) = (16)				0.37	(18)
Air permeability value applies	if a pressurisation test ha	s been done	e or a deg	ree air pei	rmeability	is being us	sed			٦
Shelter factor	sneitered			(20) = 1 - [0.075 x (1	9)] =			3	(19)
Infiltration rate incorporation	ng shelter factor			(21) = (18)) x (20) =	-71		l	0.70	(20)
Infiltration rate modified fo	r monthly wind speer	4		(l	0.29	
Jan Feb M	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7						-			
(22)m= 5.4 5.1 5	6.1 4.5 4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1		
Wind Easter (22a) ~ (22)		· ·						•		
$v_{\text{VIIIU}} = \frac{1}{1} \frac{35}{1} \frac{1}{1} \frac{1}{27} \frac{1}{1} 1$	7 1 12 1 02	0.98	0.92	0.92	1.05	1 1 2	12	1 27		
	1.02	0.00	0.02	0.02	1.00	1.12	1.2	1.21		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m			-		
<u> </u>	0.39	0.36	0.36	0.32	0.29	0.28	0.26	0.26	0.3	0.32	0.34	0.36		
Calcula	ate etter	ctive air al ventila	change i	rate for t	he applic	cable ca	se						0	(220)
lf exh	aust air h	eat pump i	using Appe	endix N. (2	3b) = (23a) x Fmv (e	equation (N	(5)) othe	rwise (23b) = (23a)			0	(236)
lf bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =) = (200)			0	(230)
a) If	holonoc	d moob			with hor				$a_{\rm n} = (2)$	2b)m i (f	00h) v [/	1 (22a)	· 1001	(230)
a) II					with hea				(22)	$\frac{20}{0}$	230) X [$\frac{1-(230)}{1-0}$	- 100j	(24a)
(24a)III-					without	boot roo)m ()r) 226)	0		(210)
0) II					without			//v) (240	0 $m = (22)$	20)m + (2 0	230)	0	l	(24b)
(240)11=		0			0	0	0			0	0	0		(240)
с) IT i	wnole n if (22b)n	ouse ex $0 < 0.5 \times$	tract ver	hen (24a	r positiv). otherv	vise (24)	r(22t) = (22t)	m + 0	5 x (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	ve input v	ventilatio	n from l	oft					
i	if (22b)n	n = 1, th	en (24d)	m = (22k	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b) or (240	c) or (24	d) in boy	(25)					
(25)m=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	0.57		(25)
3 He	at losse	s and he	eat loss r	paramete	ər.									
FLEN		Gros	ss	Openin	as	Net Ar	ea	U-valı	Je	AXU		k-value	3	AXk
		area	(m²)	m	2	A ,n	n²	W/m2	K	(W/ł	<)	kJ/m²-l	X	kJ/K
Doors						2.08	x	1.5	= [3.12				(26)
Window	WS					4.8	x1,	/[1/(1.5)+	0.04] =	6.79				(27)
Walls 7	Type1	53	3	0		53	x	0.25	=	13.25				(29)
Walls 7	Гуре2	24	ļ	2.08		21.92	<u>x</u>	0.23	=	4.95				(29)
Walls 7	Гуре3	9.6	6	4.8		4.8	x	0.25	=	1.2				(29)
Roof 1	Гуре1	50)	0		50	x	0.16	=	8			$\neg \ \Box$	(30)
Roof 7	Гуре2	2.3	3	0		2.3	x	0.16	=	0.37			$\neg \Box$	(30)
Total a	rea of e	lements	, m²			138.9)							(31)
Party v	vall					28	x	0	=	0				(32)
Party f	loor					63.2					[7	(32a)
Party c	eiling					0					Γ		7	(32b)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of in	effective wil aternal wall	ndow U-va Is and part	lue calcula itions	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				37.6	8 (33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	3841.	46 (34)
Therma	al mass	parame	eter (TMF	P = Cm ÷	- TFA) in	⊨kJ/m²K			Indica	tive Value:	Low		100	(35)
For desig can be u	gn assess ised inste	sments wh ad of a de	ere the de tailed calci	tails of the ulation.	constructi	on are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therma	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						5.56	; (36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			43.2	3 (37)

Ventila	tion hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.98	31.53	31.53	30.72	30.23	30	29.79	29.79	30.35	30.72	31.11	31.53		(38)
Heat t	ansfer o	coefficie	nt, W/K		-	-	-	-	(39)m	= (37) + (3	38)m			
(39)m=	75.22	74.77	74.77	73.95	73.46	73.24	73.02	73.02	73.58	73.95	74.35	74.77		
									/	verage =	Sum(39)1.	12 /12=	74.01	(39)
Heat lo	oss para	meter (H	HLP), W	/m²K				I	(40)m	= (39)m ÷	(4)			
(40)m=	1.19	1.18	1.18	1.17	1.16	1.16	1.16	1.16	1.16	1.17	1.18	1.18	4.47	(40)
Numb	er of day	s in mo	nth (Tab	le 1a)					/	<pre>Average =</pre>	Sum(40)1.	12 /12=	1.17	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			-				-	-			-			
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ar:	
Accur		nonov	NI											(40)
if TF	A > 13.9	ipancy, i 9, N = 1	in + 1.76 x	(1 - exp	(-0.0003	849 x (TF	- A -13.9)2)] + 0.()013 x (1	FA -13.	<u>2.</u> 9)	07		(42)
if TF	A £ 13.9	9, N = 1			,	,	·	, ,-	,		,			
Annua Reduce	l averag	e hot wa	ater usag	ge in litre	es per da 5% if the o	ay Vd,av Iwelling is	erage = designed t	(25 x N) to achieve	+ 36 a water us	e tarnet o	87	.76		(43)
not mor	e that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)			io largot o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	000	000		200		
(44)m=	96.54	93.03	89.52	86.01	82.5	78.99	78.99	82.5	86.01	89.52	93.03	96.54		
			I					I	-	Fotal = Su	m(44) ₁₁₂ =	=	1053.15	(44)
Energy	content of	hot water	used - ca	culated me	onthly $= 4$.	190 x Vd,r	n x nm x C	OTm / 3600) kWh/mon	th (see Ta	ables 1b, 1	c, 1d)		
(45)m=	143.51	125.51	129.52	112.92	108.35	93.49	86.64	99.42	100.6	117.24	127.98	138.98		
If in a tau						(antan O in	haven (40) <i>to (</i> 04)	Fotal = Su	m(45) ₁₁₂ =	-	1384.16	(45)
ir instan	taneous w	ater neatil	ng at point T	r or use (no I	not water	r storage),	enter 0 in I	Doxes (40) to (61)			· · · · · ·		(10)
(46)m= Water	21.53 storage	18.83 1055	19.43	16.94	16.25	14.02	13	14.91	15.09	17.59	19.2	20.85		(46)
a) If m	anufacti	irer's de	clared lo	oss facto	or is knov	vn (kWh	/dav):					0		(47)
Tempe	erature f	actor fro	m Table	2b		,	,					0		(48)
Enera	/ lost fro	m water	r storage	. kWh/ve	ear			(47) x (48) =			0		(49)
lf man	ufacture	r's decla	ared cyli	nder loss	s factor is	s not kno	own:					<u> </u>		()
Cylind	er volum	ne (litres) includi	ng any s	olar stor	age with	iin same)				0		(50)
If cor	nmunity h	eating and	l no tank ir	n dwelling,	enter 110	litres in bo	ох (50)		h (50)					
Othe	rwise ir no	storea no	ot water (tri	is includes	instantan	eous comi	, voliers)	enter 0 in	DOX (50)					
Hot wa	ater stor	age loss	actor fi	rom lab	e 2 (kW	h/litre/da	ay)					0		(51)
Volum Tompo	e factor	from 1a	ble 2a m Table	2h								0		(52)
Tempe				: ZU				((50) (54) ··· (EQ) ··· ((50)		0		(53)
Energ	/ 10st 110 (49) or (4	m water 54) in (5	r storage 5)	e, kvvn/ye	ear			((SU) X (ST) X (52) X ((53) =		0		(54)
Water	storage	loss cal	culated	for each	month			((56)m = 0)	55) x (41)r	n		U		(00)
(56)m-						0	0			0	0			(56)
(50)m=	er contains	s dedicate	d solar sto	u prage. (57)	m = (56)m	x [(50) – (U H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	(50)
(57)~-		0			()				, ()	0	,			(57)
(37)11=			I V	<u>۲</u>			<u>۲</u>	I V		U				(07)

Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	49.2	42.82	45.62	42.41	42.04	38.95	40.25	42.04	42.41	45.62	45.88	49.2		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	192.7	168.33	175.14	155.33	150.39	132.45	126.89	141.46	143.02	162.86	173.86	188.17		(62)
Solar DH	W input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0'	' if no sola	r contribut	ion to wate	er heating)	•	
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix G	S)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter							•	-		•	
(64)m=	192.7	168.33	175.14	155.33	150.39	132.45	126.89	141.46	143.02	162.86	173.86	188.17		
								Outp	out from wa	ater heate	r (annual)₁	12	1910.59	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	60.02	52.44	54.47	48.15	46.53	40.82	38.87	43.57	44.05	50.39	54.02	58.51	Ī	(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	vlinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	e Table 5	5 and 5a):	,		U				,	U U	
Motob		c (Table	5) Wot	te) -									
Metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23		(66)
Liahtin	a aains	ı (calcula	ted in Ar	pendix	L. equat	ion L9 oi	r L9a), a	lso see ⁻	Table 5		<u>.</u>	<u></u>	1	
(67)m=	49.14	43.65	35.5	26.87	20.09	16.96	18.33	23.82	31.97	40.6	47.38	50.51	l	(67)
Applia	nces da	ins (calc	L ulated ir	I Append	l lixlea	L Lation L	13 or I 1	3a) also	see Ta	ble 5			ł	
(68)m=	270.06	272.86	265.8	250.77	231.79	213.95	202.04	199.23	206.3	221.33	240.31	258.14	I	(68)
Cookir	n aains	l (calcula	L Ited in A	l nnendiv	L equat	ion 15	or 15a	l also se	L Do Tablo	5			I	
(69)m=	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	l	(69)
Pumps	and fai	ns gains	(Table /	[5a)									ł	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	I	(70)
				tivo valu	es) (Tab	- ¹⁰							i	(- /
(71)m=	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	-82 82	I	(71)
Wotor	booting		- 02.02 	02.02	02.02	02.02	02.02	02.02	02.02	02.02	02.02	02.02	i	(11)
				66.97	62.55	56.7	ED 04	E9 E6	61 10	67 72	75.02	79.64	1	(72)
(72)m=	00.07	/8.03	13.21	00.07	02.00	30.7	JZ.24	30.30	(60)	(70) m $+$ (7)	13.03	78.04	l	(12)
	nternal	gains =	475 44	445 40	445.00	(00)			400.00		1)11 + (72)	400.0	1	(72)
(73)m=	500.77	495.45	4/5.41	445.42	415.33	388.52	3/3.51	382.51	400.36	430.55	403.62	468.2		(13)
0. Solar o	ar gains	o.		r flux from	Table 6a	and associ	iated equa	itions to co	nvert to th	e applicat		ion		
			aony suid			בוים משפטטט בויי	v			applicat		.011.	Gains	
Unerita	auon. <i>F</i>	100835 F	acioi	Alea			^	-	9_	-			Gailis	

	Ta	able 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
South	0.9x	0.77	x	4.8	x	47.32	x	0.63	x	0.7	=	69.42	(78)
South	0.9x	0.77	x	4.8	x	77.18	x	0.63	x	0.7	=	113.22	(78)

South	0.9x	0.77	x	4	8	x	9	4.25	x		0.63	x	0.7	=	138.25	(78)
South	0.9x	0.77	x	4	8	x	10	05.11	x		0.63	×	0.7	=	154.2	(78)
South	0.9x	0.77	x	4	8	x	10	08.55	x		0.63	×	0.7	=	159.24	(78)
South	0.9x	0.77	x	4	.8	x	1	08.9	x		0.63	×	0.7	=	159.75	(78)
South	0.9x	0.77	×	4	.8	x	1	07.14] x		0.63	×	0.7	=	157.16	(78)
South	0.9x	0.77	x	4	8	x	10	03.88	x		0.63	×	0.7	=	152.39	(78)
South	0.9x	0.77	x	4	8	x	9	9.99	x		0.63	×	0.7	=	146.68	(78)
South	0.9x	0.77	x	4	.8	x	8	5.29	x		0.63	×	0.7	=	125.12	(78)
South	0.9x	0.77	x	4	.8	x	5	6.07	x		0.63	×	0.7	=	82.25	(78)
South	0.9x	0.77	x	4	8	x	4	0.89) x		0.63	x	0.7	=	59.98	(78)
									-							
Solar g	pains in	watts, ca	alculate	d for eac	h month	<u> </u>			(83)m	ו = S	um(74)m .	(82)m	-		L	
(83)m=	69.42	113.22	138.25	154.2	159.24	1	59.75	157.16	152	.39	146.68	125.1	2 82.25	59.98		(83)
Total g	jains – ii	nternal a	nd sola	r (84)m : 1	= (73)m	+ (8	83)m	, watts						i	I	
(84)m=	570.19	608.67	613.67	599.61	574.56	5	48.26	530.67	534	4.9	547.04	555.6	7 545.87	548.18		(84)
7. Me	an inter	nal temp	perature	(heating	g seasor	ר)										
Temp	erature	during h	eating p	periods i	n the livi	ing	area f	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living ar	ea, h1,n	1 (s	ee Ta	ble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	0.92	0.9	0.88	0.85	0.78		0.66	0.5	0.	5	0.68	0.82	0.9	0.92		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)					
(87)m=	19	19.2	19.54	19.88	20.34		20.7	20.9	20.	91	20.66	20.16	19.46	19.05		(87)
Temp	erature	durina h	neating r	periods i	n rest of	dw	vellina	from Ta	able 9	9. Tł	n2 (°C)		•	•		
(88)m=	19.93	19.94	19.94	19.95	19.95	1	9.96	19.96	19.	96	19.95	19.95	19.94	19.94		(88)
l Itilisa	tion fac	tor for a	ains for	rest of d	welling	h2	m (se	n De Table	(Qa)				-			
(89)m=	0.91	0.89	0.86	0.83	0.74		0.59	0.39	0.3	39	0.62	0.79	0.88	0.91		(89)
							TO //				7'. T .LI					
		1 temper	ature in			ling T₁	12 (f		eps 3			e 9C)	17.07	17.20		(90)
(90)11=	17.31	17.59	10.00	10.00	19.21		9.00	19.9	19	.9	19.03		$\frac{17.97}{100}$	4) =	0.29	
														., –	0.30	(01)
Mean	interna	l temper	ature (fo	or the wh	nole dwe	ellin	g) = fl	LA × T1	+ (1	- fL	.A) × T2				I	(00)
(92)m=	17.95	18.2	18.64	19.06	19.64	2	20.07	20.28	20.	28	20.02	19.42	18.54	18.01		(92)
Apply	adjustn	nent to t	he meai	n interna	l tempe	ratu	ire fro	m Table	e 4e,	whe	ere appro	opriate	10.00	47.00	l	(02)
(93)m=	17.8	18.05	18.49	18.91	19.49		9.92	20.13	20.	13	19.87	19.27	18.39	17.86		(93)
o. Spa	ace nea i to tho i	ung requ moon int	urremen ornal to	l mporatu	ro obtai	nod		on 11 of	Tabl		a co tha	t Ti m	-(76)m an	d ro colo	vulato	
the ut	ilisation	factor fo	or gains	using Ta	able 9a	neu	a 51	эрттог	Tabl	ie ar	J, 50 IIIa	L I I,III-	=(<i>1</i> 0)III all	u ie-caic	Juiale	
	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hn	<u>יי</u> ו:											I	
(94)m=	0.88	0.86	0.83	0.8	0.72		0.59	0.41	0.4	41	0.61	0.76	0.86	0.88		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m	_										
(95)m=	502.82	524.82	510.64	478.58	413.77	3	23.96	219.15	219	.48	334.54	423.7	1 466.74	484.67		(95)
Month	nly aver	age exte	rnal ten	nperatur	e from T	abl	e 8								1	
(96)m=	4.5	5	6.8	8.7	11.7		14.6	16.9	16	.9	14.3	10.8	7	4.9		(96)

Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1000.62	975.54	873.7	755.25	572.11	389.53	235.94	236.02	409.99	626.31	846.69	969.34		(97)
Spac	e heatin	g require	ement fo	or each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	370.37	302.88	270.12	199.21	117.81	0	0	0	0	150.74	273.57	360.59		,
								Tota	l per year	(kWh/yeai	r) = Sum(9	8)15,912 =	2045.27	(98)
Spac	e heatin	g require	ement in	ı kWh/m²	²/year								32.36	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:	t from o	ooondor	vlaunala	monton	avetem						-	1(204)
Fract	ion of sr		at from n	aconuar	y/supple	mentary	System	(202) = 1	– (201) =				1	(201)
Fract	ion of to	tal heati	na from	main sve	stem 1			(202) = (202)	02) × [1 –	(203)] =			1	(202)
Effici				ing evet				(201) - (2	02) ~ [1	(200)] -			1	
		nain spa		ing syste			- 0/						90	(200)
ETTICI	ency of s	seconda	ry/suppi i	ementar 1	y neatin	g systen I	1, % I	1	1				0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Spac	e heatin	g require	ement (c		d above)				450.74	070 57	000 50		
	370.37	302.88	270.12	199.21	117.81	0	0	0	0	150.74	273.57	360.59		
(211)n	$n = \{[(98)]$)m x (20	$[4)] + (2^{\prime})$	10)m } x	100 ÷ (2	206)				407.40	202.00	400.00		(211)
	411.52	330.94	300.13	221.34	130.9	0	0	U Tota	U l (kWh/vea	107.40	211)	400.00	2070 50	1(211)
Cree	a haatin	a fund (a			ine e e th			Tota		(2) –Oum(2		2	2212.52	(211)
Spac = {[(98	e nealin 3)m x (20	g luei (s)1)] + (2 [,]	econdar 14) m }	у), күүп/ « 100 – (208)									
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
			1	1	I	1	1	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}		0	(215)
Water	heating	I												1
Output	t from w	ater hea	ter (calc	ulated a	bove)	i	i	i	i	i	i			
	192.7	168.33	175.14	155.33	150.39	132.45	126.89	141.46	143.02	162.86	173.86	188.17		,
Efficie	ncy of w	ater hea	iter										90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel for $(210)m$	or water	heating,	kWh/m `(217` ∸ (onth										
(219)m=	214.11	187.03	194.59	172.59	167.1	147.16	140.99	157.17	158.91	180.96	193.18	209.08		
								Tota	I = Sum(2	19a) ₁₁₂ =	1		2122.88	(219)
Annua	al totals									k	Wh/year	•	kWh/year	1
Space	heating	fuel use	ed, main	system	1								2272.52	
Water	heating	fuel use	d										2122.88]
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatir	g pump	:									130		(230c)
boiler	r with a f	an-assis	sted flue									45		(230e)
Total e	electricity	/ for the	above,	kWh/yea	r			sum	of (230a).	(230g) =	:		175	(231)
Electri	city for li	ghting											347.16	(232)
100		to indi	idual be	opting ov	atomor									-

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 × 0.0	01 = 70.45 (240)
Space heating - main system 2	(213) x	0 × 0.0	01 = 0 (241)
Space heating - secondary	(215) x	0 × 0.0	0 (242)
Water heating cost (other fuel)	(219)	3.1 × 0.0	01 = 65.81 (247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.0	01 = 20.06 (249)
(if off-peak tariff, list each of (230a) to (2 Energy for lighting	230g) separately as applicable an (232)	d apply fuel price according	to Table 12a 11 =(250)
Additional standing charges (Table 12)			106 (251)
Appendix Q items: repeat lines (253) ar	nd (254) as needed		
Total energy cost	(245)(247) + (250)(254) =		302.1 (255)
11a. SAP rating - individual heating sy	stems		
Energy cost deflator (Table 12)			0.47 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =		1.31 (257)
SAP rating (Section 12)			81.69 (258)
12a. CO2 emissions – Individual heati	ng systems including micro-CHP		
	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating (main system 1)	kWh/year (211) x	kg CO2/kWh	kg CO2/year 449.96 (261)
Space heating (main system 1) Space heating (secondary)	kWh/year (211) x (215) x	kg CO2/kWh 0.198 = 0 =	kg CO2/year 449.96 (261) 0 (263)
Space heating (main system 1) Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.198 = 0 = 0.198 =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (263)	kg CO2/kWh 0.198 = 0 = 0.198 = 64) =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (20 xeep-hot (231) x	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (24) (261) x (231) x (232) x	kg CO2/kWh = 0.198 = 0 = 0.198 = 0.1	kg CO2/year (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (263) (231) x (232) x	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = 0.517 = sum of (265)(271) =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m²	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (263) (231) x (232) x	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = 0.517 = sum of (265)(271) = (272) \div (4) =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14)	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (263) (231) x (232) x	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = 0.517 = sum of (265)(271) = (272) \div (4) =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (20 (231) x (232) x	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = sum of (265)(271) = $(272) \div (4) =$	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (20) (231) x (232) x Energy kWh/year	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = 0.517 = sum of (265)(271) = (272) \div (4) = Primary factor	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274) P. Energy kWh/year
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1)	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (24) (231) x (232) x Energy kWh/year (211) x	kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = 0.517 = sum of (265)(271) = (272) \div (4) = Primary factor = 1.02 =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274) P. Energy kWh/year 2317.97 (261)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary)	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (20 (231) x (232) x Energy kWh/year (211) x (215) x	kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 64) = 0.517 = 0.517 = sum of (265)(271) = $(272) \div (4) =$ Primary factor = 1.02 = 0 =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274) P. Energy kWh/year 2317.97 (261) 0 (263)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (2020) (261) + (262) + (263) + (2020) (262) + (262) + (263) + (2020) (272) + (272) + (262) + (kg CO2/kWh 0.198 = 0 = 0.198 = 64) = 0.517 = 0.517 = (272) \div (4) = Primary factor 1.02 = 1.02 = 1.02 =	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274) P. Energy kWh/year 2317.97 (261) 0 (263) 2165.33 (264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (2020) (231) x (232) x Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (2020) (2020) + (kg CO2/kWh $ \begin{array}{c} 0.198 \\ = \\ 0 \\ 0.198 \\ = \\ 64) = \\ 0.517 \\ = \\ 0.517 \\ = \\ 0.517 \\ = \\ (272) \div (4) = \\ \end{array} $ Primary factor $ \begin{array}{c} 1.02 \\ = \\ 0 \\ 1.02 \\ = \\ 64) = \\ \end{array} $	kg CO2/year 449.96 (261) 0 (263) 420.33 (264) 870.29 (265) 90.48 (267) 179.48 (268) 1140.25 (272) 18.04 (273) 86 (274) P. Energy kWh/year 2317.97 (261) 0 (263) 2165.33 (264) 4483.31 (265)

Electricity for lighting	(232)	x		0	=	1013.7	(268)
'Total Primary Energy			sum of (265).	(271) =	[6008.01	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		[95.06	(273)

			User D	etails:						
Assessor Name:	Dan Watt		:	Stroma	a Num	ber:		STRO	000002	
Software Name:	Stroma FSAP 200	9	;	Softwa	are Ver	sion:		Versio	n: 1.4.0.76	
		Pro	operty A	Address:	Flat 9					
Address :	172 High St, Teddir	igton, TW	11 8HU	l						
1. Overall dwelling dimen	isions:									
Ground floor			Area 5	(m²) 5.5	(1a) x	Ave He 2.	e ight(m) .67	(2a) =	Volume(m ³) 148.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	5	5.5	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	148.19	(5)
2. Ventilation rate:										
	main S heating h	econdary neating	/ (other		total			m ³ per hour	
Number of chimneys	0 +	0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fan	s				- 	2	x ^	10 =	20	(7a)
Number of passive vents					Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fire	es				Г	0	x 4	40 =	0	(7c)
								Air ch	anges per hoj	Jr
Infiltration due to chimney	s flues and fans $-$ (6)	a)+(6b)+(7a)+(7h)+(7	(c) -	Г			. (5)	0.40	 7 (0)
If a pressurisation test has be	en carried out or is intende	ed, proceed	to (17), o	therwise c	continue fro	20 om (9) to (16)	÷ (5) =	0.13	(0)
Number of storeys in the	e dwelling (ns)						,	[0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber	frame or ().35 for	masonr	y constr	uction			0	(11)
if both types of wall are pre	sent, use the value corres	ponding to t	he greate	er wall area	a (after					
If suspended wooden flo	oor, enter 0.2 (unseal	ed) or 0.1	(seale	d), else	enter 0			I	0	(12)
If no draught lobby, ente	er 0.05, else enter 0	,	,	,,					0	(13)
Percentage of windows	and doors draught st	ripped						ĺ	0	(14)
Window infiltration			(0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			((8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =	İ	0	(16)
Air permeability value, c	50, expressed in cub	oic metres	per ho	ur per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8)	, otherwis	se (18) = (16)				0.38	(18)
Air permeability value applies	if a pressurisation test has	s been done	or a deg	ree air per	rmeability	is being us	sed			-
Number of sides on which Shelter factor	sheltered			(20) = 1 - [0.075 x (1	9)] =			3	(19)
Infiltration rate incorporation	na shelter factor			(21) = (18)	x(20) =	- /]		l	0.78	(20)
Infiltration rate modified for	r monthly wind speed	4		() ()	, (==)			l	0.3	(21)
Jan Feb N	Mar Apr Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7		I							
(22)m= 5.4 5.1 5	5.1 4.5 4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1		
		I I	I							
VVInd Factor (22a)m = (22))m ÷ 4	0.00	0.00	0.00	1.05	1.40	4.0	1.07		
(22a)m= 1.35 1.27 1	.27 1.12 1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sl	nelter an	nd wind s	speed)) = ((21a) x	(22a)m				_		
	0.4	0.38	0.38	0.34	0.31	0.29	0.28	3	0.28	0.31	0.34	0.36	0.38			
Calcula	ate effe	ctive air	change	rate for t	he appli	cable ca	se									
lf evh	aust air h		using Ann	andix N (2	23h) - (23;		acuation	n (Ni	5)) other	wise (23	h) – (23a)				0	
lf bala	anced with		overv: effic	iency in %	allowing f	for in-use f	actor (f	rom	Table 4h) –	b) = (20a)				0	
		d moob			with he) – .) m (() 2 b) m i (2026) [1 (220)		0	(23C)
a) II									0 (Z48	m = (2	$\frac{220}{1}$ + (1)	230) × [1 - (23C)	i ÷ 100]]		(24a)
(24a)III=								. /\/					0]		(244)
D) IT			anical ve			neat rec		(IVI) T	0 (V) (240)m = (∠	220)m + (23D)		1		(24b)
(240)m=		0			0				0		0	0	0]		(240)
c) If i	whole h f (22b)r	ouse ex n < 0.5 >	tract ver < (23b), 1	tilation (24)	or positiv c) = (23t	/e input v b); otherv	ventila wise (2	atior 24c	n from c :) = (22b	outside b) m + ().5 × (23ł)				
(24c)m=	0	0	0	0	0	0	0		0	0	0	0	0]		(24c)
d) lf i	natural f (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	se positi b)m othe	ve input erwise (2	ventila 24d)m	atio = 0	n from l).5 + [(2	oft 2b)m² >	(0.5]	•	•	•		
(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	ı	0.54	, 0.55	0.56	0.56	0.57]		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24) or (24	c) or (:	 24c	d) in box	(25)	- I			1		
(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	L I	0.54	0.55	0.56	0.56	0.57]		(25)
0.116	et le ce e							-			-			1		
3. He		s and ne	eat loss		er:	Not Ar							kyolu	_	د ۸	V Iz
ELEN	IENI	area	(m²)	r	igs 1 ²	A ,r	ea n²	_	W/m2	K	(W/	K)	kJ/m².	, K	kJ/	л к /К
Doors						2.08		x	1.5	=	3.12					(26)
Window	ws Type	e 1				1.6		x1/[1/(1.5)+	0.04] =	2.26					(27)
Window	ws Type	2				3.2		x1/[1/(1.5)+	0.04] =	4.53					(27)
Walls 7	Гуре1	41		0		41		x	0.25	=	10.25					(29)
Walls 7	Гуре2	6		2.08	3	3.92		x	0.23	=	0.88] [(29)
Walls 7	ГуреЗ	9.6	3	4.8		4.8		×	0.25	=	1.2			ן ר		(29)
Roof 1	Гуре1	44		0		44		×	0.16		7.04			i F		(30)
Roof 1	Гуре2	2.3	3	0		2.3		×	0.16		0.37	= i		Ξ i		(30)
Total a	rea of e	lements	, m²			102.9	€	L				'		ı		(31)
Party v	vall					28		×Г	0	=	0					(32)
Party fl	loor					63.2		L	_			I		۲ h		(32a)
Party c	eiling					0						[(32b)
* for win ** includ	dows and e the area	l roof wind as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and par	alue calcul titions	ated us	ing i	formula 1,	/[(1/U-va	lue)+0.04] a	as given in	n paragrapl	1 3.2		
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29	9.66	(33)
Heat c	apacity	Cm = S((Axk)							((28)	(30) + (3	2) + (32a)	(32e) =	33!	55.46	(34)
Therma	al mass	parame	eter (TMI		÷ TFA) ir	ר kJ/m²K				Indic	ative Value	: Low		1	00	(35)
For desig	gn asses: ised inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are noi	t known	n pre	cisely the	indicativ	ve values o	f TMP in T	able 1f			
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	ĸ							4	.12	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	31)								L		

Total fa	abric he	at loss							(33) +	(36) =			33.77	(37)
Ventila	tion hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	28.42	27.99	27.99	27.21	26.74	26.52	26.31	26.31	26.85	27.21	27.58	27.99		(38)
Heat tr	ansfer c	coefficie	nt, W/K		_	_	_		(39)m	= (37) + (3	38)m			
(39)m=	62.19	61.76	61.76	60.98	60.51	60.29	60.08	60.08	60.62	60.98	61.36	61.76		
Hoatle		motor (l	/// (D IL	/m2k					/ (40)m	Average = $(30)m$	Sum(39)1.	12 /12=	61.03	(39)
(40)m=	1.12	1.11	1.11	1.1	1.09	1.09	1.08	1.08	1.09	= (39)iii ÷	(4)	1.11		
(-)										Average =			1.1	(40)
Numbe	er of day	rs in mo	nth (Tab	le 1a)	-	-								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
Assum	ed occu	ipancy, I	N								1.	85		(42)
if TF	A > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ΓFA -13.	9)			
Annua	A£13.8 I averad	e hot wa	ater usad	ne in litre	es per da	av Vd.av	erade =	(25 x N)	+ 36		8	23		(43)
Reduce	the annua	al average	hot water	usage by	5% if the a	lwelling is	designed	to achieve	a water us	se target o	f02	2.0		()
not more	e that 125	litres per	person pei I	r day (all w I	ater use, l I	hot and co	ld) I					1	l	
Hot wat	Jan	Feb	Mar day for or	Apr	May	Jun		Aug	Sep	Oct	Nov	Dec		
(11)		07.04			77.00			(43)	00.05	00.05	07.04	00.50		
(44)m=	90.53	07.24	63.95	60.05	11.30	74.07	74.07	//.30	60.05	os.95 Total – Su	07.24 m(44)	90.53	987.6	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600) kWh/mon	th (see Ta	ables 1b, 1	c, 1d)	307.0	,
(45)m=	134.57	117.7	121.46	105.89	101.6	87.67	81.24	93.23	94.34	109.95	120.01	130.33		
										Fotal = Su	m(45) ₁₁₂ =	-	1298	(45)
If instan	taneous w	ater heati	ng at point I	of use (no	hot water	r storage), I	enter 0 in I	boxes (46)) to (61)		-	1	l	(10)
(46)m= Water	20.19 storage	17.65 Joss:	18.22	15.88	15.24	13.15	12.19	13.98	14.15	16.49	18	19.55		(46)
a) If m	anufactu	urer's de	clared lo	oss facto	or is knov	vn (kWh	/day):					0		(47)
Tempe	erature fa	actor fro	m Table	2b								0		(48)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (48)) =			0		(49)
If man	ufacture	r's decla	ared cylin	nder loss	s factor is	s not kno	own:							(50)
	er voluri	e (illies) INCludii I no tank ir	ng any s ndwelling	enter 110	litres in bo	in same	;				0		(50)
Other	wise if no	stored ho	t water (th	is includes	instantan	eous com	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a		,		• ·					0		(52)
Tempe	erature fa	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			((50) x (51) x (52) x ((53) =		0		(54)
Enter (49) or (8	54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)r	n				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	i0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primar	y circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	46.13	40.15	42.78	39.77	39.42	36.53	37.75	39.42	39.77	42.78	43.02	46.13		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	180.71	157.85	164.23	145.66	141.02	124.2	118.99	132.65	134.12	152.72	163.04	176.46		(62)
Solar DH	W input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter							•	-			
(64)m=	180.71	157.85	164.23	145.66	141.02	124.2	118.99	132.65	134.12	152.72	163.04	176.46		
								Outp	out from w	ater heate	r (annual)₁	12	1791.66	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	56.28	49.17	51.08	45.15	43.64	38.28	36.45	40.85	41.31	47.25	50.66	54.87		(65)
inclu	Ide (57)	m in calc	culation	• of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal da	ains (see	a Table 5	5 and 5a):	,		5				,	5	
Motob		o (Toblo	E) Mot	to) -									
Melab	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(66)m=	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12		(66)
Liahtin	u dains	(calcula	ted in Ar	opendix	L. equat	ion L9 o	r L9a), a	lso see ⁻	r Table 5					
(67)m=	42.8	38.01	30.92	23.41	17.5	14.77	15.96	20.75	27.84	35.36	41.26	43.99		(67)
Applia	nces da	ins (calc	L ulated ir	I Append	l dixlea	uation L	13 or I 1	i 3a) also) see Ta	l ble 5				
(68)m=	241	243.51	237.2	223.79	206.85	190.93	180.3	177.8	184.1	197.52	214.45	230.37		(68)
Cookir	L	l (calcula	L Ited in A	I npendix	L equat	ion I 15	or I 15a') also se	I ee Table	5	Į	Į		
(69)m=	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96		(69)
Pumps	and fa	l ns dains	(Table !	I 5a)				ļ	1		1			
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses		l vaporatio	n (nega	L tive valu	L es) (Tab	l le 5)								
(71)m=	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08		(71)
Water	L heating	L dains (T	able 5)		ļ				ļ		ļ	<u> </u>		
(72)m=	75.64	73.17	68.65	62.71	58.65	53.17	48.99	54.91	57.38	63.51	70.36	73.75		(72)
Total i	ntornal	aaine –				(66)	m + (67)m	1 + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		. ,
(73)m-	454 45	94113 – 449 7	431 78	404 91	378	353.88	340.26	348.46	364 33	301 30	421.08	443 11	l	(73)
6_Se	ar gaing	3:							001.00		1.00			(=)
Solar o	ains are o	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	ations to co	onvert to th	e applicab	ole orientat	ion.		
Orienta	ation: /	Access F	actor	Area		Flu	X No Go	т	g_ Jabla 6b	 т.	FF		Gains	

	Та	able 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
North	0.9x	0.77	x	1.6	x	10.73	x	0.63	x	0.7	=	5.25	(74)
North	0.9x	0.77	x	1.6	x	20.36	x	0.63	x	0.7	=	9.96	(74)

	_					_			-						-		_
North	0.9x	0.77	x		1.6	×	3	33.31	×	0.63	x		0.7		=	16.29	(74)
North	0.9x	0.77	x		1.6	×	5	54.64	x	0.63	x		0.7		=	26.72	(74)
North	0.9x	0.77	X		1.6	×	7	75.22	x	0.63	x		0.7		=	36.78	(74)
North	0.9x	0.77	x		1.6	×	8	34.09	x	0.63	x		0.7		=	41.12	(74)
North	0.9x	0.77	x		1.6	x	7	79.12	x	0.63	x		0.7		=	38.69	(74)
North	0.9x	0.77	x		1.6	x	6	61.56	x	0.63	x		0.7		=	30.1	(74)
North	0.9x	0.77	x		1.6	×	2	11.09	x	0.63	x		0.7		=	20.09	(74)
North	0.9x	0.77	x		1.6	×	2	24.81	x	0.63	x		0.7		=	12.13	(74)
North	0.9x	0.77	x		1.6	×	1	13.22	x	0.63	x		0.7		=	6.46	(74)
North	0.9x	0.77	x		1.6	×		8.94	x	0.63	x		0.7		=	4.37	(74)
East	0.9x	1	x		3.2	×	1	19.87	x	0.63	x		0.7		=	19.43	(76)
East	0.9x	1	x		3.2	×	3	38.52	x	0.63	x		0.7		=	37.67	(76)
East	0.9x	1	x		3.2	×	6	61.57	x	0.63	x		0.7		=	60.21	(76)
East	0.9x	1	x		3.2	x	ę	91.41	x	0.63	x		0.7		=	89.4	(76)
East	0.9x	1	x		3.2	×	1	11.22	x	0.63	x		0.7		=	108.77	(76)
East	0.9x	1	x		3.2	×	1	16.05	x	0.63	x		0.7		=	113.49	(76)
East	0.9x	1	x		3.2	×	1	12.64	x	0.63	x		0.7		=	110.16	(76)
East	0.9x	1	x		3.2	×	ę	98.03	x	0.63	x		0.7		=	95.87	(76)
East	0.9x	1	x		3.2	×		73.6	x	0.63	x		0.7		=	71.98	(76)
East	0.9x	1	x		3.2	x	4	46.91	x	0.63	x		0.7		=	45.87	(76)
East	0.9x	1	x		3.2	×	2	24.71	x	0.63	x		0.7		=	24.16	(76)
East	0.9x	1	х		3.2	x	1	16.39	x	0.63	x		0.7		=	16.03	(76)
Solar (gains in	watts, ca	alculate	for	each mor	nth		I	(83)m	n = Sum(74)m	n(82)ı	m					(00)
(83)m=	24.68	47.62	76.5	116 r (94)	$\frac{11}{m} = (72)$	55	154.61	148.85	125	.98 92.07	58.0	01	30.63	20.	41		(83)
(84)m-	170 13	107 32	508 27	521	$\frac{111}{02} = (73)$	55 T	(03)III 508.40	, walls	174	11 156 1	110		151 71	163	52		(84)
(04)11-	479.13	497.52	500.27	521	.02 020.	<u> </u>	500.49	403.1		.44 430.4	443	.4	431.71	403	.52		(04)
7. Me	ean inter	nal temp	erature	(hea	ting seas	son)		(I		
I emp	berature	auring n	ieating		is in the	living	g area	Trom Tai	DIE 9	, 1h1 (°C)						21	(85)
Utilisa		tor for g	ains for		area, n1	i,m (able 9a)				ot	Nov		~		
(86)m-	0.92		0.89		A 0.76	ау 6	0.62	0.46		ug Sep		3	0.91		ec 33		(86)
(00)11-	0.32	0.31	0.03	0.0	-	<u> </u>	0.02	0.40	0	+/ 0.09	0.0	5	0.91	0.0	5		(00)
Mear	interna	l temper	ature in	living	area T1	(fol	low ste	ps 3 to 7	7 in 1	able 9c)		10	40.50	10	40		(97)
(87)m=	19.1	19.26	19.61	19.	98 20.4	c,	20.77	20.93	20.	93 20.69	20.	19	19.53	19.	16		(07)
Temp	perature	during h	eating	perio	ls in rest	of d	welling	from Ta	able 9	9, Th2 (°C))			-			(00)
(88)m=	19.99	19.99	19.99	2) 20.0)1	20.01	20.02	20.	02 20.01	20)	20	19.	99		(88)
Utilis	ation fac	tor for g	ains for	rest	of dwellin	ig, h	2,m (se	e Table	9a)		-1						
(89)m=	0.91	0.9	0.87	0.8	2 0.7	1	0.56	0.36	0.3	37 0.62	0.8	3	0.89	0.9	92		(89)
Mear	interna	l temper	ature in	the r	est of dw	ellin	g T2 (f	ollow ste	eps 3	to 7 in Ta	ble 9c))		_			
(90)m=	17.49	17.71	18.21	18.	75 19.3	9	19.8	19.97	19.	97 19.71	19.0	04	18.11	17.	57		(90)
											fLA = l	_iving	area ÷ ((4) =		0.54	(91)
Mear	n interna	l temper	ature (fe	or the	whole d	welli	ng) = f	LA x T1	+ (1	– fLA) × T	2						
(92)m=	18.36	18.55	18.97	19.	42 19.9	6	20.33	20.49	20.	49 20.24	19.6	66	18.88	18.	43		(92)

Apply	[,] adjustr	nent to th	he mear	i internal	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.21	18.4	18.82	19.27	19.81	20.18	20.34	20.34	20.09	19.51	18.73	18.28		(93)
8. Sp	ace hea	ting requ	uirement											
Set T	i to the i	mean int	ernal ter	nperatu	re obtain	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a		•				,			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:	•									
(94)m=	0.89	0.88	0.85	0.8	0.71	0.57	0.4	0.41	0.63	0.79	0.87	0.89		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	427.32	436.85	430.4	417.2	369.5	288.8	194.74	193.75	286.75	353.43	392.64	413.91		(95)
Month	hly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	- =[(39)m :	x [(93)m	– (96)m]				
(97)m=	852.62	827.44	742.2	644.31	490.95	336.28	206.81	206.59	351.13	531.31	719.51	826.1		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Nh/mon	th = 0.02	24 x [(97))m – (95)m] x (4 ⁻	1)m			
(98)m=	316.42	262.48	231.98	163.52	90.35	0	0	0	0	132.34	235.34	306.67		
								Tota	l per year	(kWh/year) = Sum(9	8)15.912 =	1739.12	(98)
Snoo	o hootin	aroquir	montin	la\A/b/mai	2 h loor						, (04.04	
Space	e neaun	grequire	ementin	KVVII/III-	year								31.34	(99)
9a. En	ergy rec	quiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	HP)					
Spac	e heatii	ng:												-
Fracti	ion of sp	bace hea	it from se	econdary	y/supple	mentary	system						0	(201)
Fracti	ion of sp	bace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	ion of to	tal heatii	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90	(206)
Efficie	- ancy of s	econda	rv/sunnli	ementar	v heatin	a system	ר %						0	(208)
Lineit			iy/Suppi				1, 70		-	-			0	(200)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heatin	g require	ement (c	alculate	d above)		-	-					
	316.42	262.48	231.98	163.52	90.35	0	0	0	0	132.34	235.34	306.67		
(211)m	ו = {[(98)m x (20	4)] + (21	0)m } x	100 ÷ (2	06)								(211)
	351.58	291.64	257.76	181.69	100.39	0	0	0	0	147.05	261.49	340.74		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1932.35	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							-		_
= {[(98)m x (20	01)] + (2 ⁻	14) m } x	(100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	a										I		
Output	from w	ater hea	ter (calc	ulated a	bove)									
	180.71	157.85	164.23	145.66	141.02	124.2	118.99	132.65	134.12	152.72	163.04	176.46		
Efficier	ncy of w	ater hea	ter										90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	r water	heating	kWh/ma	onth	I	I	I	I		L	I			
(219)m	<u>1 = (64)</u>	<u>m x 100</u>) ÷ (217)	<u>m</u>										
(219)m=	200.79	175.39	182.48	161.85	156.69	138	132.21	147.39	149.02	169.69	181.15	196.07		
								Tota	I = Sum(21	19a) ₁₁₂ =			1990.73	(219)

Annual totals		kWh/year	kWh/year
Space heating fuel used, main system 1			1932.35
Water heating fuel used			1990.73
Electricity for pumps, fans and electric ke	eep-hot		_
central heating pump:		130	(2300
boiler with a fan-assisted flue		45	(2306
Total electricity for the above, kWh/year		sum of (230a)(230g) =	175 (231)
Electricity for lighting			302.35 (232)
10a. Fuel costs - individual heating syst	ems:		
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 × 0.01	= 59.9 (240)
Space heating - main system 2	(213) x	0 x 0.01 :	= 0 (241)
Space heating - secondary	(215) x	0 x 0.01 :	= 0 (242)
Water heating cost (other fuel)	(219)	3.1 × 0.01	= 61.71 (247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.01	= 20.06 (249)
(if off-peak tariff, list each of (230a) to (23 Energy for lighting	30g) separately as applica (232)	able and apply fuel price according to 11.46 × 0.01	Table 12a = 34.65 (250)
Additional standing charges (Table 12)			106 (251)
Appendix Q items: repeat lines (253) and Total energy cost	(254) as needed (245)(247) + (250)(254) =		282.32 (255)
11a. SAP rating - individual heating sys	tems		
Energy cost deflator (Table 12)			0.47 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =		1.32 (257)
SAP rating (Section 12)			81.58 (258)
12a. CO2 emissions – Individual heating	g systems including micro	o-CHP	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198 =	382.61 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Water heating	(219) x	0.198 =	394.16 (264)
Space and water heating	(261) + (262) + (2	263) + (264) =	776.77 (265)
Electricity for pumps, fans and electric ke	ep-hot (231) x	0.517 =	90.48 (267)
Electricity for lighting	(232) x	0.517 =	156.31 (268)
Total CO2, kg/year		sum of (265)(271) =	1023.56 (272)
CO2 emissions per m ²		(272) ÷ (4) =	18.44 (273)

El rating (section 14)				86	(274)
13a. Primary Energy					
	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	1971	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2030.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4001.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	882.86	(268)
'Total Primary Energy	sum	of (265)(271) =		5395.4	(272)
Primary energy kWh/m²/year	(272)	÷ (4) =		97.21	(273)

		Use	er Details:						
Assessor Name:	Dan Watt		Stroma	a Num	ber:		STRO	000002	
Software Name:	Stroma FSAP 200	9	Softwa	re Ver	sion:		Versio	n: 1.4.0.76	
		Prope	erty Address:	Flat 10					
Address :	172 High St, Teddir	gton, TW11	8HU						
1. Overall dwelling dimer	nsions:								
Ground floor		, 	Area(m²) 29	(1a) x	Ave He 2.	ight(m) 67	(2a) =	Volume(m ³) 77.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	29	(4)					_
Dwelling volume		L]	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	77.43	(5)
2. Ventilation rate:									
	main S heating h	econdary leating	other		total			m ³ per hour	
Number of chimneys	0 +	0 +	0] =	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	IS			, L	2	× ^	10 =	20	(7a)
Number of passive vents				Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fir	es			Γ	0	x 4	40 =	0	(7c)
							Air ch	anges per hou	ur
Infiltration due to chimney	a fluce and fore $-$ (6)	2)+(6b)+(72)+(7	$(2)_{+}(7_{c}) =$	Г					
If a pressurisation test has be	s, filles and fails = (0)	ed, proceed to (17), otherwise c	ontinue fro	20 20 (9) to	16)	÷ (5) =	0.26	(8)
Number of storeys in th	e dwelling (ns)		,,		() (,	[0	(9)
Additional infiltration						[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber	frame or 0.3	5 for masonr	y constr	uction		[0	(11)
if both types of wall are pre	esent, use the value corres	ponding to the g	greater wall area	a (after					
If suspended wooden fl	oor, enter 0.2 (unseal	ed) or 0.1 (s	ealed), else (enter 0			[0	(12)
If no draught lobby, ent	er 0.05, else enter 0						ĺ	0	(13)
Percentage of windows	and doors draught st	ripped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) +	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value, o	50, expressed in cub	oic metres pe	r hour per so	quare me	etre of e	nvelope	area	5	(17)
If based on air permeabilit	ty value, then (18) = [(1	7) ÷ 20]+(8), oth	nerwise (18) = (*	16)				0.51	(18)
Air permeability value applies	if a pressurisation test has	s been done or a	a degree air per	meability i	is being us	sed	г		
Shelter factor	IShellered		(20) = 1 - [0.075 x (1	9)] =			0.78	(19)
Infiltration rate incorporati	ng shelter factor		(21) = (18)	x (20) =			[0.70](=0)](21)
Infiltration rate modified for	or monthly wind speed	ł					L	0.00	
Jan Feb	Mar Apr May	Jun Ju	ul Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7								
(22)m= 5.4 5.1 5	5.1 4.5 4.1	3.9 3.	7 3.7	4.2	4.5	4.8	5.1		
Wind Eactor (22a) $m = (22a)$)m : 4								
(22a)m = 1.35 + 1.27 + 1	<u>,27</u> 1.12 1.02	0.98 0.9	92 0.92	1.05	1.12	1.2	1.27		
			- 0.02				,		

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	elter an	d wind s	peed) =	(21a) x	(22a)m	_			_	
<u> </u>	0.53	0.5	0.5	0.44	0.4	0.38	0.36	0.36	0.41	0.44	0.47	0.5		
Calcula If ma	ate ette	<i>Ctive air</i> al ventila	change	rate for t	he appli	cable ca	se							(220)
lf exh	aust air h	eat pump	using App	endix N. (2	3b) = (23a	i) x Fmv (e	equation (1	N5)), othe	rwise (23b) = (23a)			0	(23a)
lf bala	anced wit	h heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =) = (200)			0	(230)
a) If	balance	nd moch			with hor	at rocov			$)^{-}$	2b)m i (22h) v [1 (220) : 1001	(230)
a) 11 (24a)m-					0) - 100j]	(24a)
(2 la)	halance		anical ve		without	heat rec		1 (1)/) (2/F	$\int_{-\infty}^{\infty}$	$l = \frac{1}{2}$	23h)	Ů]	
(24b)m=					0						0	0	1	(24b)
() If			tract ver				ventilatio	n from (l <u> </u>	, , , , , , , , , , , , , , , , , , ,	<u> </u>	, in the second se	J	· · · ·
c) ii	if (22b)r	n < 0.5 >	(23b), t	then (24c	c) = (23b); other	vise (24	c) = (22)	b) m + 0.	.5 × (23t))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	n from l	oft	Į	ļ	Į	1	
, i	if (22b)r	n = 1, th	en (24d)	m = (22k)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			_	
(24d)m=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	k (25)	-	-	-	_	
(25)m=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63		(25)
3. He	at losse	s and he	eat loss i	oaramete	er:									
ELEN	/ENT	Gros	SS	Openin	gs	Net Ar	ea	U-val	ue	ΑXU		k-valu	е	AXk
		area	(m²)	m	2	A ,r	n²	W/m2	K	(W/	K)	kJ/m²∙	К	kJ/K
Doors						2.08	x	1.5	=	3.12				(26)
Windo	WS					3.2	x1	/[1/(1.5)+	0.04] =	4.53				(27)
Walls 7	Type1	38	3	0		38	x	0.25	=	9.5				(29)
Walls 7	Type2	22	2	2.08		19.92	<u>x</u>	0.23	=	4.5				(29)
Walls 7	Туре3	6.4	ļ.	3.2		3.2	x	0.25	=	0.8				(29)
Roof T	Type1	25	5	0		25	x	0.16	=	4	ו ר			(30)
Roof 7	Гуре2	1.5	5	0		1.5	x	0.16	=	0.24	ז ר		$\neg \vdash$	(30)
Total a	area of e	elements	s, m²			92.9							<u> </u>	(31)
Party v	wall					28	x	0	=	0				(32)
Party f	loor					63.2							\dashv	(32a)
Party o	ceiling					0					ſ		\dashv	(32b)
* for win ** inclua	dows and le the area	l roof wind as on both	ows, use e sides of ir	effective wil nternal wall	ndow U-va 's and part	lue calcul titions	ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrap	L h 3.2	
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				26.68	3 (33)
Heat c	apacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	3423.8	86 (34)
Therm	al mass	parame	eter (TMF	⁻ = Cm ÷	TFA) in	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For desi can be ι	ign asses used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	constructi	ion are noi	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix l	<						3.72	(36)
if details	of therma	al bridging	are not kn	own (36) =	: 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			30.4	(37)

Ventila	ation hea	t loss c	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	16.39	16	16	15.29	14.86	14.66	14.47	14.47	14.96	15.29	15.63	16		(38)
Heat ti	ransfer o	oefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	46.79	46.4	46.4	45.69	45.26	45.06	44.87	44.87	45.36	45.69	46.03	46.4		
					-					Average =	Sum(39)1.	12 /12=	45.74	(39)
Heat lo	oss para	meter (H	HLP), W	/m²K	4.50	4.55	4.55	4.55	(40)m	= (39)m ÷	(4)			
(40)m=	1.61	1.6	1.6	1.58	1.56	1.55	1.55	1.55	1.56	1.58	1.59	1.6	1 50	(40)
Numbe	er of day	rs in mo	nth (Tab	le 1a)					,	<pre>Average =</pre>	Sum(40)1.	12 / 12=	1.56	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
								•	•					
4. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ar:	
•		Ŭ												
Assum if TF	A > 13.9	ipancy,). N = 1	N + 1.76 x	(1 - exp	(-0.0003	349 x (TF)2)] + 0.(0013 x (1	FA -13.	<u>1.</u> 9)	15		(42)
if TF	A £ 13.9	9, N = 1			(0.0000			/_/] / 01)			
Annua	l averag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	a tarrat a	64	.86		(43)
not more	e that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)	lo acriieve	a water us	e largel o	I			
	lan	Fob	Mar	Apr	May	lun		Δυσ	Son	Oct	Nov	Dec		
Hot wat	er usage ii	n litres per	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	Seb	001	NOV	Dec		
(44)m=	71.34	68.75	66.15	63.56	60.97	58.37	58.37	60.97	63.56	66.15	68.75	71.34		
(,										Fotal = Su	m(44) ₁₁₂ =		778.28	(44)
Energy	content of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,ı	m x nm x D	0Tm / 3600) kWh/mon	th (see Ta	ables 1b, 1	c, 1d)		
(45)m=	106.05	92.75	95.71	83.44	80.07	69.09	64.02	73.47	74.35	86.64	94.58	102.7		
										Fotal = Su	m(45) ₁₁₂ =	=	1022.88	(45)
lf instan	taneous w	ater heati	ng at poin	t of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)					
(46)m=	15.91	13.91	14.36	12.52	12.01	10.36	9.6	11.02	11.15	13	14.19	15.41		(46)
vvater	storage	IOSS: Iror's de	alarad k	acc facto	r ie knou	wp (k\//b	(day):							(47)
a) II III Tomno	anulacii	nel 5 de		255 1aulu		wii (kvvii	/uay).					0		(47)
Enorm	v loot fro			; 20 	oor			(17) × (10)	\ _			0		(40)
If man	ufacture	r's decla	ared cvli	nder loss	s factor is	s not kno	own:	(47) X (40)) =			0		(49)
Cylind	er volum	e (litres) includi	ng any s	olar stor	age with	nin same	!				0		(50)
If con	nmunity he	eating and	l no tank ii	n dwelling,	enter 110	litres in bo	ox (50)							
Othe	rwise if no	stored ho	ot water (th	is includes	instantan	eous com	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor f	rom Tab	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature fa	actor fro	m Table	2b								0		(53)
Energy	y lost fro	m watei	r storage	e, kWh/ye	ear			((50) x (51	I) x (52) x ((53) =		0		(54)
Enter	(49) or (54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)r	n				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ((H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primar	y circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor fi	rom Tab	le H5 if t	here is s	olar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	36.36	31.64	33.71	31.34	31.07	28.79	29.75	31.07	31.34	33.71	33.9	36.36		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	, (59)m + (61)m	
(62)m=	142.41	124.4	129.42	114.79	111.13	97.88	93.77	104.54	105.69	120.35	128.48	139.06		(62)
Solar DH	W input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter					•		•	•			
(64)m=	142.41	124.4	129.42	114.79	111.13	97.88	93.77	104.54	105.69	120.35	128.48	139.06		
								Outp	but from w	ater heate	r (annual)₁	12	1411.92	(64)
Heat g	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	44.35	38.75	40.25	35.58	34.39	30.17	28.72	32.19	32.56	37.24	39.92	43.24		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal da	ains (see	Table 5	5 and 5a):	•		-				•	-	
Motab		s (Table	5) Wat	te) -									
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26		(66)
Liahtin	a aains	(calcula	ted in Ar	pendix	L. equat	ion L9 o	r L9a). a	lso see ⁻	Table 5	1				
(67)m=	23.98	21.3	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.81	23.12	24.64		(67)
Applia	nces da	ins (calc	ulated ir	Append	lixlea	uation L	13 or I 1	i 3a) also	i See Ta	l ble 5				
(68)m=	142.02	143.49	139.78	131.87	121.89	112.51	106.25	104.77	108.49	116.39	126.37	135.75		(68)
Cookin	n dains	(calcula	L Ited in A	l ppendix	L equat	ion I 15	l or I 15a') also se	l e Table	5	I			
(69)m=	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08		(69)
Pumps	and fai	ns dains	(Table /	[5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	l	(70)
		anoratio		tivo valu	es) (Tab	lo 5)								. ,
(71)m=	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	-46 17	l	(71)
Wator	booting	goine (T	ablo 5)	10.11	10.11	10.11	10.11	10.11	10.11	10.11	10.11	10.11		()
(72)m-	50 61	9aii 15 (1	able 5)	10 12	46.22	/1 0	38.61	13.27	15 22	50.05	55 45	58 12	l	(72)
Tetel:		57.07	04.1	40.42	40.22	(66)	00.01	+0.27	(60)m	(70)m L (7)	1)m + (72)	00.12		(/
10tal 1	201 77	gains =	207.27	270 57	254.00	220.05	220.06	225.92	245 47		201 1	204.69	l	(73)
(13)III=	ar gaing	230.02	207.37	210.01	204.00	230.00	229.90	233.03	243.47	202.41	201.1	294.00		(10)
Solar o	ains are o	alculated	usina sola	r flux from	Table 6a	and assoc	iated equa	ations to co	nvert to th	e applicat	le orientat	ion.		
Orient	ation: 4	Access F	actor	Area		Flu	X		a		FF		Gains	
								-	<u> </u>	-			(14/)	

	Та	able 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
North	0.9x	0.77	x	3.2	x	10.73	x	0.63	×	0.7] =	10.49	(74)
North	0.9x	0.77	x	3.2	x	20.36	x	0.63	x	0.7	=	19.91	(74)

North	0.9x	0.77	x	3	.2	x	3	3.31	x		0.63	×	0.7	=	32.57	(74)
North	0.9x	0.77	x	3	.2	x	5	4.64	x		0.63		0.7	=	53.44	(74)
North	0.9x	0.77	x	3	.2	x	7	5.22	x		0.63		0.7	=	73.56	(74)
North	0.9x	0.77	x	3	.2	x	8	4.09	x		0.63		0.7	=	82.24	(74)
North	0.9x	0.77	x	3	.2	x	7	'9.12	x		0.63	×	0.7	=	77.38	(74)
North	0.9x	0.77	x	3	.2	x	6	51.56	x		0.63	×	0.7	=	60.21	(74)
North	0.9x	0.77	x	3	.2	x	4	1.09	x		0.63	x	0.7	=	40.18	(74)
North	0.9x	0.77	x	3	.2	x	2	4.81	x		0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	3	.2	x	1	3.22	x		0.63	x	0.7	=	12.93	(74)
North	0.9x	0.77	x	3	.2	x	8	8.94	x		0.63	x	0.7	=	8.75	(74)
Solar	gains in	watts, ca	alculated	d for ead	ch month	n			(83)m	n = Su	ım(74)m .	(82)m				
(83)m=	10.49	19.91	32.57	53.44	73.56	8	32.24	77.38	60.2	21	40.18	24.27	12.93	8.75		(83)
Total g	gains – i	nternal a	and sola	r (84)m	= (73)m	+ (83)m	, watts								
(84)m=	312.26	318.53	319.94	324	327.64	3	21.09	307.34	296	.04	285.65	286.68	294.03	303.42		(84)
7. Me	ean inter	nal temp	perature	(heating	g seasor	า)										
Temp	oerature	during h	neating p	periods i	n the livi	ng	area f	from Tab	ole 9,	, Th1	l (°C)				21	(85)
Utilis	ation fac	tor for g	ains for	living ar	ea, h1,m	า (s	ее Та	ble 9a)	_							
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	0.91	0.9	0.88	0.85	0.77		0.65	0.5	0.5	52	0.71	0.83	0.89	0.91		(86)
Mear	n interna	l temper	ature in	living a	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)					
(87)m=	18.41	18.57	18.99	19.45	20.09	2	20.57	20.84	20.8	83	20.45	19.78	18.95	18.49		(87)
Temp	oerature	during h	neating p	beriods i	n rest of	dw	elling	from Ta	able 9	9, Th	12 (°C)		·			
(88)m=	19.61	19.62	19.62	19.64	19.65	1	9.65	19.66	19.	66	19.64	19.64	19.63	19.62		(88)
Utilis	ation fac	tor for a	ains for	rest of c	Iwellina.	h2.	.m (se	e Table	9a)				-			
(89)m=	0.9	0.89	0.86	0.82	0.72		0.56	0.37	0.3	38	0.63	0.79	0.87	0.9		(89)
Mear	interna	l temper	rature in	the rest	of dwell	lina	T2 (fr	nllow ste	i ns 3	to 7	in Tabl	e 9c)	I		1	
(90)m=	16.3	16.53	17.13	17.79	18.66	1	9.28	19.57	19.	57	19.15	18.25	17.09	16.42		(90)
			<u> </u>	!	1						f	LA = Liv	ing area ÷ (4	4) =	1.03	(91)
Mear	n interna	l temper	ature (fo	or the wl	nole dwe	ellin	g) = fl	LA × T1	+ (1	– fL/	A) × T2					
(92)m=	18.48	18.64	19.05	19.51	20.13	2	20.61	20.88	20.8	87	20.5	19.83	19.02	18.56		(92)
Apply	/ adjustr	nent to t	he mear	n interna	al tempe	ratu	ire fro	m Table	4e,	whe	re appro	opriate	-			
(93)m=	18.33	18.49	18.9	19.36	19.98	2	20.46	20.73	20.	72	20.35	19.68	18.87	18.41		(93)
8. Sp	ace hea	iting req	uiremen	t			_									
Set T the u	i to the tilisation	mean inf	ternal te or gains	mperatu using T	ire obtaii able 9a	ned	l at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m=	:(76)m an	d re-calo	culate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilis	ation fac	tor for g	ains, hr	ו:										•		
(94)m=	0.88	0.87	0.85	0.81	0.73		0.62	0.48	0.4	19	0.67	0.79	0.86	0.88		(94)
Usef	ul gains,	hmGm	, W = (9	4)m x (8	84)m										1	
(95)m=	274.7	277.22	270.71	262.44	239.53	1	98.3	146.92	145	.21	191.91	227.51	252.76	267.03		(95)
Mont	hly aver	age exte	ernal terr	nperatur	e from T	abl	e 8	(a -					-		1	
(96)m=	4.5	5	6.8	8.7	11.7		14.6	16.9	16.	.9	14.3	10.8	7	4.9		(96)

Heat	loss rate	e for mea	an interr	al temp	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	647.22	626.09	561.54	487.04	374.94	264.16	172	171.59	274.24	405.6	546.36	626.92		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m=	277.15	234.44	216.38	161.71	100.75	0	0	0	0	132.5	211.39	267.76		_
								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	1602.08	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								55.24	(99)
9a. En	ergy rec	uiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					-
Spac	e heatir	ng:										1		,
Fracti	ion of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	– (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g system	n, %	-	-	-	-		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space	e heatin	g require	ement (o	alculate	d above)							I	
	277.15	234.44	216.38	161.71	100.75	0	0	0	0	132.5	211.39	267.76		
(211)m	n = {[(98)m x (20	4)] + (2'	10)m } x	100 ÷ (2	206)		1		1	i		I	(211)
	307.95	260.49	240.42	179.68	111.94	0	0	0	0	147.22	234.88	297.51		1
		/						Tota	ii (kvvn/yea	ar) =Sum(2	211) _{15,1012}	=	1780.09	(211)
Space	e heating	g fuel (s	econdar	′y), kWh/ ∡100 ↔ (month									
= {[(90 (215)m=		0	0		200)	0	0	0	0	0	0	0		
(-)		-						Tota	l (kWh/yea	ar) =Sum(2	215) _{15 1012}	=	0	(215)
Water	heating	1]
Output	from w	ater hea	ter (calc	ulated a	bove)									
	142.41	124.4	129.42	114.79	111.13	97.88	93.77	104.54	105.69	120.35	128.48	139.06		-
Efficier	ncy of w	ater hea	ter	i							i		90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m=	158.23	138.22	143.8	127.54	123.48	108.75	104.19	116.15	117.43	133.73	142.76	154.51		
			I	!	!	ļ	I	Tota	I = Sum(2	19a) ₁₁₂ =	!		1568.8	(219)
Annua	al totals									k	Wh/year	•	kWh/year	1
Space	heating	fuel use	ed, main	system	1								1780.09	
Water	heating	fuel use	d										1568.8]
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								-
centra	al heatin	a pump:	:									130		(230c)
hoiler	with a f	an-accie	ted flue									15		(230e)
Tatal		. for the -		1.1.1/h / · · · ·	-			0.100	of (220c)	(220a)		40	4	(2000)]/004)
i otal e	electricity		above,	kvvn/yea	ll.			sum	u (∠30a).	(230g) =	•		175	(231) 1
Electri	city for li	ghting											169.38	(232)
100		to indi	idual be	oting ou	otomo									

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1 × 0.01	= 55.18	(240)
Space heating - main system 2	(213) x	0 × 0.01	= 0	(241)
Space heating - secondary	(215) x	0 × 0.01	= 0	(242)
Water heating cost (other fuel)	(219)	3.1 × 0.01	= 48.63	(247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.01	= 20.06	(249)
(if off-peak tariff, list each of (230a) to (2 Energy for lighting	230g) separately as applicable an (232)	d apply fuel price according to 11.46 × 0.01	o Table 12a =	(250)
Additional standing charges (Table 12)			106	(251)
Appendix Q items: repeat lines (253) ar	nd (254) as needed			
Total energy cost	(245)(247) + (250)(254) =		249.28	(255)
11a. SAP rating - individual heating sy	stems			
Energy cost deflator (Table 12)			0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =		1.58	(257)
SAP rating (Section 12)			77.91	(258)
12a. CO2 emissions – Individual heatin	ng systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/ye	ar
Space heating (main system 1)	(211) x	0 198 =	352.46	(261)
opade nearing (main bystern 1)		0.100		(=0.)
Space heating (secondary)	(215) x	0 =	0	(263)
Space heating (secondary) Water heating	(215) x (219) x	0 =	0 310.62	(263) (264)
Space heating (main system r) Space heating (secondary) Water heating Space and water heating	(215) x (219) x (261) + (262) + (263) + (2	0 = 0.198 = 64) =	0 310.62 663.08	(263) (264) (265)
Space heating (main system r) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric k	(215) x (219) x (261) + (262) + (263) + (2 (231) x	0 = 0.198 = 64) = 0.517 =	0 310.62 663.08 90.48	(263) (264) (265) (267)
Space heating (main system r) Space heating Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting	(215) x $(219) x$ $(261) + (262) + (263) + (2$ $(231) x$ $(232) x$	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ 64) = \\ \hline 0.517 \\ = \\ 0.517 \\ \end{array}$	0 310.62 663.08 90.48 87.57	(263) (263) (264) (265) (267) (268)
Space heating (main system r) Space heating Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year	(215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ 64) = \\ \hline 0.517 \\ = \\ 0.517 \\ = \\ sum of (265)(271) = \end{array}$	0 310.62 663.08 90.48 87.57 841.12	(263) (263) (264) (265) (265) (267) (268) (268) (272)
Space heating (main system r) Space heating Water heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m²	(215) x $(219) x$ $(261) + (262) + (263) + (26$	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ 64) = \\ \hline 0.517 \\ = \\ 0.517 \\ = \\ 0.517 \\ = \\ (272) \div (4) = \end{array}$	0 310.62 663.08 90.48 87.57 841.12 29	(263) (263) (264) (265) (267) (267) (268) (272) (272) (273)
Space heating (main system r) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14)	(215) x $(219) x$ $(261) + (262) + (263) + (263) + (262) + (263) + (26) + ($	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ 64) = \\ \hline 0.517 \\ = \\ 0.517 \\ = \\ sum of (265)(271) = \\ (272) \div (4) = \end{array}$	0 310.62 663.08 90.48 87.57 841.12 29 85	(263) (263) (264) (265) (267) (268) (272) (272) (273) (274)
Space heating (main system r) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	(215) x $(219) x$ $(261) + (262) + (263) + (26)$	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ 64) = \\ \hline 0.517 \\ = \\ 0.517 \\ = \\ 0.517 \\ = \\ (272) \div (4) = \end{array}$	0 310.62 663.08 90.48 87.57 841.12 29 85	(263) (263) (264) (265) (267) (268) (272) (273) (273) (274)
Space heating (main system r) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	(215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ 64) = \\ \hline 0.517 \\ = \\ 0.517 \\ = \\ 0.517 \\ = \\ (272) \div (4) = \\ \end{array}$ Primary factor	0 310.62 663.08 90.48 87.57 841.12 29 85 P. Energy kWh/year	(263) (264) (265) (267) (267) (268) (272) (272) (273) (274)
Space heating (main system 1) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1)	(215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year (211) x	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0.198 \\ \end{array} = \\ \begin{array}{c} 0.517 \\ 0.517 \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} + \begin{array}{c} 0.272 \\ \end{array} = \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ \begin{array}{c} 0.272 \\ \end{array} = \\ = \\$	0 310.62 663.08 90.48 87.57 841.12 29 85 P. Energy kWh/year 1815.69	(261) (263) (264) (265) (267) (268) (272) (273) (274)
Space heating (main system 1) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary)	(215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year (211) x (215) x	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	0 310.62 663.08 90.48 87.57 841.12 29 85 P. Energy kWh/year 1815.69 0	(261) (263) (264) (265) (267) (267) (268) (272) (273) (273) (274)
Space heating (main system 1) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating	(215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year (211) x (215) x (219) x	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	0 310.62 663.08 90.48 87.57 841.12 29 85 P. Energy kWh/year 1815.69 0 1600.17	(264) (263) (264) (265) (267) (268) (272) (273) (273) (274) (274)
Space heating (main system 1) Space heating Space and water heating Electricity for pumps, fans and electric k Electricity for lighting Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	(215) x (219) x (261) + (262) + (263) + (2 (231) x (232) x Energy kWh/year (211) x (215) x (219) x (219) x (261) + (262) + (263) + (2	$\begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	0 310.62 663.08 90.48 87.57 841.12 29 85 P. Energy kWh/year 1815.69 0 1600.17 3415.86	(263) (263) (264) (265) (267) (267) (268) (272) (273) (273) (274) (261) (263) (264) (265)

Electricity for lighting	(232)	x		0	= [494.59	(268)
'Total Primary Energy			sum of (265).	(271) =	[4421.45	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		[152.46	(273)



User Details:												
Assessor Name:	000002											
Software Name.	otionia i or	AI 2003 Pi	operty	Address	Flat 8 2	31011.		VCISIC	n. 1. 4 .0.75			
Address :	172 High St.	Teddington, TV	/11 8HL	J	1 101 0 2	.070						
1. Overall dwelling dimer	nsions:	, e a su igreri, e i		-								
			Area	a(m²)		Ave He	eight(m)		Volume(m ³))		
Ground floor	168.74	(3a)										
Total floor area TFA = (1a)+(1b)+(1c)+(1	1d)+(1e)+(1n) e	63.2	(4)							
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	168.74	(5)		
2. Ventilation rate:	-					_						
	main heating	Secondar heating	У	other		total			m ³ per hou	r		
Number of chimneys	0	+ 0	+	0] =	0	x 4	40 =	0	(6a)		
Number of open flues	0	+ 0	<u> </u> + [0] = [0	x 2	20 =	0	(6b)		
Number of intermittent far	IS	_			- <u> </u>	2	x ′	10 =	20	(7a)		
Number of passive vents					Γ	0	x ^	10 =	0	(7b)		
Number of flueless gas fir	es				Г	0	x 4	40 =	0	(7c)		
								Air ch	anges per bo			
Le Clare d'anne de la Carachite e a	. ()	(0-) (0-) (0-) (7	-).(7 b).()	7-)								
Inflitration due to chimney	s, flues and fa	INS = (6a) + (6b) + (7) is intended, proceed	a)+(7b)+(7C) = otherwise (continue fro	20 20 (9) to ((16)	÷ (5) =	0.12	(8)		
Number of storeys in th	e dwelling (ns))					,		0	(9)		
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)		
Structural infiltration: 0.2	25 for steel or	timber frame or	0.35 foi	r masonr	y constr	uction			0	(11)		
if both types of wall are pre	esent, use the values of the v	ue corresponding to	the great	er wall are	a (after							
If suspended wooden fl	oor, enter 0.2	(unsealed) or 0.	1 (seale	ed), else	enter 0				0	(12)		
If no draught lobby, ent	er 0.05, else e	nter 0	,						0	(13)		
Percentage of windows	and doors dra	aught stripped							0	(14)		
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)		
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)		
Air permeability value, o	50, expressed	d in cubic metre	s per ho	our per so	quare m	etre of e	nvelope	area	5	(17)		
If based on air permeabili	y value, then	$(18) = [(17) \div 20] + (8)$), otherwi	se (18) = (16)				0.37	(18)		
Air permeability value applies	if a pressurisation	n test has been don	e or a deg	gree air pei	rmeability	is being us	sed		[
Shelter factor	sneitered			(20) = 1 -	0.075 x (1	9)] =			3	(19)		
Infiltration rate incorporati	ng shelter fact	or		(21) = (18)) x (20) =				0.70	(20)		
Infiltration rate modified for	r monthly wind	d speed							0.20			
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Monthly average wind spe	ed from Table	97										
(22)m= 5.4 5.1	5.1 4.5	4.1 3.9	3.7	3.7	4.2	4.5	4.8	5.1				
Wind Eactor $(22a)m = (22a)m $)m ÷ 4	I I					•					
(22a)m = 1.35 1.27 1	.27 1.12	1.02 0.98	0.92	0.92	1.05	1.12	1.2	1.27				
		II					1	1	I			



Adjuste	ed infiltr	ation rate	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m				_		
	0.39	0.36	0.36	0.32	0.29	0.28	0.26	0.26	0.3	0.32	0.34	0.36			
Calcula If me	ate ette chanica	ctive air (al ventila	<i>change</i> . tion:	rate for ti	he applic	cable ca	se							0	(23a)
lf exh	aust air h	eat pump (using Appe	endix N, (2	3b) = (23a) × Fmv (e	equation (N	N5)), othe	rwise (23b) = (23a)					(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing for	or in-use fa	actor (from	n Table 4h) =	, , ,					(23c)
a) If	balance	d mecha	anical ve	entilation	with hea	at recove	erv (MVI	HR) (24a	a)m = (22)	2b)m + (2	23b) × [′	1 – (23c)	÷ 1001		
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	overy (N	и ЛV) (24b)m = (22	2b)m + (2	23b)				
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24b)
c) If v	whole h	ouse ex	tract ver	tilation c	or positiv	e input v	/entilatic	n from c	outside						
i	f (22b)n	n < 0.5 ×	: (23b), t	hen (24c	c) = (23b); otherv	vise (24	c) = (22b	o) m + 0.	5 × (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If i	natural f (22b)n	ventilation = 1, the	on or wh en (24d)	ole hous m = (22t	e positiv)m othe	ve input v rwise (2	ventilatio 4d)m = 0	on from I 0.5 + [(2	oft 2b)m² x	0.5]					
(24d)m=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	0.57			(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24b) or (24	c) or (24	d) in boy	x (25)			_	-		
(25)m=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	0.57			(25)
3. Hea	at losse	s and he	at loss i	paramete	er:										
ELEN	IENT	Gros area	ss (m²)	Openin m	gs ²	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²·ł	e ≺	A X kJ/	(k K
Doors						2.08	x	1.5		3.12					(26)
Window	WS					4.8	x1,	/[1/(1.5)+	0.04] =	6.79	=				(27)
Walls 1	Гуре1	53		0		53	x	0.25	= [13.25	= [(29)
Walls T	Гуре2	24		2.08		21.92	x	0.23	=	4.95			ה ה		(29)
Walls 1	ГуреЗ	9.6		4.8		4.8	x	0.25		1.2	ה ה		ה ה		(29)
Roof T	Type1	50		0		50	x	0.16		8](30)
Roof T	Гуре2	2.3		0		2.3	x	0.16		0.37	7 7](30)
Total a	rea of e	lements	, m²			138.9	,]		I						 (31)
Party w	vall					28	×	0	= [0					(32)
Party fl	loor					63.2			I		L				(32a)
* for wind	dows and e the area	roof winde as on both	ows, use e sides of ir	ffective wil nternal wall	ndow U-va 's and part	lue calcula itions	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	∟ s given in	paragraph	L		
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				37	.68	(33)
Heat ca	apacity	Cm = S(Axk)						((28)	(30) + (32	!) + (32a).	(32e) =	384	1.46	(34)
Therma	al mass	parame	ter (TMF	P = Cm ÷	- TFA) in	⊨kJ/m²K			Indica	tive Value:	Low		1	00	(35)
For desig	gn assess Ised inste	sments wh ad of a dei	ere the de tailed calc	tails of the ulation.	constructi	on are not	⁻ known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f			
Therma	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						5.	56	(36)
<i>if details</i> Total fa	of therma	al bridging at loss	are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			<u></u>	23	_](37)
Ventila	tion hea	at loss ca	alculated	I monthly	/				(38)m	= 0.33 × (2	25)m x (5))			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			



(38)m=	31.98	31.53	31.53	30.72	30.23	30	29.79	29.79	30.35	30.72	31.11	31.53		(38)
Heat tra	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	75.22	74.77	74.77	73.95	73.46	73.24	73.02	73.02	73.58	73.95	74.35	74.77		
Heat lo	ss para	imeter (H	HLP), W/	/m²K					(40)m	Average = = (39)m ÷	Sum(39) _{1.} (4)	.12 /12=	74.01	(39)
(40)m=	1.19	1.18	1.18	1.17	1.16	1.16	1.16	1.16	1.16	1.17	1.18	1.18		
								•		Average =	Sum(40)1.	.12 /12=	1.17	(40)
Numbe	er of day	/s in moi	nth (Tab	le 1a)					0	0.1	NL	Du	l	
(41)-	Jan	Feb		Apr 20		Jun	JUI	Aug	Sep	0Ct	N0V	Dec		(41)
(41)11=	31	20	31	30	31	30	31	31	30	31	30	31		(+1)
4 307														
4. Wa	ter heat	ting ene	rgy requ	irement:								KVVh/ye	ear:	
Assum		ipancy, l	N 1 76 v	[1 ovn	(0 0003		- 120)2)] + 0 (012 v /	TEA 12	2.	07		(42)
if TF.	A 2 13.9 A £ 13.9	9, N = 1 9, N = 1	+ 1.70 X	. [1 - exp	(-0.0003	949 X (11	-A -13.9)2)] + 0.0	JU13 X (IFA - 13.	9)			
Annual	averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		83	.37		(43)
Reduce a not more	the annua that 125	al average litres per	not water person per	usage by r day (all w	5% if the a rater use, l	hot and co	designed i ld)	to achieve	a water us	se target o	t			
[lan	Feb	Mar	Anr	May	lun		Δυσ	Sen	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	Ocp	001	1101	Dee		
(44)m=	91.71	88.38	85.04	81.71	78.37	75.04	75.04	78.37	81.71	85.04	88.38	91.71		
L			Į	I			1	I	-	Fotal = Su	m(44) ₁₁₂ =	:	1000.5	(44)
Energy o	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	n x nm x E	0Tm / 3600) kWh/mor	oth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	136.33	119.24	123.04	107.27	102.93	88.82	82.3	94.45	95.57	111.38	121.58	132.03		_
lf instant	aneous w	ater heati	ng at point	t of use (no	hot water	^r storage),	enter 0 in	boxes (46	-) to (61)	Fotal = Su	m(45) ₁₁₂ =		1314.95	(45)
(46)m=	20.45	17.89	18.46	16.09	15.44	13.32	12.35	14.17	14.34	16.71	18.24	19.8		(46)
a) If ma	anufactu	urer's de	clared lo	oss facto	or is knov	vn (kWh	/dav):					<u>ר</u>		(47)
Tempe	rature f	actor fro	m Table	2b		,	, , , , , , , , , , , , , , , , , , ,					<u>,</u> ז		(48)
Energy	lost fro	m water	· storage	, kWh/ye	ear			(47) x (48)) =)		(49)
If manu	ufacture	r's decla	ared cylir	nder loss	s factor is	s not kno	own:					-		
Cylinde	er volum	ne (litres) includir	ng any s	olar stor	age with	iin same	•				0		(50)
lf com Other	munity he wise if no	eating and stored ho	l no tank in t water (th	n dwelling, is includes	enter 110 instantan	litres in bo eous com	ox (50) hi hoilers)	enter 'Ω' in	box (50)					
	tor ctor		foctor fr	om Tabl		b/litro/dc			007 (00)				l	(54)
Volume		from To					iy))		(51)
Tempe	rature f	actor fro	m Table	2b								<u>ן</u>		(52)
Enerav	lost fro	m water	storage	. kWh/ve	ear			((50) x (51) x (52) x	(53) =		ຸ ງ		(54)
Enter (49) or (54) in (5	5)	,, y					/ (- /)	()		5 D		(55)
Waters	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
lf cylinde	r contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
•													-	



Fill table of each month (159) if a (50) if 360 × (41) iff (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59) (60) if a (61) is calculated for each month (61) if there is solar water heating and a cylinder thermostat) (61) (61) (61) if a (67,4) 40.68 43.34 40.29 39.94 37 38.24 39.94 40.29 43.34 43.58 46.74 (61) (61) if a (67,4) 40.68 43.34 40.29 39.94 37 38.24 39.94 40.29 43.34 43.58 46.74 (61) (61) if a (62) if a (63) if a (61) if a (62) if a (63) if a (63) if a (63) if a (63) if a (64) if a (65) if a (65) if a (65) if a (65) if a (66)
(59)m= 0
Combi loss calculated for each month $(61)m = (60) + 365 \times (41)m$ (61)m = 46.74 + 40.68 + 43.34 + 40.29 + 39.94 + 37 + 38.24 + 39.94 + 40.29 + 43.34 + 43.58 + 46.74 + (61)m (61)m = 46.74 + 40.68 + 43.34 + 40.29 + 39.94 + 37 + 38.24 + 39.94 + 40.29 + 43.34 + 43.58 + 46.74 + (61)m (62)m = 183.07 + 159.91 + 166.38 + 147.56 + 142.87 + 125.82 + 120.54 + 134.38 + 135.87 + 154.72 + 165.17 + 178.77 + (62)m + (61)m (62)m = 183.07 + 159.91 + 166.38 + 147.56 + 142.87 + 125.82 + 120.54 + 134.38 + 135.87 + 154.72 + 165.17 + 178.77 + (63)m + (63)m = 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0
(61)m= 46.74 40.68 43.34 40.29 39.94 37 38.24 39.94 40.29 43.34 43.58 46.74 (61) Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m= 183.07 159.91 166.38 147.56 142.87 125.82 120.54 134.38 135.87 154.72 165.17 178.77 (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) (63)m= 0 0 0 0 0 0 0 0 0 (64) Heat gains from water heater (64)m + (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating (65) (66)m + (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating (66) 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23
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 + (183.07 159.91 166.38 147.56 142.87 125.82 120.54 134.38 135.87 154.72 165.17 178.77 (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)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(62)me 183.07 159.91 166.38 147.56 142.87 125.82 120.54 134.38 135.87 154.72 165.17 178.77 (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) 0 <
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) (63)m= 0
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63) (63)m= 0 <td< td=""></td<>
(63)m= 0
Output from water heater $(64)_{m} = \begin{bmatrix} 183.07 & 159.91 & 166.38 & 147.56 & 142.87 & 125.82 & 120.54 & 134.38 & 135.87 & 154.72 & 165.17 & 178.77 \\ \hline Output from water heater (annual)_{t-12} & 1815.06 & (64) \\ Heat gains from water heating, kWh/month 0.25 ' [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m] (65)_{m} = \begin{bmatrix} 57.01 & 49.82 & 51.75 & 45.74 & 44.21 & 38.78 & 36.93 & 41.39 & 41.85 & 47.87 & 51.32 & 55.58 & (65) \\ include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating Set Table 5 and 5a): Metabolic gains (rable 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 124.23 & 124.24 & 124.24 & 124.24 & 124.24 & 124.24 & 124.$
Output from water heater (annual) 1815.06 (64) Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (65)m 57.01 49.82 51.75 45.74 44.21 38.78 36.93 41.39 41.85 47.87 51.32 55.58 (65) include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating S. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts S. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts See Table 5 and 5a): Mar Apr May Jun Jul Aug Sep Oct Nov Dec 124.23 124.23 124.23
Heat gains from water heating, kWh/month 0.25 $^{\prime}$ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (65)m $\overline{57.01}$ 49.82 $\overline{51.75}$ 45.74 44.21 38.78 36.93 41.39 41.85 47.87 $\overline{51.32}$ 55.58 (65) 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 (66)m $\overline{124.23}$ 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m $\overline{49.14}$ 43.65 35.5 26.87 20.09 16.96 18.33 23.82 31.97 40.6 47.38 50.51 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m $\overline{270.06}$ 272.86 265.8 250.77 231.79 213.95 202.04 199.23 206.3 221.33 240.31 258.14 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(65)m= 57.01 49.82 51.75 45.74 44.21 38.78 36.93 41.39 41.85 47.87 51.32 55.58 (65) 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 Image: see Table 5 and 5a) Image: see Table 5 and 5a) </td
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 (66)m= 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 124.23 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 49.14 43.65 35.5 26.87 20.09 16.96 18.33 23.82 31.97 40.6 47.38 50.51 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 270.06 272.86 265.8 250.77 231.79 213.95 202.04 199.23 206.3 221.33 240.31 258.14 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
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 (66)m= 124.23 <
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 124.23 125.23 124.23 </td
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 124.23
(66)m= 124.23
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 49.14 43.65 35.5 26.87 20.09 16.96 18.33 23.82 31.97 40.6 47.38 50.51 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 270.06 272.86 265.8 250.77 231.79 213.95 202.04 199.23 206.3 221.33 240.31 258.14 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 668
(67)m= 49.14 43.65 35.5 26.87 20.09 16.96 18.33 23.82 31.97 40.6 47.38 50.51 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 270.06 272.86 265.8 250.77 231.79 213.95 202.04 199.23 206.3 221.33 240.31 258.14 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (68) </td
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 270.06 272.86 265.8 250.77 231.79 213.95 202.04 199.23 206.3 221.33 240.31 258.14 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 680 680 680 680
(68)m= 270.06 272.86 265.8 250.77 231.79 213.95 202.04 199.23 206.3 221.33 240.31 258.14 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 680 680 680 680 680
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Pumps and fans gains (Table 5a)
(70)m= 10 10 10 10 10 10 10 10 10 (70)
Losses e.g. evaporation (negative values) (Table 5)
Water heating gains (Table 5)
$ \begin{array}{c} (72)m = & 76.63 & 74.13 & 69.55 & 63.53 & 59.42 & 53.87 & 49.63 & 55.63 & 58.13 & 64.34 & 71.28 & 74.71 \\ \end{array} $
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$
(73)m= 496.74 491.54 471.75 442.07 412.2 385.68 370.9 379.59 397.3 427.17 459.87 484.27 (73)
0. Solar gains:
Orientation: Access Factor Area Flux g FF Gains

Olleniai	.1011.	Table 6d		m²		Table 6a		g_ Table 6b		Table 6c		(W)	
South	0.9x	0.77	x	4.8	x	47.32	×	0.63	x	0.7	=	69.42	(78)
South	0.9x	0.77	x	4.8	x	77.18	×	0.63	x	0.7	=	113.22	(78)



South	0.9x	0.77		x	4.8	3	x	9	4.25	x		0.63		×	0.7		=	138.25	(78)
South	0.9x	0.77	:	x	4.8	3	x	10	05.11	x		0.63		×Ē	0.7		=	154.2	(78)
South	0.9x	0.77	:	x	4.8	3	x	10	08.55	x		0.63		×	0.7		=	159.24	(78)
South	0.9x	0.77	:	x	4.8	3	x	1	08.9	x		0.63		×Ē	0.7		=	159.75	(78)
South	0.9x	0.77	:	x	4.8	3	x	10	07.14	x		0.63		×Ē	0.7		=	157.16	(78)
South	0.9x	0.77	:	x	4.8	3	x	10	03.88	x		0.63		×	0.7		=	152.39	(78)
South	0.9x	0.77		x	4.8	3	x	9	9.99	x		0.63		×Ē	0.7		=	146.68	(78)
South	0.9x	0.77		x	4.8	3	x	8	5.29	x		0.63		×Ē	0.7		=	125.12	(78)
South	0.9x	0.77		x	4.8	3	x	5	6.07	x		0.63		×	0.7		=	82.25	(78)
South	0.9x	0.77		x	4.8	3	x	4	0.89	x		0.63		×Ē	0.7		=	59.98	(78)
	_									_									_
Solar	gains in	watts, ca	alculate	bd	for eac	n month	<u>1</u>			(83)m	n = Si	um(74)m .	(82) m					
(83)m=	69.42	113.22	138.25	;	154.2	159.24	1	59.75	157.16	152	.39	146.68	12	5.12	82.25	59.9	98		(83)
Total (gains – i	nternal a	ind sola	ar	(84)m =	= (73)m	+ (83)m	, watts									I	
(84)m=	566.16	604.77	610		596.27	571.44	5	45.43	528.06	531	.98	543.98	552	2.29	542.12	544.	.25		(84)
7. Me	ean intei	rnal temp	erature	e (heating	seaso	n)												
Temp	perature	during h	eating	pe	eriods ir	the liv	ing	area f	rom Tab	ole 9	, Th	1 (°C)						21	(85)
Utilis	ation fac	ctor for g	ains fo	r li	ving are	ea, h1,n	n (s	ее Та	ble 9a)										_
	Jan	Feb	Mar		Apr	May		Jun	Jul	A	ug	Sep	C	Oct	Nov	D	ес		
(86)m=	0.92	0.91	0.88		0.85	0.78		0.67	0.5	0.	5	0.69	0.	82	0.9	0.9	2		(86)
Mear	n interna	l temper	ature ir	n li	iving are	ea T1 (f	follo	w ste	ps 3 to 7	7 in 1	able	e 9c)							
(87)m=	19	19.19	19.53		19.87	20.34		20.7	20.9	20.	91	20.66	20	.16	19.45	19.0	04		(87)
Tem	berature	during h	eating	pe	eriods ir	n rest of	f dw	/elling	from Ta	able	9, Tł	n2 (°C)							
(88)m=	19.93	19.94	19.94	Ť	19.95	19.95	1	19.96	19.96	19.	96	19.95	19	.95	19.94	19.9	94		(88)
Utilis	ation fac	tor for a	ains for	r re	est of d	vellina	h2	m (se	e Table	9a)					<u>.</u>				
(89)m=	0.91	0.89	0.86	Т	0.83	0.74	T	0.6	0.4	0.3	39	0.62	0.	79	0.89	0.9)1		(89)
Moor			atura ir		ho rost	of dwol	ling	T2 (f	ollow ste			 7 in Tabl		-)	ļ				
(90)m=	17.3	17.58	18.07	T	18.56	19.2		12 (1	19.9	19	.9	19.63	18	.96	17.96	17.3	37		(90)
()											-	f	LA =	Livir	ng area ÷ (4	4) =	-	0.38	(91)
Maar	interne		atura (i	(مام مابین		~) fl	Δ	. (4	£I	<u>م)</u> דס							
		$1 \frac{18}{18}$		T	19.06	19.63		$g) = \pi$	-A X 11	+ (1	- TL	A) X I Z	10	11	18 53	15	2		(92)
	/ adjustr	nent to t			internal	tempe	rati		m Tahle	<u></u>	whe				10.55		,		(02)
(93)m=	17.79	18.04	18.48	T	18.91	19.48		19.92	20.13	20.	13	19.87	19	.26	18.38	17.8	85		(93)
8. Sp	ace hea	atina rea	uiremer	nt															
Set T	i to the	mean int	ernal te	em	nperatur	e obtai	ned	l at ste	ep 11 of	Tab	le 9t	o, so tha	t Ti,	m=(76)m an	d re-	calc	ulate	
the u	tilisatior	factor fo	or gains	s u	ising Ta	ble 9a			-						-			I	
	Jan	Feb	Mar		Apr	May		Jun	Jul	A	ug	Sep	C	Oct	Nov	D	ес		
Utilis	ation fac	ctor for g	ains, hi	m:			-								1			I	(2.1)
(94)m=	0.88	0.86	0.83		0.8	0.72		0.59	0.41	0.4	11	0.61	0.	76	0.86	0.8	9		(94)
Uset	ui gains,	nmGm	VV = (9	94 . T)m x (84	+)m		22.24	210.04	040	25	222 77	404	2 4 0	164.04	404	02		(05)
		022.20	508.46	<u>'</u>	4/0.8	412.52		∠ა.ა1 ৹ ⁰	∠18.94	219	.25	JJJ.//	422	2.13	404.34	481.	.92		(33)
(96)m=	4.5		6.8	T	8.7	11 7		14.6	16.9	16	.9	14.3	1().8	7	4 0	9		(96)
(~~)····-	1	ı ~	0.0	- 1	5.1					· ''	· 🖌 🔰					- T.S	-		()



Heat	loss rate	e for mea	an interr	al tempo	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	999.81	974.8	873.07	754.75	571.77	389.36	235.89	235.97	409.79	625.87	846	968.54		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m=	371.85	304.1	271.27	200.12	118.48	0	0	0	0	151.58	274.79	362.05		
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	2054.24	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								32.5	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					_
Spac	e heatir	ng:												_
Fracti	ion of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fract	ion of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	– (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of a	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space	e heatin	g require	ement (c	alculate	d above)									
	371.85	304.1	271.27	200.12	118.48	0	0	0	0	151.58	274.79	362.05		
(211)n	n = {[(98)m x (20	4)] + (21	10)m } x	100 ÷ (2	06)								(211)
	413.17	337.89	301.41	222.36	131.64	0	0	0	0	168.43	305.33	402.27		•
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	<u>_</u>	2282.49	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									
$= \{[(98)$)m x (20	(1)] + (2)	14) m } >	(100 ÷ (208)	0	0	0	0			0		
(215)m=	0	0	0	0	0	0	0	U Tota	U L (k\\/h/vea	$\frac{0}{-Sum(2)}$	0	-	0	(215)
Motor	hooting							Tota			- 1 0 / _{15,10} 12	2	0	(213)
	from w) ater hea	ter (calc	ulated a	bove)									
oupu	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77		
Efficie	ncy of w	ater hea	iter	•									90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100) ÷ (217)	m	158 74	130.8	133.04	1/0 31	150.96	171 01	183.52	108.63		
(210)11-	200.41	111.00	104.00	100.00	100.14	100.0	100.04	Tota	I = Sum(2)	19a), =	100.02	100.00	2016 73	(219)
Annua	al totals									k	Wh/vear		kWh/vear](210)
Space	heating	fuel use	ed, main	system	1								2282.49	1
Water	heating	fuel use	d										2016.73]
Electri	city for r	numpe f	ane and	oloctric	koon-ho	•								J
LIECUI		umps, i	ans anu	electric	Keep-110	L								(000)
centra	al heatir	ig pump										130		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	electricit	/ for the	above, l	kWh/yea	ır			sum	of (230a).	(230g) =			175	(231)
Electri	city for I	ghting											347.16	(232)
Electri	city gen	erated b	y PVs										-1011.84	(233)
			-											J .



10a. Fuel costs - individual heating systems:			
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 × 0.0	l = 70.76 (240)
Space heating - main system 2	(213) x	0 x 0.0	1 = 0 (241)
Space heating - secondary	(215) x	0 × 0.0	1 = 0 (242)
Water heating cost (other fuel)	(219)	3.1 × 0.07	l = <u>62.52</u> (247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.07	1 = 20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) se Energy for lighting	eparately as applicable an (232)	d apply fuel price according 11.46 × 0.0	to Table 12a I =(250)
Additional standing charges (Table 12)			106 (251)
	one of (233) to (235) x)	11.46 × 0.07	l = <u>-115.96</u> (252)
Appendix Q items: repeat lines (253) and (254) Total energy cost (245)(as needed 247) + (250)(254) =		183.16 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12)			0.47 (256)
Energy cost factor (ECF) [(255) x	(256)] ÷ [(4) + 45.0] =		0.8 (257)
SAP rating (Section 12)			88.9 (258)
12a. CO2 emissions – Individual heating syste	ems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198 =	451.93 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Water heating	(219) x	0.198 =	399.31 (264)
Space and water heating	(261) + (262) + (263) + (2	64) =	851.25 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517 =	90.48 (267)
Electricity for lighting	(232) x	0.517 =	179.48 (268)
Energy saving/generation technologies Item 1		0.529 =	-535.26 (269)
Total CO2, kg/year		sum of (265)(271) =	585.94 (272)
CO2 emissions per m ²		(272) ÷ (4) =	9.27 (273)
EI rating (section 14)			93 (274)
13a. Primary Energy			
	Energy kWh/vear	Primary factor	P. Energy kWh/year
	···· , , • • •		•



Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2057.07	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		4385.21	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	1013.7	(268)
Energy saving/generation technologies Item 1		2.92	=	-2954.57	(269)
'Total Primary Energy	\$	sum of (265)(271) =		2955.34	(272)
Primary energy kWh/m²/year	((272) ÷ (4) =		46.76	(273)



User Details:											
Assessor Name: Dan Watt Stroma Number: STROO	000002										
Software Name: Stroma FSAP 2009 Software Version: Version	on: 1.4.0.79										
Property Address: Flat 9 20%											
Address : 172 High St, Teddington, TW11 8HU											
1. Overall dwelling dimensions:											
Area(m²)Ave Height(m)Ground floor 55.5 $(1a) \times$ 2.67 $(2a) =$	Volume(m³) 148.19 (3a)										
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 55.5 (4)											
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = $	148.19 (5)										
2. Ventilation rate:											
main Secondary other total heating heating	m ³ per hour										
Number of chimneys 0 + 0 + 0 = 0 × 40 =	0 (6a)										
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)										
Number of intermittent fans	20 (7a)										
Number of passive vents $0 \times 10 =$	0 (7b)										
Number of flueless gas fires $0 \times 40 =$	0 (7c)										
Air cha	anges per hour										
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20$ \div (5) =	0.13 (8)										
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)	0 (9)										
Additional infiltration $[(9)-1]x0.1 = $	0 (10)										
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	0 (11)										
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)										
If no draught lobby, enter 0.05, else enter 0	0 (13)										
Percentage of windows and doors draught stripped	0 (14)										
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Unifilter the end to (12) + (12	0 (15)										
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0 (16)										
All permeability value, q50, expressed in cubic metres per hour per square metre or envelope area If based on air permeability value, then $(18) = [(17) \div 20] \pm (8)$, otherwise $(18) = (16)$	5 (17)										
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	0.38 (16)										
Number of sides on which sheltered	3 (19)										
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78 (20)										
Infiltration rate incorporating shelter factor (21) = (18) × (20) =	0.3 (21)										
Infiltration rate modified for monthly wind speed											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec											
Monthly average wind speed from Table 7											
(22)m= 5.4 5.1 5.1 4.5 4.1 3.9 3.7 3.7 4.2 4.5 4.8 5.1											
Wind Factor (22a)m = (22)m \div 4											
(22a)m= 1.35 1.27 1.27 1.12 1.02 0.98 0.92 0.92 1.05 1.12 1.2 1.27											



Adjuste	ed infiltr	ation rat	e (allow	ing for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
<u> </u>	0.4	0.38	0.38	0.34	0.31	0.29	0.28	0.28	0.31	0.34	0.36	0.38		
Calcula	ate effe	Ctive air	change	rate for t	he applic	cable ca	se							(220)
lf exh	aust air h	eat numn	using App	endix N (2	3b) = (23a) x Fmv (e	equation (N	(5)) othe	rwise (23h) = (23a)			0	(234)
lf bala	anced with	n heat reco	overv: effic	ciency in %	allowing f	or in-use f	actor (from	n Table 4h) =) = (20u)			0	(230)
a) If	balance	nd moch			with hor				y = (2)	2b)m i (22h) v [/	1 (22a)	· 1001	(230)
a) 11 (24a)m-					0							$\frac{1-(230)}{0}$	- 100j	(24a)
(2 la)	balance				without	hoat roc		 1\/) (21h	$\int_{-\infty}^{\infty}$	2b)m + ('	23h)	Ů	l	
(24b)m-											230)	0	1	(24b)
(240)III-							vontilatio			0	Ů	Ŭ	l	(,
c) n	if (22b)r	n < 0.5	(23b), 1	then (24c	r positiv c) = (23b): otherv	vise (24)	c) = (22b	m + 0	.5 x (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ı ventilati	on or wh	iole hous	e positiv	e input	ventilatio	n from l	oft				1	
i	if (22b)r	n = 1, th	en (24d))m = (22b)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. He	at losse	s and he	eat loss i	paramete	er:									
	IENT	Gros	SS	Openin	as	Net Ar	ea	U-valu	Je	AXU		k-value)	AXk
		area	(m²)	m	2	A ,n	n²	W/m2	K	(W/I	K)	kJ/m²₊l	K	kJ/K
Doors						2.08	x	1.5	=	3.12				(26)
Window	ws Type	e 1				1.6	x1,	/[1/(1.5)+	0.04] =	2.26				(27)
Window	ws Type	e 2				3.2	x1,	/[1/(1.5)+	0.04] =	4.53				(27)
Walls 7	Гуре1	41		0		41	x	0.25	=	10.25				(29)
Walls 7	Гуре2	6		2.08		3.92	x	0.23	=	0.88			7	(29)
Walls 7	ГуреЗ	9.6	3	4.8		4.8	x	0.25		1.2	ז ר		\exists	(29)
Roof 7	Гуре1	44	L .	0		44	x	0.16		7.04			\exists	(30)
Roof 1	Гуре2	2.3	3	0		2.3	x	0.16		0.37			i F	(30)
Total a	irea of e	elements	s, m²			102.9)				L			(31)
Party v	vall					28	x	0	=	0				(32)
Partv f	loor					63.2					L		4	(32a)
* for win ** includ	dows and le the area	l roof wind as on both	ows, use e sides of ii	effective wil nternal wall	ndow U-va 's and part	lue calcula itions	ated using	formula 1	/[(1/U-valı	ıe)+0.04] a	L as given in	paragraph	3.2	(***)
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				29.66	3 (33)
Heat c	apacity	Cm = S	(Axk)						((28).	(32e) =	3355.4	16 (34)		
Therma	al mass	parame	eter (TMI	P = Cm ÷	- TFA) in	⊨kJ/m²K			Indica	tive Value	: Low		100	(35)
For desi can be u	gn asses: Ised inste	sments wh ad of a de	ere the de tailed calc	etails of the rulation.	constructi	on are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therma	al bridg	es : S (L	x Y) cal	lculated u	using Ap	pendix ł	<						4.12	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	33.77	, (37)			



Ventila	ation hea	at loss ca	alculated	d monthl	у				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	28.42	27.99	27.99	27.21	26.74	26.52	26.31	26.31	26.85	27.21	27.58	27.99		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	62.19	61.76	61.76	60.98	60.51	60.29	60.08	60.08	60.62	60.98	61.36	61.76		
						-	-	-		Average =	Sum(39)1.	12 /12=	61.03	(39)
Heat l	oss para		HLP), W	/m²K	1.00	1.00	1.00	1.00	(40)m	= (39)m ÷	(4)	1 1 1		
(40)m=	1.12	1.11	1.11	1.1	1.09	1.09	1.06	1.06	1.09		1.11 Sum(40),	1.11 /12=	1 1	(40)
Numb	er of day	s in mo	nth (Tab	le 1a)					,	Wordgo -	Curr(+0)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF	ned occu A > 13 9	ipancy, l 9 N = 1	N + 1 76 x	(1 - exp	0.0003	349 x (TI	=A -13 9)2)] + 0 ()013 x (TFA -13	9)	85		(42)
if TF	A £ 13.9	9, N = 1			(/_/]						
Annua	l averag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	se tarnet o	78	.18		(43)
not mor	e that 125	litres per	person pe	r day (all w	/ater use, l	hot and co	ld)	io acilieve	a water us	se largel o	I			
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Hot wat	er usage ii	n litres per	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	86	82.88	79.75	76.62	73.49	70.37	70.37	73.49	76.62	79.75	82.88	86		
									-	Total = Su	m(44) ₁₁₂ =	=	938.22	(44)
Energy	content of	hot water	used - ca	lculated me	onthly = 4.	190 x Vd,ı	m x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	127.85	111.81	115.38	100.59	96.52	83.29	77.18	88.57	89.62	104.45	114.01	123.81		
lf instan	taneous w	ater heati	ng at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1233.1	(45)
(46)m=	19.18	16.77	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57		(46)
Water	storage	loss:							_					
a) If m	anufactu	urer's de	clared lo	oss facto	or is knov	wn (kWh	/day):					0		(47)
Tempe	erature f	actor fro	m Table	e 2b								0		(48)
Energ	y lost fro	m water	storage	e, kWh/ye	ear			(47) x (48)) =			0		(49)
If man Cylind	ufacture er volum	r's decla ne (litres	area cyili) includi	nder loss nd anv s	olar stor	s not kno age with	own: nin same	1				0		(50)
If cor	nmunity he	eating and	l no tank ii	n dwelling,	enter 110	litres in bo	ox (50)					0		(00)
Othe	rwise if no	stored ho	t water (th	is includes	s instantan	eous com	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor f	rom Tabl	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	e 2b								0		(53)
Energ	y lost fro	m water	r storage	e, kWh/ye	ear			((50) x (51	l) x (52) x	(53) =		0		(54)
Enter	(49) or (54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
It cylind	er contains	s dedicate	a solar sto	orage, (57)	m = (56)m	x [(50) – ((H11)] ÷ (5	∪), else (5 •	/)m = (56)	m where (H11) is fro	m Append	IX H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)



Primar	y circui	t loss (an	nual) fro	om Table	e 3							0]	(58)
Primar (moo	y circui dified b	t loss cal y factor fi	culated ⁻ rom Tab	for each Ie H5 if t	month (here is s	59)m = (solar wat	(58) ÷ 36 er heati	65 × (41) ng and a	m i cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m					I	
(61)m=	43.83	38.15	40.64	37.79	37.45	34.7	35.86	37.45	37.79	40.64	40.87	43.83		(61)
Total h	leat req	uired for	water h	eating ca	alculated	l for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64		(62)
Solar DH	-IW input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	1	
(add a	dditiona	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)		-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64		-
								Outp	out from wa	ater heate	r (annual)₁	12	1702.08	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	1 + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	53.47	46.71	48.52	42.89	41.46	36.37	34.63	38.81	39.25	44.89	48.13	52.12		(65)
inclu	ıde (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ernal g	ains (see	e Table 5	5 and 5a):									
Metab	olic gaiı	<u>ns (Table</u>	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	42.8	38.01	30.92	23.41	17.5	14.77	15.96	20.75	27.84	35.36	41.26	43.99		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5				
(68)m=	241	243.51	237.2	223.79	206.85	190.93	180.3	177.8	184.1	197.52	214.45	230.37		(68)
Cookir	ng gains	s (calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5				
(69)m=	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96		(69)
Pumps	and fa	ns gains	(Table s	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08		(71)
Water	heating	gains (T	able 5)											
(72)m=	71.86	69.52	65.22	59.57	55.72	50.51	46.54	52.17	54.51	60.33	66.84	70.06		(72)
Total i	nterna	gains =				(66)	m + (67)m	n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m		
(73)m=	450.67	446.04	428.34	401.77	375.07	351.22	337.81	345.71	361.46	388.21	417.57	439.42		(73)
6. So	lar gain	S:												
Solar g	ains are	calculated	using sola	r flux from	Table 6a	and associ	iated equa	ations to co	onvert to th	e applicat	le orientat	tion.	Qui	
Orienta	ation:	Access F Table 6d	actor	Area m ²		Flu Tal	X hle 6a	т	g_ able 6b	т	FF able 6c		Gains (W)	

	Table 6d		m²			Table 6a		Table 6b	Table 6c			(VV)	
North).9x	0.77	×	1.6	x	10.73	×	0.63	×	0.7	=	5.25	(74)
North).9x	0.77	x	1.6	x	20.36	×	0.63	×	0.7	=	9.96	(74)


North	0.9x	0.77		x	1.0	6	×	3	33.31	×	0.0	63] × [0.7		=	16.29	(74)
North	0.9x	0.77		x	1.0	6	×	5	54.64] ×	0.0	63	ī × Ī	0.7		=	26.72	(74)
North	0.9x	0.77		x	1.0	6	x	7	75.22	×	0.	63	- × [0.7		=	36.78	(74)
North	0.9x	0.77		x	1.0	6	×	1	34.09] ×	0.	63		0.7		=	41.12	(74)
North	0.9x	0.77		x	1.6	6	x	7	79.12	Ī×	0.	63	Ī × [0.7		=	38.69	(74)
North	0.9x	0.77		x	1.6	6	x	6	61.56	×	0.	63] × [0.7		=	30.1	(74)
North	0.9x	0.77		x	1.0	6	x	4	41.09	×	0.	63] × [0.7		=	20.09	(74)
North	0.9x	0.77	:	x	1.0	6	x	2	24.81	x	0.	63] × [0.7		=	12.13	(74)
North	0.9x	0.77		x	1.0	6	x	1	13.22	x	0.	63) × [0.7		=	6.46	(74)
North	0.9x	0.77		x	1.0	6	x		8.94	x	0.	63] × [0.7		=	4.37	(74)
East	0.9x	1	:	x	3.2	2	x	1	19.87	x	0.	63	_ × [0.7		=	19.43	(76)
East	0.9x	1	:	x	3.2	2	x	3	38.52	x	0.	63	_ × [0.7		=	37.67	(76)
East	0.9x	1	:	x	3.2	2	x	6	61.57	x	0.	63] × [0.7		=	60.21	(76)
East	0.9x	1	:	x	3.2	2	x	ę	91.41	x	0.	63] × [0.7		=	89.4	(76)
East	0.9x	1		x	3.2	2	x	1	11.22	×	0.	63] × [0.7		=	108.77	(76)
East	0.9x	1	:	x	3.2	2	x	1	16.05	x	0.	63] × [0.7		=	113.49	(76)
East	0.9x	1	:	x	3.2	2	x	1	12.64	x	0.	63	_ × [0.7		=	110.16	(76)
East	0.9x	1		x	3.2	2	x	ę	98.03	x	0.	63	_ × [0.7		=	95.87	(76)
East	0.9x	1	:	x	3.2	2	x		73.6	x	0.	63	_ × [0.7		=	71.98	(76)
East	0.9x	1		x	3.2	2	x	4	46.91	x	0.	63	×	0.7		=	45.87	(76)
East	0.9x	1		x	3.2	2	x	2	24.71	x	0.	63	_ × [0.7		=	24.16	(76)
East	0.9x	1		x	3.2	2	x	1	16.39	x	0.	63	_ × [0.7		=	16.03	(76)
Solar (gains in	watts, ca	alculate	bd	for eac	n mon	th		I	(83)n	n = Sum(74)m	.(82)m		<u> </u>		I	(00)
(83)m=	24.68	47.62	76.5		116.11	145.5	5	$\frac{154.61}{(92)m}$	148.85	125	5.98 92	2.07	58.01	30.63	20	.41		(83)
(84)m-	475 35	493.67	504.84		(04)III =	520.6	2	505.83	, walls	471	69 45	53 53	446 22	448 19	450	9 83		(84)
(01)11-		100.01				020.01	-			1			110.22					(,
7. Me	an inter	nal temp		e (na	heating	seaso	on) vinc	oroo	from Tol		Th1 /9	20)					01	
Litilio		during r	oine foi	pe ali		n the in	ving m (ble 9	, 1111 (C)					21	(60)
Ullisa	lan	Feb	Mar	T		May						Sen	Oct	Nov				
(86)m=	0.93	0.91	0.89	╈	0.85	0.76		0.63	0.46	0.4	48 0	0.69	0.84	0.91	0.9	93		(86)
()						- T 4				7 : 7		-)						
		1 temper	ature ir	וו ר T	IVING are	20 45		OW Ste	ps 3 to	/ IN I		C)	20.18	10.52	10	15		(87)
(07)11-	19.09	19.20	13.0		19.90	20.43	<u> </u>		20.33		.95 2	0.03	20.10	19.52	13	.15		(0.)
Temp	erature	during h	neating	pe	eriods ir	n rest o	of d	welling	from Ta	able	9, Th2	(°C)		00		00		(00)
(88)m=	19.99	19.99	19.99		20	20.01		20.01	20.02	20.	.02 20	0.01	20	20	19	.99		(00)
Utilisa	ation fac	tor for g	ains for	r re	est of d	welling	j, hź	2,m (se	e Table	9a)				-			I	<i>(</i>)
(89)m=	0.92	0.9	0.87		0.82	0.72		0.56	0.37	0.:	38 0	0.63	0.81	0.89	0.9	92		(89)
Mean	interna	l temper	ature ir	n t	he rest	of dwe	llin	g T2 (f	ollow ste	eps 3	8 to 7 in	Table	e 9c)	i				
(90)m=	17.47	17.7	18.2		18.74	19.39		19.8	19.97	19.	.97 1	9.71	19.04	18.1	17	.55		(90)
												fL	A = Liv	ing area ÷	(4) =		0.54	(91)
Mean	interna	l temper	ature (I	for	the wh	ole dw	/elli	ng) = f	LA × T1	+ (1	– fLA)	× T2						
(92)m=	18.35	18.54	18.96	T	19.41	19.96	T	20.33	20.49	20.	.49 20	0.24	19.66	18.87	18	.41		(92)



Apply	adjustn	nent to t	he mear	interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.2	18.39	18.81	19.26	19.81	20.18	20.34	20.34	20.09	19.51	18.72	18.26		(93)
8. Spa	ace hea	ting requ	uirement	:										
Set Ti	to the i	mean int	ernal ter	nperatu	re obtain	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor for	or gains	using Ta	able 9a		-			•		-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm	1:										
(94)m=	0.89	0.88	0.85	0.8	0.71	0.57	0.4	0.41	0.63	0.79	0.87	0.89		(94)
Usefu	l gains,	hmGm	W = (94	4)m x (8-	 4)m									
(95)m=	424.63	434.35	428.29	415.56	368.43	288.28	194.58	193.56	286	351.84	390.32	411.28		(95)
Month	ly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9		(96)
Heat I	oss rate	e for mea	an intern	al temp	erature,	Lm , W =	=[(39)m x	x [(93)m·	– (96)m]				
(97)m=	851.92	826.79	741.65	643.89	490.69	336.16	206.77	206.54	350.95	530.9	718.9	825.42		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	4 x [(97))m – (95)m] x (4	1)m			
(98)m=	317.9	263.72	233.14	164.4	90.96	0	0	0	0	133.22	236.58	308.12		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1748.05	(98)
Space	hoatin	a requir	omont in	k \//b/m2	2/voor								21 5	
Space	Tieaun	grequit			year								31.5	(33)
9a. Ene	ergy rec	luiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space Fracti	e heatir on of sp	1g: bace hea	t from s	econdar	v/supple	mentary	system						0	(201)
Fracti	on of sr	ace hea	it from m	nain svst	em(s)	,	5	(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	na from	main sv	stem 1			(204) = (20	02) × [1 – ((203)] =			1	(204)
Efficie	ency of i	main sna	ace heat	ina syste	-m 1			. , .	, .				90	
Efficie	ncy of a	num opt	ry/suppl	omontar	v boatin	a evetor	0/						0	
		I	i y/suppi	I	y neating I		I, 70				1	1	0	(200)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heatin	g require	ement (c	alculate	d above))								
	317.9	263.72	233.14	164.4	90.96	0	0	0	0	133.22	236.58	308.12		
(211)m	= {[(98)m x (20	4)] + (21	0)m } x	100 ÷ (2	06)					-			(211)
	353.22	293.02	259.05	182.67	101.06	0	0	0	0	148.02	262.87	342.35		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	2=	1942.27	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									_
= {[(98))m x (20)1)] + (2 ⁻	14) m } x	(100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	1												
Output	from w	, ater hea	ter (calc	ulated a	bove)									
	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64		
Efficier	ncy of w	ater hea	ter										90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	r water	heating,	kWh/mo	onth	•						•	•		
(219)m	= (64)	<u>m x 100</u>) ÷ (217)	m										
(219)m=	190.75	166.62	173.36	153.75	148.86	131.1	125.6	140.02	141.57	161.21	172.09	186.26		_
								Tota	$I = Sum(2^{2})$	19a) ₁₁₂ =			1891.2	(219)



Annual totals Space heating fuel used, main system 1		kWh/year	kWh/year 1942.27
Water heating fuel used			1891.2
Electricity for pumps, fans and electric keep-ho	t		
central heating pump:		130	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of	(230a)(230g) =	175 (231)
Electricity for lighting			302.35 (232)
Electricity generated by PVs			-1030.08 (233)
10a. Fuel costs - individual heating systems:			
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 × 0.01 =	60.21 (240)
Space heating - main system 2	(213) x	0 × 0.01 =	0 (241)
Space heating - secondary	(215) x	0 × 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1 × 0.01 =	58.63 (247)
Pumps, fans and electric keep-hot	(231)	11.46 x 0.01 =	20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) se Energy for lighting	eparately as applicable and (232)	apply fuel price according to $11.46 \times 0.01 =$	Table 12a 34.65 (250)
Additional standing charges (Table 12)			106 (251)
	one of (233) to (235) x)	11.46 × 0.01 =	-118.05 (252)
Appendix Q items: repeat lines (253) and (254)	as needed		
Total energy cost (245)((247) + (250)(254) =		161.49 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12)			0.47 (256)
Energy cost factor (ECF) [(255) x	(256)] ÷ [(4) + 45.0] =		0.76 (257)
SAP rating (Section 12)			89.46 (258)
12a. CO2 emissions – Individual heating syste	ems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198 =	384.57 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Water heating	(219) x	0.198 =	374.46 (264)
Space and water heating	(261) + (262) + (263) + (264)	4) =	759.03 (265)
Electricity for pumps, fans and electric keep-ho	t (231) x	0.517 =	90.48 (267)
Electricity for lighting	(232) x	0.517 =	156.31 (268)



Energy saving/generation technologies Item 1		0.529	=	-544.91	(269)
Total CO2, kg/year		sum of (265)(271) =		460.9	(272)
CO2 emissions per m ²		(272) ÷ (4) =		8.3	(273)
EI rating (section 14)				94	(274)
13a. Primary Energy					
	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	1981.12	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1929.02	(264)
Space and water heating	(261) + (262) + (263) + (26	4) =		3910.14	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	882.86	(268)
Energy saving/generation technologies Item 1		2.92	=	-3007.83	(269)
'Total Primary Energy		sum of (265)(271) =		2296.16	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		41.37	(273)



User Details:	
Assessor Name: Dan Watt Stroma Number: STRO	00002
Software Name: Stroma FSAP 2009 Software Version: Version	า: 1.4.0.79
Property Address: Flat 10 20%	
Address :172 High St, Teddington, TW11 8HU	
1. Overall dwelling dimensions:	
Area(m²)Ave Height(m)Ground floor29(1a) x2.67(2a) =	Volume(m³) 77.43 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 29 (4)	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = $	77.43 (5)
2. Ventilation rate:	2
heating heating total	m ³ per nour
Number of chimneys $0 + 0 + 0 = 0 $ x 40 =	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$	0 (6b)
Number of intermittent fans	20 (7a)
Number of passive vents $0 \times 10 =$	0 (7b)
Number of flueless gas fires $0 \times 40 = 0$	0 (7c)
Air cha	anges per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20$ \div (5) =	0.26 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	
Number of storeys in the dwelling (ns)	0 (9)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (10)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
$0.23 \cdot [0.2 \times (14) \div 100] = $	0 (15)
Air permeability value, g50, expressed in cubic metres per hour per square metre of envelope area	(17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$	0.51 (18)
L Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	
Number of sides on which sheltered	3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	0.39 (21)
Infiltration rate modified for monthly wind speed	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	
JanFebMarAprMayJunJulAugSepOctNovDecMonthly average wind speed from Table 7(22)m=5.45.15.14.54.13.93.73.74.24.54.85.1	
JanFebMarAprMayJunJulAugSepOctNovDecMonthly average wind speed from Table 7(22)m= 5.4 5.1 5.1 4.5 4.1 3.9 3.7 3.7 4.2 4.5 4.8 5.1 Wind Factor (22a)m = (22)m $\div 4$	



Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
	0.53	0.5	0.5	0.44	0.4	0.38	0.36	0.36	0.41	0.44	0.47	0.5		
Calcula	ate effe	ctive air	change i	rate for t	he appli	cable ca	se	-			-		- 	
lf exh	aust air h		using Anne	ndix N (2	3h) - (23a) x Fmv (e	equation (N	(5)) othe	rwise (23h) - (23a)			0	(238)
lf bala	anced with	heat reco	overv: effici	iency in %	allowing f	or in-use f	actor (from	Table 4h) –	(20u)			0	(230)
a) If	balance	d mach			with hor	ot rocov) = (2)	2b)m i ('	22b) v [·	1 (22a)	0 . 1001	(230)
a) II (24a)m-								11() (242	a = (2)			1 - (230)	- 100j	(24a)
(2-10)11- b) If	balance			ntilation	without	boot roc		 /\/\ (24k	$\int_{-\infty}^{\infty}$		22h)	Ů	l	()
(24b)m-								0			230)	0	1	(24b)
(2-10)11-				tilation	r pocitiv		vontilatio			Ů	Ů	Ů	l	(,
i c) ii	f (22b)n	0.5 ex	(23b), t	hen (240	p(23b) = (23b)): other	ventilatic	c) = (22b	m + 0	.5 x (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input '	ventilatio	n from l	oft				1	
i	f (22b)n	n = 1, th	en (24d)	m = (22k	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			_	
(24d)m=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63		(24d)
Effec	ctive air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)					
(25)m=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63		(25)
3 He	at losse	s and he	eat loss r	haramete	er.									
FLEN		Gros	ss	Openin	as	Net Ar	ea	U-valı	ue	AXU		k-value	<i>3</i>	AXk
		area	(m²)	m	2	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K	kJ/K
Doors						2.08	x	1.5	=	3.12				(26)
Window	ws					3.2	x1,	/[1/(1.5)+	0.04] =	4.53				(27)
Walls 7	Гуре1	38	;	0		38	x	0.25	=	9.5				(29)
Walls 1	Гуре2	22	2	2.08		19.92	<u>x</u>	0.23		4.5	ז ר		\exists	(29)
Walls 7	ГуреЗ	6.4	μ	3.2		3.2	x	0.25		0.8	i F		= =	(29)
Roof T	Гуре1	25	;	0		25	x	0.16		4	ה ה		\exists	(30)
Roof 1	Гуре2	1.5	;	0		1.5	×	0.16		0.24	= i		\dashv	(30)
Total a	rea of e	lements	, m²			92.9					L			(31)
Partv v	vall					28	x	0		0				(32)
Party fl	loor					63.2					L [\dashv	(32a)
* for win	dows and	roof wind	ows. use e	ffective wi	ndow U-va	alue calcul	 ated usino	formula 1	/[(1/U-valu	ıe)+0.041 a	L Is aiven in	paragraph	 ∖ 3.2	(024)
** includ	e the area	as on both	sides of in	ternal wal	s and part	titions				,	- J	P		
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				26.68	(33)
Heat ca	apacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	3423.86	6 (34)
Therma	al mass	parame	eter (TMF	P = Cm ÷	- TFA) in	∩ kJ/m²K			Indica	tive Value	: Low		100	(35)
For desi can be u	gn assess Ised inste	sments wh ad of a de	ere the de tailed calcu	tails of the ılation.	constructi	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therma	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						3.72	(36)
if details	of therma	al bridging at loss	are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			20.4	(37)
Ventila	tion her	at loss of	alculated	monthly	1				(38)m	$= 0.33 \times ($	25)m x (5)		30.4	(37)
v on tind	Jan	Feh	Mar	Anr	Mav	Jun	Jul	Aug	Sen	Oct	Nov	Dec	1	
	Jun			יקי י	may	3011		L Yug	1 200				I	



(38)m=	16.39	16	16	15.29	14.86	14.66	14.47	14.47	14.96	15.29	15.63	16		(38)
Heat tra	ansfer c	oefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	46.79	46.4	46.4	45.69	45.26	45.06	44.87	44.87	45.36	45.69	46.03	46.4		
Heat lo	ss para	meter (H	HLP), W	/m²K		-	-		(40)m	Average = = (39)m ÷	Sum(39)₁. (4)	12 /12=	45.74	(39)
(40)m=	1.61	1.6	1.6	1.58	1.56	1.55	1.55	1.55	1.56	1.58	1.59	1.6		
L				·					/	Average =	Sum(40)1.	12 /12=	1.58	(40)
Numbe	er of day	rs in mo	nth (Tab	le 1a)		i .								
(11)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
Assum		ipancy, l	N + 1 76 x	/ [1 - exp	(-0.0003	249 x (TF	-13 9)2)] + 0 ()013 x (⁻	FA -13	1.	15		(42)
if TF.	A £ 13.9	9, N = 1	1.70	i ovb	(0.0000	, , , , , , , , , , , , , , , , , , ,	10.0	/2/] 1 0.0		1177 10.	0)			
Annual	averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	a taraat a	61	.61		(43)
not more	the annua e that 125	li average litres per	not water person pei	usage by : r day (all w	o% ir trie d ater use, l	hot and co	aesignea i ld)	to achieve	a water us	e target o	Γ			
[Jan	Feb	Mar	Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
L Hot wate	er usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	000	001	1101	200		
(44)m=	67.77	65.31	62.85	60.38	57.92	55.45	55.45	57.92	60.38	62.85	65.31	67.77		
		hat water			and by A	400 ··· \/). 	-	Fotal = Su	m(44) ₁₁₂ =	- (-1)	739.36	(44)
Energy c	content of	not water	usea - cai I	culated mo	ontniy = 4.	190 x Va,r I	n x nm x L I	1 m / 3600) kvvn/mor	ith (see Ta	adies 1d, 1 I	c, 1a)		
(45)m=	100.75	88.12	90.93	79.27	76.06	65.64	60.82	69.79	70.63	82.31	89.85	97.57	074 74	
lf instant	aneous w	ater heati	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	l otal = Su	m(45) ₁₁₂ =	⁼ [9/1./4	(45)
(46)m= Water s	15.11 storage	13.22 loss:	13.64	11.89	11.41	9.85	9.12	10.47	10.59	12.35	13.48	14.64		(46)
a) If ma	anufactu	irer's de	clared lo	oss facto	r is knov	vn (kWh	/day):					0		(47)
Tempe	rature fa	actor fro	m Table	2b								0		(48)
Energy	lost fro	m water	· storage	e, kWh/ye	ear			(47) x (48)) =			0		(49)
If manu	ufacture	r's decla	ared cylin	nder loss	factor is	s not kno	own:							
Cylinde	er volum	ie (litres) includii	ng any s	olar stor	age with	IIN same					0		(50)
It com Other	munity he wise if no	ating and stored ho	l no tank ir t water (th	i dwelling, is includes	enter 110 instantan	litres in bo eous comi	ox (50) hi hoilers) i	enter '0' in	hox (50)					
Hotwa	tor stor		factor fr	om Tabl	o 2 (k\M	b/litro/da			<i>box</i> (00)			_		(54)
Volume	a factor	from Ta	hla 22		6 Z (KVV	1/1116/06	y)					0		(51)
Tempe	rature fa	actor fro	m Table	2b								0		(52)
Enerav	v lost fro	m water	storage	. kWh/ve	ear			((50) x (51) x (52) x	(53) =		0		(54)
Enter (49) or (8	54) in (5	5)	, .,					, , ,			0		(55)
Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	n	·			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
lf cylinde	er contains	dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)



Primar	y circui	t loss (an	inual) fro	om Table	e 3	50)						0]	(58)
Primar (mod	y circui dified b	t loss cal v factor fi	rom Tab	for each le H5 if t	here is s	59)m = (solar wat	(58) ÷ 36 ter heatii	ng and a	m i cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)						1	
(61)m=	34.54	30.06	32.03	29.78	29.51	27.35	28.26	29.51	29.78	32.03	32.21	34.54		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11		(62)
Solar DH	HW input	calculated	using App	endix G or	Appendix	H (negativ	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	1	
(add a	dditiona	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)		-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter	-	-	-	-		-					
(64)m=	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11		-
								Outp	out from wa	ater heate	r (annual)₁	12	1341.32	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	42.13	36.81	38.24	33.8	32.67	28.66	27.29	30.59	30.93	35.37	37.93	41.08		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	rom com	munity h	neating	
5. Int	ernal g	ains (see	Table 5	5 and 5a):									
Metab	olic gaiı	ns (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 oi	r L9a), a	lso see	Table 5				1	
(67)m=	23.98	21.3	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.81	23.12	24.64		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	i	i		
(68)m=	142.02	143.49	139.78	131.87	121.89	112.51	106.25	104.77	108.49	116.39	126.37	135.75		(68)
Cookir	ig gains	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5			1	
(69)m=	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08		(69)
Pumps	and fa	ns gains	(Table &	5a)									1	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)					1	1	1	
(71)m=	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17		(71)
Water	heating	gains (T	able 5)										1	
(72)m=	56.63	54.78	51.4	46.95	43.91	39.81	36.68	41.11	42.96	47.55	52.68	55.21		(72)
Total i	nterna	l gains =				(66)	m + (67)m	n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m	1	
(73)m=	298.79	295.74	284.66	268.1	251.77	236.76	228.03	233.67	243.21	259.91	278.33	291.77		(73)
6. So	lar gain	S:		<i>(</i>) <i>(</i>)	T-LL C		·				1			
Solar g	ains are		using sola		i adie 6a a	and associ	iateo equa	itions to co	onvert to th	e applicat	Die orientat	uon.	Coinc	
Unenta		nucess F Table 6d	ลบเป	Area				т	y_ abla 6b	т	TT able 6c			

ononiai	ion.	Table 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
North	0.9x	0.77	x	3.2	x	10.73	×	0.63	x	0.7	=	10.49	(74)
North	0.9x	0.77	x	3.2	×	20.36	×	0.63	×	0.7	=	19.91	(74)



North	0.9x	0.77	>	:;	3.2	x	3	3.31	x		0.63	x	0.7	=	32.57	(74)
North	0.9x	0.77)		3.2	x	5	64.64	x		0.63	×	0.7	=	53.44	(74)
North	0.9x	0.77)	: ;	3.2	x	7	75.22	x		0.63	x	0.7	=	73.56	(74)
North	0.9x	0.77)	: ;	3.2	x	8	4.09	x		0.63	x	0.7	=	82.24	(74)
North	0.9x	0.77)	: ;	3.2	x	7	'9.12	x		0.63	x	0.7	=	77.38	(74)
North	0.9x	0.77	>	: ;	3.2	x	6	51.56	x		0.63	x	0.7	=	60.21	(74)
North	0.9x	0.77	>	: ;	3.2	x	4	1.09	x		0.63	x	0.7	=	40.18	(74)
North	0.9x	0.77	>		3.2	x	2	4.81	x		0.63	×	0.7	=	24.27	(74)
North	0.9x	0.77	>	:	3.2	x	1	3.22	x		0.63	×	0.7	=	12.93	(74)
North	0.9x	0.77	>		3.2	x		8.94	x		0.63	x	0.7	=	8.75	(74)
Solar	gains in	watts, ca	alculate	d for ea	ch mont	h Ta	22.24	77.00	(83)m	1 = SL	um(74)m .	(82)m	7 40.00	0.75	7	(83)
Total (10.49	nternal a	and sole	or (84)m	- (73)m	$\frac{1}{1}$	83)m	watts	60.	21	40.16	24.2	12.93	0.75		(00)
(84)m=	309.28	315.65	317 23	321.53	325 33		319	305 41	293	88	283 39	284 1	8 291 26	300 52		(84)
	000.20			(1	020.00		010	000.11	200		200.00	201.1	0 201120	000.02		()
	ean Inter	during k		(neatin	g seaso in the liv	n) /ing	aroa	from Tak		Th	1 (°C)				21	(85)
Litilie	otion for	tor for a	ains for	living a	roa b1 r	/iliy m (s			JIE 9	,	I (C)				21	(03)
Ouns	Jan	Feb	Mar			/			Δ		Sen	00	t Nov	Dec		
(86)m=	0.91	0.9	0.88	0.85	0.77	+	0.65	0.5	0.5	52	0.71	0.83	0.89	0.91	-	(86)
		1 4 4 4 4 4 4 4 4		1					7 : 7	-	. 0)					
		1 temper	$\frac{1808}{1808}$		rea 11 (0W Ste	ps 3 to 7	/ IN I	able	9C)	10.7	7 18 0/	18/18	7	(87)
(07)11-	10.4		10.00		20.00			20.04			20.40	10.7	10.04	10.40		(0.)
Tem		during h	neating	periods	in rest o	of dw	velling	from Ta	able 9	9, Tr	12 (°C)	40.0	1 40.00	40.00	7	(99)
(88)m=	19.61	19.62	19.62	19.64	19.65		19.65	19.66	19.	66	19.64	19.64	19.63	19.62		(00)
Utilis	ation fac	tor for g	ains for	rest of	dwelling	, h2	,m (se	e Table	9a)						-	(22)
(89)m=	0.9	0.89	0.86	0.82	0.72		0.57	0.37	0.3	38	0.63	0.79	0.87	0.9		(89)
Mear	n interna	l temper	ature in	the res	t of dwe	lling	T2 (f	ollow ste	eps 3	8 to 7	in Tabl	e 9c)			-	
(90)m=	16.28	16.52	17.11	17.78	18.66	1	19.28	19.57	19.	57	19.14	18.24	17.07	16.4	_	(90)
											f	LA = Li	ving area ÷	(4) =	1.03	(91)
Mear	n interna	l temper	ature (f	or the w	hole dw	ellin	g) = fl	LA x T1	+ (1	– fL	A) × T2			_	_	
(92)m=	18.47	18.63	19.04	19.5	20.13	2	20.61	20.88	20.	87	20.49	19.82	2 19.01	18.55		(92)
Apply	/ adjustr	nent to t	he mea	n intern	al tempe	eratu	ure fro	m Table	4e,	whe	re appro	opriate	; 	-	-	
(93)m=	18.32	18.48	18.89	19.35	19.98	2	20.46	20.73	20.	72	20.34	19.67	7 18.86	18.4		(93)
8. Sp		iting requ	uiremer	it man a rat	we abte			on 11 of	Tabl			4 T:	(70)		levilete	
the u	tilisation	factor fo	or gains	using 1	able 9a	inec	atste	эрттог	Tab	ie 90	, so tha	t II,m	=(76)m a	na re-ca	Iculate	
	Jan	Feb	Mar	Apr	May	/	Jun	Jul	A	ug	Sep	Oc	t Nov	Dec		
Utilis	ation fac	tor for g	ains, hr	n:											_	
(94)m=	0.88	0.87	0.85	0.81	0.73		0.62	0.48	0.4	19	0.67	0.8	0.86	0.88		(94)
Usef	ul gains,	hmGm	, W = (9	4)m x (84)m									-1	-	
(95)m=	272.58	275.24	268.97	261.03	238.5	1	97.69	146.63	144	.87	191.1	226.1	5 250.91	264.96	;	(95)
Mont	hly aver	age exte	ernal ter	nperatu	re trom	Tabl	le 8	10.0	40		14.0	40.0	-	4.0	7	(06)
(90)M=	4.5	1 2	0.0	Ö./	1 11.7		14.0	1 10.9	1 16	.y	14.3	10.8	1 /	4.9		(96)



Heat	loss rate	e for mea	an interr	al tempe	erature, l	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	646.66	625.57	561.08	486.67	374.68	264.01	171.93	171.51	274.03	405.24	545.88	626.38		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	278.31	235.43	217.33	162.46	101.31	0	0	0	0	133.25	212.38	268.89		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1609.37	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								55.5	(99)
9a. En	ergy rec	uiremer	ıts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					_
Spac	e heatir	ng:												
Fracti	ion of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	ion of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								90	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space	e heatin	g require	ement (c	alculate	d above))								
	278.31	235.43	217.33	162.46	101.31	0	0	0	0	133.25	212.38	268.89		
(211)m	า = {[(98)m x (20	4)] + (21	10)m } x	100 ÷ (2	06)								(211)
	309.24	261.59	241.48	180.52	112.57	0	0	0	0	148.05	235.98	298.77		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	Ē	1788.19	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									
$= \{[(98)]$)m x (20	01)] + (22	14) m } >	(100 ÷ (208)	0	0		0	0		0		
(215)m=	0	0	0	0	0	0	0	U Tota	U L (k\\/h/vea	$\frac{0}{-Sum(2)}$	U 215)	-		1(215)
Motor	heating							Tota	i (ittili yot		- 107 _{15,1012}		0	(213)
output	from w	l ater hea [.]	ter (calc	ulated a	hove)									
oupu	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11		
Efficier	ncy of w	ater hea	ter		·								90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel fo	or water	heating,	kWh/m	onth							•			
(219)m	1 = (64)	m x 100) ÷ (217)	m	117.21	102.22	00 00	110.24	111 56	127.04	125.62	146 70		
(219)11-	150.52	131.31	130.01	121.17	117.51	105.52	90.90	Tota	I = Sum(2)	19a) =	155.02	140.79	1400.36	
Δnnua	al totals									د	Wh/vear		kWh/vear	(213)
Space	heating	fuel use	d, main	system	1					N.	, yca		1788.19	1
Water	heating	fuel use	d										1490.36]
Electric	city for r	umpo f	- and and	oloctric	kaan ha	+							1100.00	J
Electric		umps, ia	ans anu	electric	кеер-по	L								
centra	al heatin	g pump:										130		(230c)
boiler	with a f	an-assis	ted flue									45		(230e)
Total e	electricity	for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electric	city for li	ghting											169.38	(232)
Electri	city aen	erated by	v PVs										-686.72	(233)
	9011		,										500.72](,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,



10a. Fuel costs - individual heating systems:			
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 × 0.0	1 = 55.43 (240)
Space heating - main system 2	(213) x	0 × 0.0	1 = 0 (241)
Space heating - secondary	(215) x	0 x 0.0	1 = 0 (242)
Water heating cost (other fuel)	(219)	3.1 × 0.0	1 = 46.2 (247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.0	1 = 20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) so Energy for lighting	eparately as applicable and a (232)	oply fuel price according	to Table 12a 1 = 19.41 (250)
Additional standing charges (Table 12)			106 (251)
	one of (233) to (235) x)	11.46 × 0.0	1 =(252)
Appendix Q items: repeat lines (253) and (254)Total energy cost(245)	as needed (247) + (250)(254) =		168.4 (255)
11a. SAP rating - individual heating systems			
Energy cost deflator (Table 12)			0.47 (256)
Energy cost factor (ECF) [(255) ×	(256)] ÷ [(4) + 45.0] =		1.07 (257)
SAP rating (Section 12)			85.08 (258)
12a. CO2 emissions – Individual heating syste	ems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	Energy kWh/year (211) x	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Emission factor kg CO2/kWh 0.198 = 0 =	Emissions kg CO2/year 354.06 (261) 0 (263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = t (231) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.517 =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = t (231) x (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting Energy saving/generation technologies Item 1	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = t (231) x (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = 0.517 =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268) -363.27 (269)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting Energy saving/generation technologies Item 1 Total CO2, kg/year	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = t (231) x (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.198 = 0.517 = 0.517 = 0.517 = 0.517 = 0.529 = um of (265)(271) =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268) -363.27 (269) 463.92 (272)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting Energy saving/generation technologies Item 1 Total CO2, kg/year CO2 emissions per m²	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = t (231) x (232) x st (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.198 = 0.517 = 0.517 = 0.517 = 0.517 = 0.529 = um of (265)(271) = 72) ÷ (4) =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268) -363.27 (269) 463.92 (272) 16 (273)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting Energy saving/generation technologies Item 1 Total CO2, kg/year CO2 emissions per m² El rating (section 14)	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (232) x st (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = 0.517 = 0.529 = um of (265)(271) = 72) ÷ (4) =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268) -363.27 (269) 463.92 (272) 16 (273) 92 (274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting Energy saving/generation technologies Item 1 Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (232) x st (232) x (232) x	Emission factor kg CO2/kWh 0.198 = 0 = 0.198 = 0.198 = 0.517 = 0.517 = 0.517 = 0.529 = um of (265)(271) = 72) ÷ (4) =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268) -363.27 (269) 463.92 (272) 16 (273) 92 (274)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-ho Electricity for lighting Energy saving/generation technologies Item 1 Total CO2, kg/year CO2 emissions per m² El rating (section 14) 13a. Primary Energy	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = t (231) x (232) x st (2 Energy kWh/year	Emission factor kg CO2/kWh 0.198 = 0 0.198 = 0.198 = 0.517 = 0.517 = 0.517 = 0.529 = m of (265)(271) = 72) ÷ (4) =	Emissions kg CO2/year 354.06 (261) 0 (263) 295.09 (264) 649.15 (265) 90.48 (267) 87.57 (268) -363.27 (269) 463.92 (272) 16 (273) 92 (274) P. Energy KWh/year



Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1520.16	(264)
Space and water heating	(261) + (262) + (263) + (264)) =		3344.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	494.59	(268)
Energy saving/generation technologies Item 1		2.92	=	-2005.22	(269)
'Total Primary Energy		sum of (265)(271) =		2344.48	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		80.84	(273)