

Energy Statement

36 Lancaster Grove

For Nicholas Taylor and Associates

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XCO2 energy

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About us:

XCO2 Energy are a low-carbon consultancy working in the built environment. We are a multi-disciplinary company consisting of both architects and engineers, with specialists including CIBSE low carbon consultants, Code for Sustainable Homes, EcoHomes and BREEAM assessors and LEED accredited professionals.

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Executive Summary

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 36 Lancaster Grove, based on the information provided by the design team.

The site is located between Lancaster Grove Road, Lambolle Place and Eton Ave within the London Borough of Camden, just north of Primrose Hill. The proposed scheme comprise the change of use, refurbishment and extension of the Grade II Listed former Belsize Park Fire Station Building into 10 units of apartment accommodation. The existing 7 units of residential accommodation will not form part of this application.

As the former Belsize Park Fire Station is a Listed Building located within the Belsize Park conservation area, all of the existing facades, roof, windows and floors will be retained and re-used as far as possible to maintain the character of the existing building.

In line with the 'GLA Guidance on preparing energy assessments' (April 2015) Sections 8.11-8.14, the existing building with it's current fabric and building services systems are used as the baseline condition for the scheme in this Energy Statement. The 7 no. existing residential accommodation, which do not form part of this application, has not been included in this assessment.

The methodology used to determine the CO₂ emissions is in accordance with the London Plan's three-step Energy Hierarchy (Policy 5.2) outlined below.

1. Be Lean - use less energy

The first step deals with the reduction in energy use, through the adoption of sustainable design and construction measures. In accordance with this strategy, this development will incorporate a range of energy efficiency measures including the provision of a new and highly efficiency space heating and hot water system, electrical rewiring to include provision of low energy lighting throughout the scheme, and insulation levels meeting Part L1B targets for the any new thermal elements. Insulation will also be provided between and below the rafters at the existing pitched roof. The improvements in the building systems and fabric have reduced regulated CO_2 emissions by 45.8% in comparison to the existing building, thus exceeding the requirements outlined by the Camden Council and London Plan 2015.

2. Be Clean - supply energy efficiently

The second strategy takes into account the efficient supply of energy, by prioritising decentralised energy generation. The feasibility study showed that no district heating network currently exists within close proximity of the site. Due to the nature of the development, a CHP unit would not be an economically viable option. Hence, high efficiency boilers where installed to provide space heating and hot water to each apartment.

3. Be Green - use renewable energy

The third strategy covers the use of renewable technologies. The feasibility study analysed a number of renewable technologies for their suitability for the site. The analysis included a biomass heating system, ground-source heat pumps, air-source heat pumps, photovoltaic panels, solar thermal and wind turbines.

The analysis demonstrated that due to the conservation requirements of the existing Grade II listed building, it will not be feasible to install renewable technologies without considerable construction and alterations to the former Belsize Park Fire Station.

In total, the development is expected to reduce regulated CO_2 emissions by 45.8% when compared to the existing baseline building. This meets the London Plan CO_2 reduction target of 35% set out for all major developments.





Conclusion

The graph below provides a summary of the regulated CO_2 savings at each stage of the London Plan Energy Hierarchy. The table below and on the following page detail the regulated and unregulated emissions at each stage of the hierarchy.

It can be seen on the graph below that the development at 36 Lancaster Grove will achieve a regulated CO_2 saving exceeding the required 35% beyond the existing baseline building.



36 Lancaster Grove Energy Hierarchy

CO₂ Emissions Breakdown from each stage of the energy hierarchy

	Carbon Dioxide Emissions (tonnes CO ₂ per annum)		
	Regulated	Total	
Existing building baseline	85.2	95.2	
After energy demand reduction	44.2	57.8	
After efficient energy supply	44.2	57.8	
After renewable technologies	44.2	57.8	





$\mathrm{CO}_{_2}$ Savings Breakdown from each stage of the energy hierarchy

	Regulated Carbon Dioxide Savings		
	Tonnes CO ₂ / year	% over baseline	
Savings from energy demand reduction	37.4	45.8%	
Savings from efficient energy supply	0.0	0.0%	
Savings from renewable energy	0.0	0.0%	
Cumulative savings	37.4	45.8%	



Introduction

The proposed Belsize Park Fire Station development located at Lancaster, is a five-storey high Grade II listed building. It is a change of use development from a fire station to domestic units.

The site is located between Lancaster Grove Road, Lambolle Place and Eton Ave within the London Borough of Camden, just north of Primrose Hill. The proposed scheme comprise the change of use, refurbishment and extension of the Grade II Listed former Belsize Park Fire Station Building into 10 units of apartment accommodation. The existing 7 units of residential accommodation will not form part of this application.

This document demonstrates how the proposed development addresses the relevant energy policies of the London Plan 2015 (Further Alterations to the London Plan) and the requirements of Camden Council as outlined in their Core Strategy 2010-2025.

In particular this report responds to the energy policies of section 5 in the London Plan, including:

- Policy 5.2 Minimising Carbon Dioxide Emissions
- Policy 5.3 Sustainable Design and Construction
- Policy 5.5 Decentralised Energy Networks
- Policy 5.6 Decentralised Energy in Development proposals
- Policy 5.7 Renewable Energy where feasible.

and the Policy CS13 of the Camden's Core Strategy 2010-2025, which states the following in relation to sustainable redevelopment in the local area:

Camden Core Strategy 2010-2025: CS13 -Tackling climate change through promoting high environmental standards

Reducing the effects of and adapting to climate change

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

- ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
- promoting the efficient use of land and buildings;
- minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
- 1. ensuring developments use less energy,
- 2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
- 3. generating renewable energy on-site; and
- ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Local energy generation

The Council will promote local energy generation and networks by:

 working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:







- 1. housing estates with community heating or the potential for community heating and other uses with large heating loads;
- 2. the growth areas of King's Cross; Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;
- 3. schools to be redeveloped as part of Building Schools for the Future programme;
- 4. existing or approved combined heat and power/ local energy networks;

and other locations where land ownership would facilitate their implementation.

• protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

- taking measures to reduce its own carbon emissions;
- triallng new energy efficient technologies, where feasible; and
- raising awareness on mitigation and adaptation measures



Furthermore, the Camden Core Strategy recommends that:

Given the large proportion of development in the borough that relates to existing buildings, we will expect proportionate measures to be taken to improve their environmental sustainability, where possible.

The methodology employed in this Energy Statement to determine the potential CO_2 savings for this development, is in accordance with the three step Energy Hierarchy outlined in the London Plan:

- Be Lean Improve the energy efficiency of the scheme
- Be Clean Supply as much of the remaining energy requirement with low-carbon technologies such as combined heat and power (CHP)
- Be Green Offset a proportion of the remaining carbon dioxide emissions by using renewable technologies.

It should be noted that due to the change-ofuse and refurbishment nature of the proposed development, the baseline conditions for the development are calculated based on the existing fabric and services of the retained building.

Energy calculations were carried out using the SAP (Standard Assessment Procedure) methodology. This is in line with Building Regulations Part L 2013. The SAP sheets for the existing building baseline is presented in Appendix A, while those for the proposed development is presented in Appendix B.





Demand Reduction (Be Lean)

Passive Design Measures

Enhanced Building Fabric

The heat loss of different building elements is dependent upon their U-value. The lower the Uvalue, the better the level of insulation of a particular element. A building with low U-values has a reduced heating demand during the cooler months.

The extended portions of the development at 36 Lancaster Grove will incorporate insulation meeting building regulation Part L1B threshold U-values and high efficiency glazing where possible in order to reduce the demand for space heating (see tables below).

Insulation would be installed to between and below the rafters of the existing pitched roof of the building, to achieve a u-value of circa 0.28 W/m2.K. However, it must be noted that since the building is a Grade II listed structure of heritage interest, alteration of the existing fabric elements (external walls, floors, roofs and such) will impact the original character of the building, no changes apart from addition of roof insulation will be made to the existing fabric elements.

Air Tightness

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration into a building.

Current Part L Building Regulations (2013) sets a maximum air permeability rate of 10m³/m² at 50Pa for new build dwellings. The development will achieve this air tightness as a minimum, through draught proofing and the application of best practice construction techniques.

Daylight

The development will aim to maintain the existing good sized windows to provide satisfactory levels of daylighting in all habitable spaces such as living rooms, as a way of improving the health and wellbeing of its occupants.

Active Design Measures

High Efficacy Lighting

The development intends to incorporate low energy lighting fittings throughout the dwellings and communal spaces. All light fittings will be specified as low energy lighting to minimise energy demand. Internal and external areas which are not frequently used will be fitted with occupant sensors, whereas daylit areas will be fitted with daylight sensors and timers.

Energy Demand

The table below shows a breakdown of energy demand for space conditioning and electricity. These figures indicate baseline and Lean demand after energy efficiency measures have been applied.

The table below demonstrates the energy savings achieved through energy efficiency measures (Lean stage of the Energy Hierarchy).

	Baseline Building				Lean	
	Energy (kWh/year)	CO ₂ emissions (kgCO ₂ /year)	CO ₂ (kgCO ₂ / m ²)	Energy (kWh/year)	CO ₂ emissions (kgCO ₂ /year)	CO ₂ (kgCO ₂ / m ²)
Hot Water	76,030	16,420	22.1	42,180	9,110	12.3
Space Heating	282,710	61,070	82.2	150,090	32,420	45.6
Cooling	0	0	0.0	0	0	0.0
Auxiliary	2,010	1,040	1.4	1,650	860	1.2
Lighting	5,810	3,010	4.1	3,420	1,770	2.4
Equipment (not incl. in Part L)	26,310	13,650	18.4	26,310	13,650	18.4
Total Part L	366,560	81,540	109.7	197,340	44,160	59.4
Total (incl. Equip)	382,860	95,190	128.1	223,650	57,810	77.8

Breakdown of Energy Consumption and CO₂ Emissions

CO₂ Emissions

The table below shows the regulated and unregulated carbon dioxide emissions for the baseline scheme and the emissions after the passive and active lean measures have been implemented. A saving exceeding the required 35% is expected from the regulated CO_2 emission over the existing building.

CO₂ Emissions Breakdown at Lean stage

	Carbon Dioxide emissions (tonnes CO ₂ per annum)					
	Regulated Unregulated Total					
Baseline building	81.5	13.7	95.2			
After energy demand reduction (Lean)	44.2	13.7	57.8			

	Carbon dioxide savings (tonnes CO ₂ per annum)		Carbon dioxide savingsCarbon dioxide savings(tonnes CO2 per annum)baseline (%)		e savings from ne (%)
	Regulated	Total	Regulated	Total	
Savings from energy demand reduction	37.4	37.4	45.8%	39.3%	





Heating and Cooling Infrastructure (Be Clean)

Energy System Hierarchy

The energy system for the development has been selected in accordance with the London Plan decentralised energy hierarchy. The hierarchy listed in Policy 5.6 states that energy systems should consider:

- 1. Connection to existing heating and cooling networks
- 2. Site wide CHP network
- 3. Communal heating and cooling

Local supply of heat and power minimise distribution losses, thereby achieving a greater efficiency and reducing CO_2 emissions, when compared to the individual systems.

In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network to surrounding residencies and commercial units.

Connection to Existing Low Carbon Heat Distribution Networks

The London Heat Map identifies existing and potential opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study. An excerpt from the London Heat Map below shows the energy demand for different areas. Darker shades of red signify areas where energy demand is high. The map also highlights any existing and proposed district heating network (DHN) within the vicinity of the development.

A review of the map shows that the closest existing or proposed heat networks approximately 1.4 miles to the south-east of the site. The scale of the development does not make it economically viable for connection with networks located at a distance from the site. For this reason connection to district heat networks are not currently considered feasible.



London Heat Map with proposed district heat network outlined in red



Combined Heat and Power (CHP)

CHP, or Co-generation is the production of electricity and useful heat from a single engine. Unlike conventional electricity generation, heat is re-used in a CHP system, primarily for hot water, thereby improving the overall energy conversion from 25-35% to around 80%.

Due to the type and size of the development, this technology would not be suitable for this site. The hot water load of the site would not be sufficient to justify the use of this technology.

Hence, this technology is deemed to be unsuitable for the development at 36 Lancaster Grove.

There will be no further reduction in $\rm CO_2$ emissions at the Clean Stage.

CO, Emissions Breakdown at Clean stage

	Carbon Dioxide emissions (tonnes CO ₂ per annum)					
	Regulated Unregulated Tota					
Baseline building	81.5	13.7	95.2			
After energy demand reduction (Lean)	44.2	13.7	57.8			
After district heating system (Clean)	44.2	13.7	57.8			

	Carbon dioxide savings (tonnes CO ₂ per annum) Regulated Total		Carbon dioxide savings from baseline (%)	
			Regulated	Total
Savings from energy demand reduction	37.4	37.4	45.8%	39.3%
Savings from clean technologies	0.0	0.0	0.0%	0.0%





An example of a CHP engine (courtesy of Baxi)

Renewable Energy (Be Green)

Once the energy demand has been minimised, methods of generating low and zero carbon energy can be assessed. The renewable technologies to be considered for the development are:

- Biomass
- Photovoltaic panels
- Solar thermal panels
- Ground/water source heat pumps
- Air source heat pump
- Wind energy

The table below summarises the factors taken into account in determining the appropriate renewable technology for this project. This includes estimated lifetime, level of maintenance, and level of impact on external appearance. The final column indicates the feasibility of the technology in relation to the site conditions (10 being the most feasible and 0 being infeasible).

The analysis demonstrated that due to the conservation requirements of the existing Grade II listed building, it will not be feasible to install renewable technologies without considerable construction and alterations to the former Belsize Park Fire Station building.

	36 Lancaster Grove					
	Comments	Lifetime	Maintenance	Impact on External Appearance	Site Feasibility	
Biomass	Not adopted -burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20yrs	High	High	1	
Nd	Not adopted - PV panels mounted on the pitched roof would significantly alter the appearance and character of the Listed Building.	25yrs	Low	Med	3	
Solar Thermal	Not adopted - Solar thermal array mounted on the pitched roof would significantly alter the appearance and character of the Listed Building.	25yrs	Low	Med	3	
GSHP	Not adopted -the installation of ground loops require significant space, additional time at the beginning of the construction process and very high capital costs.	20yrs	Med	Low	1	
ASHP	Not adopted -ASHP evaporator units are located externally and produce noise which can be an issue in a residential location, especially at night.	20yrs	Med	Med	3	
Wind	Not adopted - Wind turbines located at the site will have a significant visual impact on the existing building within the Conservation Area.	25yrs	Med	High	1	



CO₂ Emissions

The table below shows the regulated and unregulated carbon dioxide emissions for the baseline scheme and the emissions after the lean, clean and green measures have been implemented.

The proposed Energy Strategy outlined in this document achieved significant CO₂ savings for this development. The savings achieved through sustainable design measures alone are significant.

The figures below show a CO₂ reduction in regulated emissions exceeding the required 35% when compared to the building with its existing fabric and systems.

CO₂ Emissions Breakdown

	Carbon Dioxide emissions (tonnes CO ₂ per annum)				
	Regulated	Unregulated	Total		
Baseline building	81.5	13.7	95.2		
After energy demand reduction (Lean)	44.2	13.7	57.8		
After efficient technology (Clean)	44.2	13.7	57.8		
After renewable technologies (Green)	44.2	13.7	57.8		

CO₂ Savings Breakdown at all stages for the energy hierarchy

	Carbon dioxide savings (tonnes CO ₂ per annum)		Carbon dioxid baseli	le savings over ne (%)
	Regulated Total		Regulated	Total
Savings from energy demand reduction	37.4	37.4	45.8%	39.3%
Savings from clean technology	0.0	0.0	0.0%	0.0%
Savings from renewable energy	0.0	0.0	0.0%	0.0%
Cumulative savings	37.4	37.4	45.8%	39.3%



Conclusion

In line with the London Plan's three step energy hierarchy, the regulated CO_2 emission savings for this development will exceed 35% when energy efficiency measures are taken into account.

The tables on the following page provide a breakdown of the CO₂ savings made at each stage of the Energy Hierarchy. The reductions made through each step have been outlined below:

1. Be Lean - use less energy

The first step deals with the reduction in energy use, through the adoption of sustainable design and construction measures. In accordance with this strategy, this development will incorporate a range of energy efficiency measures including the provision of a new and highly efficiency space heating and hot water system, electrical rewiring to include provision of low energy lighting throughout the scheme, and insulation levels meeting Part L1B targets for the any new thermal elements.

Insulation will also be provided between and below the rafters at the existing pitched roof. The improvements in the building systems and fabric have reduced regulated CO_2 emissions by 45.8% in comparison to the existing building, thus exceeding the requirements outlined by the Camden Council and London Plan 2015.

2. Be Clean - supply energy efficiently

The feasibility study showed that no district heating network currently exists within close proximity of the site. Due to the nature of the development, a CHP unit would not be an economically viable option. Hence, high efficiency boilers where installed to provide space heating and hot water to each apartment.

3. Be Green - use renewable energy

The feasibility study analysed a number of renewable technologies for their suitability for the site. The analysis included a biomass heating system, groundsource heat pumps, air-source heat pumps, photo voltaic panels, solar thermal and wind turbines.

The analysis demonstrated that due to the conservation requirements of the existing Grade II listed building, it will not be feasible to install renewable technologies without considerable construction and alterations to the former Belsize Park Fire Station.

In total, the development is expected to reduce regulated CO_2 emissions by 45.8% when compared to the existing baseline building. This meets the London Plan CO_2 reduction target of 35% set out for all major developments.



CO₂ Emissions Breakdown at all stages for the energy hierarchy

	Carbon Dioxid	de emissions (tonnes CO	D_2 per annum)
	Regulated	Unregulated	Total
Baseline building	81.5	13.7	95.2
After energy demand reduction (Lean)	44.2	13.7	57.8
After district heating system (Clean)	44.2	13.7	57.8
After renewable technologies (Green)	44.2	13.7	57.8

CO₂ Savings Breakdown at all stages for the energy hierarchy

	Carbon diox (tonnes CO ₂	kide savings per annum)	Carbon dioxid baseli	le savings over ne (%)
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	37.4	37.4	45.8%	39.3%
Savings from district heating system	0.0	0.0	0.0%	0.0%
Savings from renewable energy	0.0	0.0	0.0%	0.0%
Cumulative savings	37.4	37.4	45.8%	39.3%





Appendix A - SAP outputs for the existing building baseline

The DER from the FSAP modelling of the proposed development with the existing fabric and building services systems were used to calculate the baseline CO_2 emissions of the existing building.



				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	D	roporty	Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.3.4	
Address :	. london. NV	V3 4PB			Audress.						
1. Overall dwelling dime	nsions:										
				Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	
Basement					33	(1a) x	2.	.25	(2a) =	74.25	(3a)
Ground floor					19	(1b) x	1.	.65	(2b) =	31.35	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+((1d)+(1e)+	⊦(1n	ı)	52	(4)					-
Dwelling volume				L		(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	105.6	(5)
2 Ventilation rate											_
2. Ventilation rate.	main	sec	ondar	у	other		total			m ³ per hour	
Number of chimneys		ne:] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0] + [0] + [0	」] = 「	0	x 2	20 =	0	」 ┃(6b)
Number of intermittent fa	ns					л Г Г	2	x 1	10 =	20] (7a)
Number of passive vents							0	x 1	10 =	0	(7b)
Number of flueless gas fi	res						0	x 4	40 =	0](7c)
Ĵ						L	-		Air ch	anges per hou	ריי זג
Infiltration due to chimne	ys, flu <mark>es an</mark> d fa	ans = (6a)	+(6b)+(7	a)+(7b)+(7c) =		20	· [÷ (5) =	0.19	(8)
If a pressurisation test has b	een ca <mark>rried o</mark> ut or	is intended,	proceed	d to (17), o	otherwise o	continue fr	om (9) to (16)			٦
Additional infiltration	he dw <mark>eiling</mark> (ns	5)						[(9)-	-11x0 1 –	0	(9)
Structural infiltration: 0	.25 for steel or	timber fra	ame or	0.35 foi	r masonr	v constr	uction	[(3)-	11×0.1 =	0	$\frac{1}{1}$
if both types of wall are p	resent, use the va	lue correspo	onding to	the great	er wall are	a (after				0	7,
deducting areas of openir	ngs); if equal user	0.35 (upsoalor	d) or 0	1 (soale	d) else	ontor 0				0	
If no draught lobby en	ter 0.05 else ϵ	enter 0	u) or 0.	i (seale	u), eise					0	$\int_{(12)}^{(12)}$
Percentage of windows	s and doors dr	aught strip	oped							0](10)](14)
Window infiltration		0 1	•		0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	d in cubic	; metre	s per ho	our per so	quare m	etre of e	nvelope	area	20	(17)
If based on air permeabil	ity value, then	(18) = [(17)	÷ 20]+(8	3), otherwi	se (18) = (16)				1.19	(18)
Air permeability value applie	s if a pressurisatio	on test has b	een don	e or a deg	gree air pe	rmeability	is being us	sed	ĺ		
Shelter factor	iu				(20) = 1 -	[0.075 x (1	9)] =			0.92	(19)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				1.1](21)
Infiltration rate modified f	or monthly win	d speed							I		^
Jan Feb	Mar Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tabl	e 7									
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	2a)m =	(22)m ÷	4									_		
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18			
Adjuste	ed infiltra	ation rat	e (allowi	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m						
	1.4	1.38	1.35	1.21	1.18	1.05	1.05	1.02	1.1	1.18	1.24	1.29			
Calcula	ate effec	tive air	change	rate for t	he appli	cable ca	se								(220)
lf ovh	eust air he		using Ann	endiv N (2	3h) - (23a	a) v Emv (e	auation (N	(15)) other	rwise (23h) - (23a)					(23a)
If bala	anced with	beat rec		$\frac{1}{2}$		for in-use f	actor (from	n Table <i>1</i> b) –	<i>(</i> 200)				0	(230)
a) If		d moob			with ho	of rocov			$(2)^{-1}$	2b)m i ('	22h) v [/	1 (22a)	· 1001	0	(23C)
(24a)m =								0	$\frac{1}{1} = \frac{2}{1}$			$\frac{1-(230)}{0}$	- 100j		(24a)
(2 la)	halance	d mech	anical ve		without	heat rec		1)/) (24h	$\int_{-\infty}^{-\infty} (2^{\prime})$	$1 \frac{1}{2}$	23h)	Ů	J		(,
(24b)m=											230)	0	1		(24b)
(2-10)III-			tract vor					n from c		Ů	Ů	Ů	J		()
c) ii	if (22b)m	0.5×0.5	(23b). 1	then (24)	c) = (23b)	b): other	ventilatic vise (24	c) = (22b)	m + 0	.5 × (23b))				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	n or wh	lole hous	e positiv	ve input '	ventilatio	n from l	loft				J		
i	if (22b)m	n = 1, th	en (24d)	m = (22	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			_		
(24d)m=	1.4	1.38	1.35	1.21	1.18	1.05	1.05	1.02	1.1	1.18	1.24	1.29			(24d <mark>)</mark>
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	d) in boy	x (25)						
(25)m=	1.4	1.38	1.35	1.21	1.18	1.05	1.05	1.02	1.1	1.18	1.24	1.29			(25)
2 1 10	at losses	e and he		naramet	ar.										
3. He	ai 10330.	s anu ne	zai 1033 i	varancu											
S. FIE		Gros	SS 1055	Openin	gs	Net Ar	ea	U-valu	ue	AXU		k-value)	A X k	(
ELEN		Gros area	ss (m²)	Openin m	gs J ²	Net Ar A ,r	ea n²	U-valu W/m2	ue 2K	A X U (W/ł	<)	k-value kJ/m²·l	e K	A X k kJ/K	(
Doors	IENT Type 1	Gros area	ss (m²)	Openin r	gs ₁ 2	Net Ar A ,r 7.3	ea m² x	U-valu W/m2	ue 2K =	A X U (W/ł 10.22	<)	k-value kJ/m²·l	e K	A X k kJ/K	(26)
Doors	IENT Type 1 Type 2	Gros area	ss (m²)	Openin r	gs _{J2}	Net Ar A ,r 7.3	ea m ² x	U-valu W/m2 1.4	ue 2K = =	A X U (W/I 10.22 6.02	<)	k-value kJ/m²·I	e K	A X k kJ/K	(26) (26)
3. He ELEN Doors Doors Windov	AENT Type 1 Type 2 ws Type	Gros area	ss (m ²)	Openin m	gs ₂	Net Ar A ,r 7.3 4.3 1.6	ea n ² x x x x ¹	U-valu W/m2 1.4 1.4 /[1/(2.1)+	2K 2K = = 0.04] =	A X U (W/I 10.22 6.02 3.1	<)	k-value kJ/m²·I	e K	A X k kJ/K	(26) (26) (27)
S. He ELEN Doors Doors Windov Windov	IENT Type 1 Type 2 ws Type ws Type	Gros area	ss (m ²)	Openin r	gs ₁₂	Net Ar A ,r 7.3 4.3 1.6 1.97	ea n ² x x x ¹ x ¹	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+	ue 2K = = 0.04] = 0.04] =	A X U (W/I 10.22 6.02 3.1 3.82	<)	k-value kJ/m²·I	e K	A X k kJ/K	(26) (26) (27) (27)
S. He ELEN Doors Doors Window Window Floor	Type 1 Type 2 ws Type ws Type	Gros area	(m ²)	Openin m	gs ₁ 2	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3	ea n ² x x x ¹ x ¹ x ¹	U-valu W/m2 1.4 (1/(2.1)+ /[1/(2.1)+ (1/(2.1)+	ue 2K = = • 0.04] = • 0.04] = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546		k-value kJ/m²·I	×	A X k kJ/K	(26) (26) (27) (27) (28)
S. He ELEN Doors Doors Windov Floor Walls	IENT Type 1 Type 2 ws Type ws Type Type1	Grosarea	4	Openin m 15.1	gs ₁ 2 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23	ea n ² x x x x ¹ x ¹ x ¹ x ²	U-valu W/m2 1.4 (1/(2.1)+ /[1/(2.1)+ 0.22 0.28	ue 2K = = 0.04] = 0.04] = = =	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98	<)	k-value kJ/m²+l		A X k kJ/K	(26) (26) (27) (27) (28) (29)
Doors Doors Windov Windov Floor Walls	AENT Type 1 Type 2 ws Type ws Type Type1 Type2	Gros area 1 2 29. 44.	4 1	Openin m 15.1	gs ₁ 2 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1	ea n ² x x x x ¹ x ¹ x ¹ x ² x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28	ue 2K = = 0.04] = 0.04] = = = = = =	A X U (W/) 10.22 6.02 3.1 3.82 7.546 3.98 12.35		k-value kJ/m²+l		A X k kJ/K	 (26) (27) (27) (28) (29) (29)
S. He ELEN Doors Doors Windov Floor Walls ⁻ Roof	AENT Type 1 Type 2 ws Type ws Type Type1 Type2	Gros area 1 2 29. 44.	4 1	Openin m 15.1' 0 0 0	gs ,2 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19	ea n ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.16	ue 2K = = = 0.04] = = 0.04] = = = = = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04		k-value kJ/m²·l		A X k kJ/K	 (26) (27) (27) (27) (28) (29) (29) (30)
S. He ELEN Doors Doors Windov Floor Walls ⁻ Roof Total a	IENT Type 1 Type 2 ws Type ws Type Type1 Type2 area of e	Gros area 1 2 29. 44. 19. 19. 19.	4 1 , m ²	Openin m 15.1 0 0 0	gs ₁ 2 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8	ea n ² x x x x ¹ x ¹ x ¹ x ² x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.16	ue 2K = = = 0.04] = = 0.04] = = = = = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04		k-value kJ/m²+l		A X k kJ/K	 (26) (27) (27) (28) (29) (29) (30) (31)
S. He ELEN Doors Doors Windov Windov Floor Walls ⁻ Roof Total a Party v	A E NT Type 1 Type 2 ws Type ws Type Type1 Type2 area of el wall	Grosarea	4 1 , m ²	Openin 15.1 0 0	7	Net Ar A,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9	ea n ² x x x x ¹ x ¹ x ¹ x ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 (1/(2.1)+ /[1/(2.1)+ (1/(2.1)+ 0.22 0.28 0.28 0.28 0.16	ue 2K = = 0.04] = = 0.04] = = = = = = = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04		k-value kJ/m²-I		A X k kJ/K	 (26) (26) (27) (27) (28) (29) (29) (30) (31) (32)
S. ree ELEN Doors Doors Windou Floor Walls ⁻ Roof Total a Party v * for win	ALENT Type 1 Type 2 ws Type ws Type Type1 Type2 area of e wall dows and le the area	Gros area 1 2 29. 44. 19 lements roof wind	4 1 , m ² ows, use 6 sides of it	Openin m 15.1 0 0 effective wi	gs ⁷ ndow U-va ¹ / ₂	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calcul titions	ea n ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ (1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.16	ue	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 ue)+0.04] a	K)	k-value kJ/m²+l		A X k kJ/K	 (26) (27) (27) (28) (29) (29) (30) (31) (32)
S. ree ELEN Doors Doors Windov Floor Walls ⁻ Roof Total a Party v * for win ** includ Fabric	Area of e wall dows and heat los	Gros area 1 2 2 9. 44. 19 19 19 19 19 19 19 19 19 19 19 19 19	4 1 , m ² ows, use e sides of ir = S (A x	Openin m 15.1 0 0 effective wi nternal wal	gs j ² 7 ndow U-va Is and par	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 14.9 alue calculations	ea n ² x x x ¹ x ¹ x ¹ x ² x ³ x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 [1/(2.1)+ /[1/(2.1)+ [0.22 0.28 0.28 0.28 0.28 0.16 0.16 (26)(30)	$\begin{array}{c} ue \\ 2K \\ = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ = \\ = \\ 0.04] = \\ = \\ 0.04]$	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 12.35 3.04	<)	k-value kJ/m²-I		A X k kJ/K	 (26) (27) (27) (28) (29) (30) (31) (32)
S. ree ELEN Doors Doors Windov Windov Floor Walls ⁻ Roof Total a Party v * for win ** includ Fabric Heat c	Area of e wall dows and heat los apacity (Gros area Grosarea122 $29.44.19lementsroof windas on boths, W/KCm = St$	4 1 , m ² ows, use e sides of ir = S (A x (A x k)	Openin m 15.1 0 0 effective winternal wall U)	gs j2 7 ndow U-va Is and par	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calculations	ea n ² x x x ¹ x ¹ x ¹ x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.28 0.16	$\begin{array}{c} ue \\ 2K \\ = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ = \\ = \\ = \\ 0 \\ = \\ 0 \\ 0.04] = \\ = \\ 0 \\ 0.04] = \\ = \\ 0 \\ 0.04] = \\ = \\ 0 \\ 0.04] = \\ = \\ 0 \\ 0.04] = \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 ue)+0.04] a	() (1)	k-value kJ/m²·l		A X k kJ/K	 (26) (27) (27) (28) (29) (29) (30) (31) (32) (33) (34)
S. He B. S. He ELEN Doors Uindou Windou Floor Walls ⁻ Roof Total a Party v * for win ** includ Fabric Heat c Therm	ALENT Type 1 Type 2 ws Type ws Type ws Type Type1 Type2 area of e wall dows and le the area heat los apacity (al mass	Gros area Grosarea129. $44.19lementsroof windas on boths, W/KCm = Scparame$	$\frac{4}{1}$ $\frac{4}{1}$ $\frac{1}{2}$ $\frac{4}{2}$ $\frac{1}{2}$ $\frac{1}$	Openin r 15.1° 0 15.1° 0 0 0 0 0 0 0 0	gs ⁷ ⁷ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ² ² ² ³ ⁴ ⁴ ⁴ ⁵ ⁶ ⁷ ⁷ ⁷ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calculations	ea n ² x x x ¹ x ¹ x ¹ x ² x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ (1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.28 0.16	$\begin{bmatrix} ue\\2K \\ - & = \\ - & 0.04] = \\ - & 0.04] = \\ - & = $	A X U (WV/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 12.35 3.04 0 12.35 3.04	<pre>K)</pre>	k-value kJ/m²-l			 (26) (27) (27) (28) (29) (29) (30) (31) (32) (33) (34) (35)
S. He S.	ALENT Type 1 Type 2 ws Type ws Type ws Type Type1 Type2 area of e wall dows and le the area heat los apacity (al mass ign assess used instea	Gros area Grosarea129.44.19191919191919191919191919	$\frac{4}{1}$ $\frac{4}{2}$ $\frac{4}{2}$ $\frac{4}{2}$ $\frac{1}{2}$ $\frac{4}{2}$ $\frac{1}{2}$ $\frac{1}$	Openin m $ \begin{array}{c} 15.1\\ \hline 0\\ \hline $	gs 2 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calcul titions	ea n ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ (1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.28 0.16 0.16	$\frac{ue}{2K} = \frac{1}{2}$ $= \frac{1}$	A X U (WV/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 12.35 3.04 0 12.35 3.04	<pre>K)</pre>	k-value kJ/m²-I		A X k kJ/K	 (26) (27) (27) (28) (29) (29) (30) (31) (32) (33) (34) (35)

if detail	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)			(22)	(20)				
	abric ne	atioss							(33) +	(36) =			70.07	(37)
Ventila	ation hea	at loss ca	alculated	monthly	y 				(38)m	= 0.33 × (25)m x (5)			
(38)m-	Jan 48.88	Feb 47.92	46.97	Apr 42.17	May	Jun 36.42	Jul 36.42	Aug 35.46	Sep	41 21	NOV	45.05		(38)
(50)11-	40.00	47.52	40.97	42.17	41.21	30.42	30.42	33.40	00.04	41.21	40.10	43.03		(00)
Heat t	ranster of		1, W/K	110.05	111.00	100 F	106 5	105 54	(39)m	= (37) + (37)	38)m	115 10	l	
(39)11=	118.90	110	117.04	112.20	111.29	106.5	106.5	105.54	106.41	111.29	Sum(20)	(12-	112.01	(39)
Heat I	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)	12 / 12-	112.01	
(40)m=	2.29	2.27	2.25	2.16	2.14	2.05	2.05	2.03	2.08	2.14	2.18	2.21		
Numb	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1	12 /12=	2.15	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. W	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Λεειιο	ned occi	inancy	N									75		(40)
if TF	FA > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	- A -13.9)2)] + 0.0)013 x (TFA -13.	9)	.75		(42)
if TF	FA £ 13.9	9, N = 1											L	
Annua	al averag	e hot wa al average	ater usa	ge in litre <i>usage by</i> :	es per da 5% if the o	ay Vd,av Iwelling is	erage = designed	(25 x N) to achieve	+ 36 a water us	se target o	75 f	5.74		(43)
not mor	re that 125	litres per l	person pe	r day (all w	ater use, l	hot and co	ld)		a mator at	la la got o				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	ter usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)				•		
(44)m=	83.31	80.28	77.26	74. <mark>2</mark> 3	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31		
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	DTm / 3600) kWh/mor	Tota <mark>l = Su</mark> hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	9 <mark>08.89</mark>	(44)
(45)m=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65		
		ļ			ļ	I	1			Total = Su	l m(45) ₁₁₂ =	=	1191.69	(45)
lf instar	ntaneous w	ater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)					
(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95		(46)
Vvater	storage	IOSS:) includir		alar or M		storago	within or	amo vos	دما		400		(47)
If com			nd no to	ng any su	volling o	ntor 110	litroc in	(47)		501		160		(47)
Other	wise if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:		(· · ·					/	(,			
a) If n	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temp	erature f	actor fro	m Table	2b								0		(49)
Energ	y lost fro	m water	r storage	, kWh/y€	ear			(48) x (49)) =		1	60		(50)
b) If n	nanufact	urer's de	eclared of	cylinder l	oss fact	or is not	known:							
If com	ater stora	age ioss leating s	ee secti	om 1 abi on 4 3	e z (kvv	n/iitre/da	iy)				0.	.05		(51)
Volum	ne factor	from Ta	ble 2a	0.1 1.0							0	.91		(52)
Temp	erature f	actor fro	m Table	2b							0.	.78		(53)
Energ	y lost fro	m water	r storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	5.	.85		(54)
Enter	(50) or ((54) in (5	55)								5.	.85		(55)

Water	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(56)
If cylinde	er contain	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	lix H	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated f	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	433.17	387.71	421.12	396.84	402.9	297.8	299.14	310.14	303.92	410.56	409.81	429.27		(62)
Solar DH	-IW input	calculated	using App	endix G oı	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 (<u>3)</u>	-				
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter								-			
(64)m=	433.17	387.71	421.12	396.84	402.9	297.8	299.14	310.14	303.92	410.56	409.81	429.27		-
								Outp	out from w	ater heate	r (annual)₁	12	4502.4	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m]	
(65)m=	143.78	128.69	139.78	131.71	133.72	60.3	59.45	63.11	62.33	136.26	136.03	142.49		(65)
inclu	ide (57)	m in c <mark>al</mark> d	culation of	of (65)m	only if c	ylinder i	s in t <mark>he c</mark>	dwelling	or hot w	ate <mark>r is fr</mark>	om com	<mark>mu</mark> nity h	eating	
		_												
5. Int	ernal ga	ains (see	e Ta <mark>ble 5</mark>	and 5a):									
5. Int Metabo	ernal ga olic gair	ains (see ns (Table	e Table 5 5), Wat	and 5a):									
5. Int Metabo	ernal ga olic gair Jan	ains (see ns (Table Feb	Table 5 5), Wat Mar	and 5a ts Apr): May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
5. Int Metabo (66)m=	ernal ga olic gair Jan 87.45	ains (see ns (Table Feb 87.45	Table 5 5), Wat Mar 87.45	ts Apr 87.45): May 87.45	Jun 87.45	Jul 87.45	Aug 87.45	Sep 87.45	Oct 87.45	Nov 87.45	Dec 87.45		(66)
5. Int Metabo (66)m= Lightin	ernal ga olic gair Jan 87.45 g gains	ains (see ns (Table Feb 87.45 (calcula	5), Wat Mar 87.45	and 5a ts Apr 87.45 opendix): May 87.45 L, equati	Jun 87.45 ion L9 of	Jul 87.45 r L9a), a	Aug 87.45 Iso see	Sep 87.45 Table 5	Oct 87.45	Nov 87.45	Dec 87.45		(66)
5. Int Metabo (66)m= Lightin (67)m=	ernal ga olic gair Jan 87.45 g gains 28.32	ains (see rs (Table Feb 87.45 (calcula 25.16	5), Wat Mar 87.45 ted in Ap 20.46	and 5a ts Apr 87.45 opendix 15.49): May 87.45 L, equati 11.58	Jun 87.45 ion L9 o 9.77	Jul 87.45 r L9a), a 10.56	Aug 87.45 Iso see 13.73	Sep 87.45 Table 5 18.43	Oct 87.45 23.4	Nov 87.45 27.31	Dec 87.45 29.11		(66)
5. Int Metabo (66)m= Lightin (67)m= Applian	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga	ains (see rs (Table Feb 87.45 (calcula 25.16 ins (calc	5), Wat Mar 87.45 ted in Ap 20.46 ulated in	Apr 87.45 ppendix 15.49 Append): 87.45 L, equati 11.58 dix L, eq	Jun 87.45 ion L9 o 9.77 uation L	Jul 87.45 r L9a), a 10.56 13 or L13	Aug 87.45 Iso see 13.73 3a), also	Sep 87.45 Table 5 18.43 see Ta	Oct 87.45 23.4 ble 5	Nov 87.45 27.31	Dec 87.45 29.11		(66) (67)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m=	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43	ains (see rs (Table Feb 87.45 (calcula 25.16 ins (calc 154.01	Table 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02	and 5a ts Apr 87.45 opendix 15.49 Append 141.54): 87.45 L, equati 11.58 dix L, eq 130.83	Jun 87.45 ion L9 of 9.77 uation L 120.76	Jul 87.45 r L9a), a 10.56 13 or L1: 114.03	Aug 87.45 Iso see 13.73 3a), also 112.45	Sep 87.45 Table 5 18.43 see Ta 116.44	Oct 87.45 23.4 ble 5 124.92	Nov 87.45 27.31 135.63	Dec 87.45 29.11 145.7		(66) (67) (68)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 tted in Ap	Apr 87.45 bpendix 15.49 Append 141.54 opendix): 87.45 L, equati 11.58 dix L, eq 130.83 L, equat	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15	Jul 87.45 r L9a), a 10.56 13 or L1 114.03 or L15a)	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se	Sep 87.45 Table 5 18.43 5 see Ta 116.44 ee Table	Oct 87.45 23.4 ble 5 124.92 5	Nov 87.45 27.31 135.63	Dec 87.45 29.11 145.7		(66) (67) (68)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m=	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calcula 154.01 (calcula 31.75	Table 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 ited in A 31.75	and 5a ts Apr 87.45 opendix 15.49 Append 141.54 opendix 31.75): 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75	Sep 87.45 Table 5 18.43 9 see Ta 116.44 ee Table 31.75	Oct 87.45 23.4 ble 5 124.92 5 31.75	Nov 87.45 27.31 135.63 31.75	Dec 87.45 29.11 145.7 31.75		(66) (67) (68) (69)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps	ernal ga olic gain Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 a and fai	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 ted in Ap 31.75 (Table 5	and 5a ts Apr 87.45 opendix 15.49 Appendix 141.54 opendix 31.75 5a)): 87.45 L, equati 11.58 dix L, eq 130.83 L, equat 31.75	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75	Jul 87.45 r L9a), a 10.56 13 or L1: 114.03 or L15a) 31.75	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75	Sep 87.45 Table 5 18.43 see Ta 116.44 ee Table 31.75	Oct 87.45 23.4 ble 5 124.92 5 31.75	Nov 87.45 27.31 135.63 31.75	Dec 87.45 29.11 145.7 31.75		(66) (67) (68) (69)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m=	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 and fan 10	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains 10	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 tted in Ap 31.75 (Table 5 10	and 5a ts Apr 87.45 opendix 15.49 Append 141.54 opendix 31.75 5a) 10): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75	Sep 87.45 Table 5 18.43 9 see Ta 116.44 ee Table 31.75	Oct 87.45 23.4 ble 5 124.92 5 31.75	Nov 87.45 27.31 135.63 31.75	Dec 87.45 29.11 145.7 31.75		(66) (67) (68) (69) (70)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 and fa 10 s e.g. ev	ains (see ns (Table Feb 87.45 (calcula 25.16 ins (calcula 154.01 (calcula 31.75 ns gains 10 vaporatic	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 ited in Ap 31.75 (Table 5 10 on (negation)	and 5a ts Apr 87.45 opendix 15.49 Append 141.54 opendix 31.75 5a) 10 tive valu): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10 es) (Tab	Jun 87.45 ion L9 o 9.77 uation L 120.76 ion L15 31.75 10 le 5)	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75 10	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75 10	Sep 87.45 Table 5 18.43 0 see Ta 116.44 20 Table 31.75 10	Oct 87.45 23.4 ble 5 124.92 5 31.75 10	Nov 87.45 27.31 135.63 31.75 10	Dec 87.45 29.11 145.7 31.75 10		(66) (67) (68) (69) (70)
5. int Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 a and fai 10 s e.g. ev -69.96	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains 10 vaporatic -69.96	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in Ap 150.02 ited in Ap 31.75 (Table 5 10 on (negat -69.96	and 5a ts Apr 87.45 opendix 15.49 Appendix 141.54 opendix 31.75 5a) 10 tive valu -69.96): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10 es) (Tab -69.96	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75 10 le 5) -69.96	Jul 87.45 r L9a), a 10.56 13 or L1: 114.03 or L15a) 31.75 10 -69.96	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75 10 -69.96	Sep 87.45 Table 5 18.43 • see Ta 116.44 • Table 31.75 10 -69.96	Oct 87.45 23.4 ble 5 124.92 5 31.75 10 -69.96	Nov 87.45 27.31 135.63 31.75 10 -69.96	Dec 87.45 29.11 145.7 31.75 10 -69.96		(66) (67) (68) (69) (70) (71)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 and fai 10 s e.g. ev -69.96 heating	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains 10 /aporatic -69.96 gains (T	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 nted in Ap 31.75 (Table 5 10 on (negat -69.96 Table 5)	and 5a ts Apr 87.45 opendix 15.49 Append 141.54 opendix 31.75 5a) 10 tive valu -69.96): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10 es) (Tab -69.96	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75 10 le 5) -69.96	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75 10 -69.96	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75 10 -69.96	Sep 87.45 Table 5 18.43 9 see Ta 116.44 ee Table 31.75 10 -69.96	Oct 87.45 23.4 ble 5 124.92 5 31.75 10 -69.96	Nov 87.45 27.31 135.63 31.75 10 -69.96	Dec 87.45 29.11 145.7 31.75 10 -69.96		(66) (67) (68) (69) (70) (71)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 and fa 10 s e.g. ev -69.96 heating 193.26	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains 10 /aporatic -69.96 gains (T 191.51	Table 5 Mar Mar 87.45 ted in Ap 20.46 ulated in 150.02 ited in Ap 31.75 (Table 5 10 on (negat -69.96 Table 5) 187.87	and 5a ts Apr 87.45 opendix 15.49 Append 141.54 opendix 31.75 5a) 10 tive valu -69.96): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10 es) (Tab -69.96	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75 10 le 5) -69.96 83.75	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75 10 -69.96	Aug 87.45 Iso see 13.73 3a), also 112.45 , also se 31.75 10 -69.96 84.83	Sep 87.45 Table 5 18.43 9 see Ta 116.44 9 at 1.75 10 -69.96 86.57	Oct 87.45 23.4 ble 5 124.92 5 31.75 10 -69.96 183.15	Nov 87.45 27.31 135.63 31.75 10 -69.96 188.92	Dec 87.45 29.11 145.7 31.75 10 -69.96 191.51		 (66) (67) (68) (69) (70) (71) (72)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total i	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 and fat 10 s e.g. ev -69.96 heating 193.26 nternal	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains 10 vaporatic -69.96 gains (T 191.51 gains =	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 tted in Ap 31.75 (Table 5) 10 on (negat -69.96 Table 5) 187.87	and 5a ts Apr 87.45 opendix 15.49 Appendix 141.54 opendix 31.75 5a) 10 tive valu -69.96 182.93): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10 es) (Tab -69.96 179.73	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75 10 le 5) -69.96 83.75 (66)	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75 10 -69.96 79.91 m + (67)m	Aug 87.45 Iso see 13.73 3a), also 112.45 0, also se 31.75 10 -69.96 84.83 + (68)m -	Sep 87.45 Table 5 18.43 9 see Ta 116.44 ee Table 31.75 10 -69.96 86.57 + (69)m + 1	Oct 87.45 23.4 ble 5 124.92 5 31.75 10 -69.96 183.15 (70)m + (7	Nov 87.45 27.31 135.63 31.75 10 -69.96 188.92 1)m + (72)	Dec 87.45 29.11 145.7 31.75 10 -69.96 191.51 m		 (66) (67) (68) (69) (70) (71) (72)
5. int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total i (73)m=	ernal ga olic gair Jan 87.45 g gains 28.32 nces ga 152.43 ng gains 31.75 and fai 10 s e.g. ev -69.96 heating 193.26 nternal 433.24	ains (see s (Table Feb 87.45 (calcula 25.16 ins (calc 154.01 (calcula 31.75 ns gains 10 /aporatic -69.96 gains (T 191.51 gains = 429.91	Table 5 5), Wat Mar 87.45 ted in Ap 20.46 ulated in 150.02 nted in Ap 31.75 (Table 5) 10 on (negat -69.96 Table 5) 187.87 4117.59	and 5a ts Apr 87.45 opendix 15.49 Appendix 141.54 opendix 31.75 5a) 10 tive valu -69.96 182.93 399.2): May 87.45 L, equati 11.58 dix L, equati 130.83 L, equati 31.75 10 es) (Tab -69.96 179.73 381.37	Jun 87.45 ion L9 of 9.77 uation L 120.76 ion L15 31.75 10 le 5) -69.96 83.75 (66) 273.51	Jul 87.45 r L9a), a 10.56 13 or L13 114.03 or L15a) 31.75 10 -69.96 79.91 m + (67)m 263.74	Aug 87.45 Iso see 13.73 3a), also 112.45), also se 31.75 10 -69.96 84.83 + (68)m = 270.24	Sep 87.45 Table 5 18.43 • see Ta 116.44 • Table 31.75 10 -69.96 86.57 • (69)m + 1 280.67	Oct 87.45 23.4 ble 5 124.92 5 31.75 10 -69.96 183.15 (70)m + (7 390.71	Nov 87.45 27.31 135.63 31.75 10 -69.96 188.92 1)m + (72) 411.1	Dec 87.45 29.11 145.7 31.75 31.75 10 -69.96 191.51 m 425.56		 (66) (67) (68) (69) (70) (71) (72) (73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	•	Area m²			Flu Tat	x ble 6a		Та	g_ able 6b		Tab	FF le 6c			Gains (W)	
North	0.9x	0.77		x	1.9	7	x	1	0.63	×		0.76	x		0.7		=	7.72	(74)
North	0.9x	0.77		x	1.9	7	x	2	0.32	x		0.76	×		0.7		=	14.76	(74)
North	0.9x	0.77		x	1.9	7	x	3	4.53	x		0.76	×		0.7		=	25.08	(74)
North	0.9x	0.77		x	1.9	7	x	5	5.46	x		0.76	×		0.7		=	40.28	(74)
North	0.9x	0.77		x	1.9	7	x	7	4.72	x		0.76	×		0.7		=	54.27	(74)
North	0.9x	0.77		x	1.9	7	x	7	9.99	x		0.76	x		0.7		=	58.09	(74)
North	0.9x	0.77		x	1.9	7	x	7	4.68	×		0.76	x		0.7		=	54.24	(74)
North	0.9x	0.77		x	1.9	7	x	5	9.25	x		0.76	x		0.7		=	43.03	(74)
North	0.9x	0.77		x	1.9	7	x	4	1.52	x		0.76	x		0.7		=	30.15	(74)
North	0.9x	0.77		x	1.9	7	x	2	4.19	x		0.76	x		0.7		=	17.57	(74)
North	0.9x	0.77		x	1.9	7	x	1	3.12	×		0.76	x		0.7		=	9.53	(74)
North	0.9x	0.77		x	1.9	7	x	3	3.86	x		0.76	×		0.7		=	6.44	(74)
South	0.9x	0.77		x	1.0	6	x	4	6.75	x		0.76	x		0.7		=	27.58	(78)
South	0.9x	0.77		x	1.0	6	x	7	6.57	×		0.76	x		0.7		=	45.17	(78)
South	0.9x	0.77		x	1.0	3	x	9	7.53	x		0.76	x		0.7		=	57.53	(78)
South	0.9x	0.77		x	1.0	6	x	1	10.23	x		0.76	X		0.7		=	65.03	(78)
Sout <mark>h</mark>	0.9x	0.77		x	1.0	3	х	1.	14.87	x		0.76	x		0.7		-	67.76	(78)
Sout <mark>h</mark>	0.9x	0.77		x	1.0	3	х	1	10.55	x		0.76	x		0.7		=	65.21	(78)
Sout <mark>h</mark>	0.9x	0.77		x	1.0	6	x	10	08.01	x		0.76	x		0.7		=	63.71	(78)
Sout <mark>h</mark>	0.9x	0.77		x	1.0	6	x	10	04.89	x		0.76	x		0.7		=	61.88	(78)
Sout <mark>h</mark>	0.9x	0.77		x	1.0	6	x	10	01.89	×		0.76	x		0.7		=	60.1	(78)
Sout <mark>h</mark>	0.9x	0.77		x	1.0	6	x	8	2.59	x		0.76	x		0.7		=	48.72	(78)
South	0.9x	0.77		x	1.0	6	x	5	5.42	x		0.76	x		0.7		=	32.69	(78)
South	0.9x	0.77		x	1.6	6	x	4	10.4	x		0.76	x		0.7		=	23.83	(78)
Solar g	ains ir	1 watts, ca			105 31	1 mont	h	123.3	117 95	(83)n	n = Su	1m(74)m . 90.25	<mark>(82)n</mark>	n a l	12 22	30.3	27		(83)
Total o	ains –	internal a	and so	blar	(84)m =	: (73)m	<u>' </u>) + (83)m	. watts			50.25	00.2		72.22	00.2	_ /		(00)
(84)m=	468.54	489.83	500.	.2	504.5	503.39		96.82	381.69	375	5.15	370.93	456.9	99 4	53.32	455.	.83		(84)
7 Mo	on inte	arnal tom		uro (boating					I	I		<u> </u>			<u> </u>			
Temp	eratur	e durina h	neatin	a ne	eriods ir	the liv	in) /ina	area f	rom Tak	nle 9	Th1	L (°C)						21	(85)
Litilisa	ation fa	e during n	ains f	g p or li	vina are	ha h1	m (s	ee Ta	hle 9a)		,	(O)						21	
0 tillot	Jan	Feb		ar I	Apr	Ma	/	Jun	Jul	A	ua	Sep	Oc	t	Nov	De	ec		
(86)m=	1	1	1		0.99	0.98	╈	0.97	0.91	0.9	92	0.98	0.99)	1	1			(86)
Mean	intern	al temper	ature	in l	iving are	a T1 (follo	ow ste	ns 3 to 7	7 in 7		9c)				I			
(87)m=	19.51	19.61	19.8	2	20.15	20.46		20.7	20.88	20	.86	20.62	20.3	3 .	19.89	19.5	54		(87)
Temp	eratur	e durina h	neatin	<u> </u>	eriods ir	n rest c	f dv	vellina	from Ta	ble	9 Th	2 (°C)				I			
(88)m=	19.86	19.87	19.8	57	19.92	19.93		19.98	19.98	19.	.99	19.96	19.9	3	19.91	19.8	89		(88)
Utilisa	ation fa	actor for a	ains f	or r	est of d	vellina	. h2	.m (se	e Table	9a)									
(89)m=	1	1	1		0.99	0.98		0.95	0.81	0.8	84	0.97	0.99)	1	1			(89)
			•							•									

Incall	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 3	7 in Tabl	le 9c)				
(90)m=	18.5	18.61	18.82	19.19	19.51	19.78	19.93	19.92	19.68	19.35	18.92	18.56		(90)
I									. 1	fLA = Livin	g area ÷ (4	4) =	0.66	(91)
Moon	intorna	l tomnor	aturo (fo	r the wh	ole dwe	llina) – fl	Δ 🗸 Τ1	⊥ (1 _ fl	Δ) v T2					
(92)m=	19.17	19.27	19.48	19.82	20.14	20.39	20.55	20.54	20.3	19.97	19.56	19.2		(92)
Apply	adiustr	nent to t	he mear	internal	temper	ature fro	m Table	4e whe	ere appro			1012		(- <i>)</i>
(93)m=	19.77	19.87	20.08	20.42	20.74	20.99	21.15	21.14	20.9	20.57	20.16	19.8		(93)
8 Sp:	ace hea	ting regi	lirement			20100						1010		· · ·
Set Ti	i to the r	mean int	ernal ter	mperatu	re obtain	ed at st	on 11 of	Table 9	h so tha	nt Ti m=('	76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a				b, 30 tha		<i>i</i> 0)iii aii		alate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	i ains, hm	<u>, ,</u> 1:	y									
(94)m=	1	1	1	0.99	0.98	0.97	0.92	0.93	0.98	0.99	1	1		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m			1	1	1	1			
(95)m=	467.93	488.95	498.71	501.32	494.75	385.63	350.16	349.07	364.87	453.48	452.27	455.34		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8			!	!				
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm, W =	-[(39)m	r x [(93)m	– (96)m	1	1			
(97)m=	1839.71	1766.58	1589.46	1293.28	1005.75	680.28	484.9	500.29	737.04	1110.09	1478.27	1796.36		(97)
Space	e heatin	a reauire	ement fo	r each n	nonth. k	Nh/mont	1 = 0.02	24 x [(97)m – (95	i j)ml x (4 ⁻	1)m			
(98)m=	1020.6	858.57	811.52	570.21	380.18	0	0	0	0	488.52	738.72	997.72		
								Tota	l per vear	(kWh/vear	I = Sum(9)	8)1 59 12 =	5866.04	(98)
0									, por you.	(
Space	e neatin	g require	ement in	KVVN/M4	year								112.81	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividu <mark>al h</mark>	eating sy	ystems į	ncluding	micro-C	CHP)					
Space	e heatir	ng:												-
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 ·	– (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		·	1	(204)
Efficie	encv of r	main spa	ace heat	ina svste	em 1							-	65.9	(206)
Efficie	ancy of g	econda	ry/suppl	omontar	v heatin	a evetor	o %						0	
LIIICIC		I	i y/Suppi I	I	y neating I		I, 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) I)		1	1	1	1			
	1020.6	858.57	811.52	570.21	380.18	0	0	0	0	488.52	738.72	997.72		
(211)m	ı = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)	-	-							(211)
	1548.71	1302.83	1231.44	865.27	576.91	0	0	0	0	741.3	1120.97	1513.99		
								Tota	al (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	8901.43	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									_
)m x (2()1)]}x1	00 ÷ (20	8)										
= {[(98]	//// //20	/1 /	· ·						İ		1			
= {[(98 (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
= {[(98 (215)m=	0	0	0	0	0	0	0	0 Tota	0 al (kWh/yea	0 ar) =Sum(2	0 215) _{15,1012}	0 =	0	(215)
= {[(98] (215)m= Water	0 heating	0	0	0	0	0	0	0 Tota	0 al (kWh/yea	0 ar) =Sum(2	0 215) _{15,1012}	0	0	(215)
= {[(98 (215)m= Water Output	0 heating	0 0 ater hea	0 ter (calc	0 ulated a	0 bove)	0	0	0 Tota	0 il (kWh/yea	0 ar) =Sum(2	0 215) _{15,10} 12	0	0	(215)
= {[(98 (215)m= Water Output	0 heating from w 433.17	0 ater hea 387.71	0 ter (calc 421.12	0 ulated a 396.84	0 bove) 402.9	0 297.8	0 299.14	0 Tota 310.14	0 II (kWh/yea 303.92	0 ar) =Sum(2 410.56	0 215) _{15,1012} 409.81	0 = 429.27	0	(215)



			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.3.4	
	London	Pr	operty <i>i</i>	Address:	Unit 2					
Address :	, London									
Basement	1510115.		Area	a (m²) 55	(1a) x	Av. He	ight(m) .17	(2a) =	Volume(m³ 119.35) (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1n))	55	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	119.35	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	$ \begin{array}{ccc} \text{main} & \text{se} \\ \text{heating} & \text{h} \\ \hline 0 & + \\ \hline 0 & + \\ \hline \end{array} $	econdary leating 0 0	/ +] +	0 0] = [total 0 0	x 4	40 = 20 =	m³ per hou 0	r (6a) (6b)
Number of intermittent far	าร					2	x ′	10 =	20	(7a)
Number of passive vents					Г	0	x ´	10 =	0	(7b)
Number of flueless gas fir	es				Ē	0	X 4	⁴⁰ = Air ch	0 ange <mark>s per</mark> ho	(7c)
Infiltration due to chimney If a pressurisation test has be Number of storeys in th Additional infiltration	s, flues and fans = (6) en carried out or is intende e dwelling (ns) 25 for steel or timber (a)+(6b)+(7a	a)+(7b)+(7 1 to (17), c	7c) = otherwise c	ontinue fro	20 om (9) to ((16) [(9)·	÷ (5) = •1]x0.1 =	0.17	(8) (9) (10)
if both types of wall are pre deducting areas of opening If suspended wooden fl If no draught lobby, ent	esent, use the value corres gs); if equal user 0.35 oor, enter 0.2 (unseal er 0.05, else enter 0	ponding to	the greate	er wall area	enter 0				0	(12) (13)
Percentage of windows	and doors draught st	ripped			~ (1 4) • 4	001			0	(14)
				(8) + (10) -	× (14) ÷ 1 ⊧ (11) + (1	2) + (13) -	+ (15) -	·	0	(15)
Air permeability value	n50 expressed in cub	ic metres	s ner ho	ur per so	uare m	etre of e	nvelone	area	0	-(10)
If based on air permeabilit	ty value, then $(18) = [(1)$	7) ÷ 20]+(8), otherwi	se (18) = (16)		involopo	aiou	1,17	
Air permeability value applies	s if a pressurisation test has	s been done	e or a deg	ıree air per	meability	is being u	sed			
Number of sides sheltered	b								2	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporati	ng shelter factor			(21) = (18)	x (20) =				0.99	(21)
Infiltration rate modified for	or monthly wind speed			. 1			1			
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7							· - 1		
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22 (22a)m = 1.27 1.25 1	e)m ÷ 4	0.95	0.95	0.92	1	1.08	1.12	1.18		
					-		I			

Adjuste	ed infiltr	ation rat	e (allow	ing for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17		
Calcula	ate effe	ctive air	change	rate for t	he appli	cable ca	se							(220)
lf exh	aust air h	eat pump	usina App	endix N. (2	3b) = (23a	i) x Fmv (e	equation (N	N5)), othe	rwise (23b	(23a) = (23a)			0	(23a)
lf bala	anced wit	h heat reco	overv: effi	ciency in %	allowing f	or in-use f	actor (from	n Table 4h) =	(200)			0	(230)
a) If	halance	d mech	anical v	entilation	with he	at recove	⊃rv (M\/I	-IR) (24:	′ a)m – (2'	2h)m + ((23h) ¥ [1 – (23c)	0 .∸ 100]	(200)
(24a)m=					0	0]	(24a)
b) If	balance	d mech	anical v	entilation	without	heat rec	coverv (N	///) (24h	1 = (2)	1 2h)m + ((23b)		I	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	unter unter unter unter unter un terretaria de la constana de la c	i ouse ex	ract ve	ntilation o	or positiv	re input v	ı ventilatio	n from o	utside			1	I	
i i	if (22b)r	n < 0.5 >	(23b),	then (24d	c) = (23b); other	wise (24	c) = (22	o) m + 0	.5 × (23	c)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilation	on or wh	nole hous	e positiv	/e input	ventilatio	on from	loft	•	-			
i	if (22b)r	n = 1, th	en (24d)m = (22t	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]	1	·	1	
(24d)m=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17		(24d)
Effe	ctive air	change	rate - e	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)				1	
(25)m=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN		Gros	s	Openin	gs	Net Ar	ea	U-val	ue	AXU		k-value	e	AXk
		area	(m ²)	m	2	A ,r	n²	W/m2	2K	(VV/	K)	kJ/m²·l	K	kJ/K
Doors	_					1.9	×	1.4	=	2.66				(26)
Windo		€1				9.03	x1,	/[1/(1.6)+	• 0.04] =	13.58				(27)
Windo	ws Type	e 2				1.82	x ^{1.}	/[1/(4.8)+	• 0 .04] =	7.33				(27)
Windo	ws Type	e 3				0.87	x1.	/[1/(4.8)+	0.04] =	3.5				(27)
Floor						55	x	0.93	=	51.15				(28)
Walls 7	Гуре1	28.	9	10.8	5	18.05	5 X	2.1	=	37.9				(29)
Walls 7	Гуре2	7.8	1	2.77		5.04	x	2.1	=	10.58				(29)
Total a	rea of e	elements	, m²			91.71								(31)
Party v	vall					27.9	x	0	=	0				(32)
Party v	vall					1.13	x	0	=	0				(32)
* for win ** includ	dows and le the are	l roof wind as on both	ows, use sides of i	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	formula 1	/[(1/U-valu	ue)+0.04] a	as given in	n paragraph	n 3.2	
Fabric	heat lo	ss, W/K	= S (A x	: U)				(26)(30) + (32) =				126.7	1 (33)
Heat c	apacity	Cm = S	(Axk)						((28).	(30) + (3	2) + (32a)	(32e) =	0	(34)
Therm	al mass	parame	ter (TM	P = Cm ÷	- TFA) in	∩ kJ/m²K			Indica	ative Value	e: High		450	(35)
For desi can be ι	gn asses ised inste	sments wh ad of a de	ere the de tailed calc	etails of the culation.	constructi	ion are noi	t known pr	ecisely the	e indicative	e values o	f TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) ca	Iculated u	using Ap	pendix I	<						14.4	(36)
if details	of therm	al bridging	are not ki	nown (36) =	= 0.15 x (3	1)								
Fotal fa	abric he	at loss							(33) +	- (36) =			141.1	1 (37)
Ventila	ition hea	at loss ca	alculate	d monthly	/			.	(38)m	$= 0.33 \times 10^{-10}$	(25)m x (5)	1	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(38)m=	49.84	48.86	47.88	43	42.02	37.2	37.2	36.29	39.09	42.02	43.97	45.93		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	190.95	189.97	188.99	184.11	183.13	178.31	178.31	177.4	180.2	183.13	185.08	187.04		
		motor (l	אי יס ור	/m21/					(10)~	Average =	Sum(39)1.	12 /12=	183.88	(39)
(40)m-	3 47		¬LP), νν/	3 35	3 33	3 24	3 24	3 23	(40)m	= (39)m ÷	(4)	34		
(40)11=	5.47	5.45	3.44	5.55	5.55	5.24	5.24	5.25	3.20	Average =	Sum(40)	3.4	3.34	(40)
Numbe	er of day	/s in mo	nth (Tab	le 1a)		-		-						
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ar:	
Assum if TF	ed occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	FA -13.9))2)] + 0.(0013 x (⁻	TFA -13.	1. 9)	84		(42)
Annual	averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		77	.84		(43)
not more	the annua that 125	litres per	not water person pe	usage by : r day (all w	5% If the a rater use, l	hot and co	aesignea t ld)	o achieve	a water us	se target o	ſ			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from T	Table 1c x	(43)	000					
(44)m=	<mark>8</mark> 5.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	<mark>8</mark> 5.62		
_										Total = Su	m(44) ₁₁₂ =		934.05	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mor	oth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	126.97	111.05	114.6	99.91	95. <mark>86</mark>	82.72	76.65	87.96	89.01	103.74	113.24	122.97		
lf instant	aneous w	ater heati	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Sui	m(45) ₁₁₂ =	• L	1224.68	(45)
(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45		(46)
Water	storage	loss:												
Storage	e volum	e (litres)) includir	ng any so	plar or W	/WHRS	storage	within sa	ame ves	sel		160		(47)
If comr	nunity h	eating a	and no ta	ank in dw	velling, e	nter 110	litres in	(47)		· · · (0) : · (47)			
Water :	nse il no storage	loss:	not wate	er (this in	iciudes i	nstantar	ieous co	nod idm	ers) ente	er u in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m watei	⁻ storage	e, kWh/ye	ear			(48) x (49)) =		1	60		(50)
b) If m	anufact	urer's de	eclared of	cylinder l	oss fact	or is not	known:							(54)
If comr	nunitv h	age ioss leating s	ee secti	on 4.3	e∠(kvv	n/iitie/ua	iy)				0.	05		(51)
Volume	e factor	from Ta	ble 2a								0.	91		(52)
Tempe	rature f	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	[.] storage	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =	5.	85		(54)
Enter	(50) or ((54) in (5	55)	_							5.	85		(55)
Water	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)	m				
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(56)
It cylinde	er contains	s dedicate	d solar sto	orage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	u), else (5	/)m = (56)	m where (H11) is fro	m Appendix	κΗ	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)

Primar	y circuit	loss (an	inual) fro	om Table	93							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor fi	om Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)		I	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss cal	culated	for each	month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	436.59	390.7	424.21	399.54	405.48	300.03	301.21	312.51	306.32	413.35	412.86	432.58		(62)
Solar DH	IW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	I	
(add ad	dditiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from wa	ater hea	ter										I	
(64)m=	436.59	390.7	424.21	399.54	405.48	300.03	301.21	312.51	306.32	413.35	412.86	432.58		
I								Outp	out from wa	ater heate	r (annual)₁	12	4535.39	(64)
Heat g	ains froi	n water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	144.92	129.69	140.8	132.61	134.58	61.04	60.14	63.9	63.13	137.19	137.04	143.59		(65)
in <mark>clu</mark>	de (57)ı	n in calc	culation	of (65)m	only if c	ylinder is	s in the a	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	leating	
5. Int	ernal da	ains (see	Table 5	and 5a):									
Metabo	olic gain	s (Table	5) Wat	ts										
Wietab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	91.87	91.87	91.87	91. <mark>87</mark>	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87		(66)
Lightin	g gains	(calcula	ted in Ar	pendix l	L, equat	ion L9 oi	r L9a), a	lso see ⁻	Table 5					
(67)m=	24.29	21.57	17.54	13. <mark>2</mark> 8	9.93	8.38	9.06	11.77	15.8	20.06	23.42	24.96		(67)
Appliar	nces gai	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5]	
(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12		(68)
Cookin	g gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5			1	
(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19		(69)
Pumps	and far	ns dains	(Table 5	5a)									1	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	se.a. ev	aporatio	n (negat	tive valu	es) (Tab	le 5)							1	
(71)m=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	1	(71)
Water	heating	gains (T	able 5)				1		1			I	1	
(72)m=	194.79	192.99	189.25	184.18	180.88	84.78	80.83	85.88	87.68	184.4	190.33	193	1	(72)
Total i	nternal	gains =				(66)	l m + (67)m	l 1 + (68)m +	⊦ (69)m + ((70)m + (7	1)m + (72)	m	ł	
(73)m=	439.82	436.97	425.02	406.76	388.86	280.62	270.29	276.39	286.41	396.31	416.85	431.64		(73)
6. Sol	ar gains	S:												
Solar g	ains are c	alculated	using sola	r flux from	Table 6a a	and assoc	iated equa	tions to co	onvert to th	e applicat	le orientat	ion.		

North	0.9x	0.77	x	1.82	x	2	20.32	x	0.85	x	0.7	=	15.25	(74)
North	0.9x	0.77	x	0.87	x	2	20.32] x	0.85	x	0.7	=	7.29	(74)
North	0.9x	0.77	x	1.82	x	3	34.53] x	0.85	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	0.87	x		34.53	x	0.85	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	1.82	x	5	55.46	x	0.85	x	0.7	=	41.62	(74)
North	0.9x	0.77	x	0.87	x	5	55.46	x	0.85	x	0.7	=	19.9	(74)
North	0.9x	0.77	x	1.82	x	7	74.72	x	0.85	x	0.7	=	56.07	(74)
North	0.9x	0.77	x	0.87	x	7	74.72	x	0.85	x	0.7	=	26.8	(74)
North	0.9x	0.77	x	1.82	x	7	79.99	x	0.85	x	0.7	=	60.02	(74)
North	0.9x	0.77	x	0.87	×	7	79.99	x	0.85	x	0.7	=	28.69	(74)
North	0.9x	0.77	x	1.82	x	7	74.68	x	0.85	x	0.7	=	56.04	(74)
North	0.9x	0.77	x	0.87	x	7	74.68	x	0.85	x	0.7	=	26.79	(74)
North	0.9x	0.77	x	1.82	x	5	59.25	x	0.85	x	0.7	=	44.46	(74)
North	0.9x	0.77	x	0.87	x	5	59.25	x	0.85	x	0.7	=	21.25	(74)
North	0.9x	0.77	x	1.82	x	4	11.52	x	0.85	x	0.7	=	31.16	(74)
North	0.9x	0.77	x	0.87	x	4	11.52	x	0.85	x	0.7	=	14.89	(74)
North	0.9x	0.77	x	1.82	x	2	24.19	x	0.85	x	0.7	=	18.15	(74)
North	0.9x	0.77	x	0.87	X	2	24.19	х	0.85	х	0.7	=	8.68	(74)
North	0.9x	0.77	x	1.82	x		3.12] x	0.85	x	0.7	-	9.84	(74)
North	0.9x	0.77	x	0.87	x		3.12] ×	0.85	x	0.7	=	4.71	(74)
North	0.9x	0.7 <mark>7</mark>	x	1.82	×		8.86] x	0.85	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.87	×		8.86	x	0.85	x	0.7	_ =	3.18	(74)
South	0.9x	0.77	x	9.03	x	4	16.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	7	6.57	x	0.76	x	0.7	=	2 <mark>54.91</mark>	(78)
South	0.9x	0.77	x	9.03	x	ę	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	1	10.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	1	14.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	1	10.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	1	08.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	1	04.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	1	01.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	8	32.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	5	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	×		40.4	x	0.76	x	0.7	=	134.49	(78)
Solar	aoino in	watta aalaul	otod	for each ma	nth			(02)~	Sum(74)m	(00)~~				
(83)m=	167.44	277.44 36		428.51 465	5.3	456.75	442.42	414	.92 385.24	301.7	7 199.04	144.32	1	(83)
Total g	gains – i	nternal and s	solar	(84)m = (73)m +	(83)m	, watts						1	
(84)m=	607.26	714.41 788	8.02	835.27 854	.15	737.37	712.7	691	.32 671.65	698.08	615.89	575.96]	(84)
7. Me	ean inter	nal temperat	ur <u>e (</u>	heating sea	son)_								-	
Temp	perature	during heati	ng pe	eriods in the	living	area	from Tal	ble 9,	Th1 (°C)				21	(85)
Utilis:	ation fac	tor for gains	for li	ving area. h	1.m (:	see Ta	ble 9a)		. ,				<u></u>	

 	- 3		3	- , ,	(,					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	1	0.99	0.99	0.98	0.95	0.91	0.82	0.84	0.94	0.98	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.85	19.05	19.37	19.82	20.25	20.6	20.83	20.8	20.49	19.97	19.36	18.85		(87)
Temp	erature	during h	heating p	beriods ir	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)					
(88)m=	19.26	19.27	19.28	19.33	19.34	19.38	19.38	19.39	19.36	19.34	19.32	19.3		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.97	0.92	0.83	0.62	0.67	0.89	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	le 9c)				
(90)m=	17.39	17.59	17.92	18.39	18.82	19.18	19.34	19.33	19.07	, 18.56	17.93	17.42		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.55	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) = fl	A x T1	+ (1 – fl	A) x T2			I		
(92)m=	18.19	18.39	18.71	19.17	19.61	19.96	20.16	20.14	19.85	19.34	18.71	18.21		(92)
Apply	adjustn	nent to t	he mear	internal	temper	i ature fro	n Table	4e, whe	ere appro	opriate				
(93)m=	18.64	18.84	19.16	19.62	20.06	20.41	20.61	20.59	20.3	19.79	19.16	18.66		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set T	i to the r	mean int	ernal ter	mperatu	re obtair	ned 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	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	n:	0.04	0.00	0.70	0.01	0.02	0.07	0.00			(04)
(94)m=		0.99	0.98	$\frac{0.97}{1000000000000000000000000000000000000$	0.94	0.89	0.78	0.81	0.93	0.97	0.99	1		(94)
(95)m-		708.43	776 17	4)III X (04	+)III 801 39	657 35	557 35	559.3	622 57	678.95	610.81	573 77		(95)
Month	ly aver		rnal ter		from T	able 8	007.00	000.0	022.01	0/0.00	010.01	070.77		(00)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	I an interr	al tempe	erature.	L	[=[(39)m_	I x [(93)m·	– (96)m	l 1				
(97)m=	2739.13	2648.18	2393.06	1974.42	1530.44	1036.1	714.2	742.88	1116.42	1682.11	2232.95	2703.87		(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=	1588.21	1303.51	1202.97	837.8	542.41	0	0	0	0	746.35	1167.94	1584.79		
								Tota	l per year	(kWh/year	·) = Sum(9	8)15,912 =	8973.99	(98)
Space	e heatin	g require	ement in	kWh/m²	/year							ĺ	163.16	(99)
9a En	erav rec	uiremer	nts – Ind	ividual h	eating s	vstems i	ncluding	umicro-C	HP)			l		
Spac	e heatir	na:			outing o	yotonio i	lioidaing		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	encv of r	main spa	ace heat	ina svste	em 1								65.9	(206)
Efficie	ency of s	seconda	rv/suppl	ementar	v heatin	a system	า %							(208)
Emol				Ann	Main		1, 70	A	0	0.4	Nau	Dee		
Snac	Jan a boatin					Jun	Jui	Aug	Sep	Oct	INOV	Dec	KVVN/y	ear
Opace	1588.21	1303.51	1202.97	837.8	542.41	0	0	0	0	746.35	1167.94	1584.79		
(211)~		$m \times (20)$			L)6)	Ĺ	Ľ	Ľ	Ŭ					(011)
رد ۱۱)۱۱	י – גננשס 2410 03	1978 02	1825 45	1271 32	823.08	0	0	0	0	1132 54	1772.3	2404.85		(211)
						L	Ĺ	L Tota	L I (kWh/yea	ar) =Sum(2	211), <u></u>	=	13617 58	(211)
									-		1			L' (

Space heating fuel (secondary), kWh/month

= {[(98)m x (20	01)]}x1	00 ÷ (20	8)						-	-	-		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	2	0	(215)
Water	heating			1-1-1-1										
Output	436.59	ater nea 390.7	ter (calc 424.21	399.54	20Ve) 405.48	300.03	301.21	312.51	306.32	413.35	412.86	432.58		
Efficier	ncy of w	ater hea	iter										55.8	(216)
(217)m=	63.42	63.26	62.93	62.26	61.16	55.8	55.8	55.8	55.8	61.91	62.93	63.44		(217)
Fuel fo (219)m	or water n = (64)	heating, m x 100	kWh/mo) ÷ (217)	onth m										
(219)m=	688.36	617.62	674.1	641.71	662.94	537.69	539.8	560.06	548.96	667.71	656.12	681.9		
								Tota	I = Sum(2 ⁻	19a) ₁₁₂ =			7476.95	(219)
Annua	l totals	fuelues	d main	aveter	1					k	Wh/year	•	kWh/yea	r T
Space	neating		u, main	System	I								13617.58	
Water	heating	fuel use	d										7476.95	
Electric	city for p	oumps, fa	ans and	electric l	keep-ho	t								
central heating pump: 156														(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Tota <mark>l e</mark>	lectricity	for the	above, l	<wh td="" yea<=""><td>r</td><td></td><td></td><td>sum</td><td>of (230a).</td><td><mark>(2</mark>30g) =</td><td></td><td></td><td>201</td><td>(231)</td></wh>	r			sum	of (230a).	<mark>(2</mark> 30g) =			201	(231)
Electric	city for li	ghting											4 <mark>28.94</mark>	(232)
12a. (CO <mark>2 em</mark>	issions -	– Individ	ual h <mark>eat</mark> i	ng syste	ems inclu	uding mi	cro-CHP			_			
						En kW	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	s ar
Space	heating	(main s	ystem 1))		<mark>(21</mark> 1	l) x			0.2	16	=	2941.4	(261)
Space	heating	(second	dary)			(215	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	1615.02	(264)
Space	and wat	ter heati	ng			(261) + (262)	+ (263) + (264) =				4556.42	(265)
Electric	city for p	oumps, fa	ans and	electric l	keep-ho	t (231	l) x			0.5	19	=	104.32	(267)
Electric	city for li	ghting				(232	2) x			0.5	19	=	222.62	(268)
Total C	CO2, kg/	year							sum o	f (265)(2	271) =		4883.36	(272)
Dwelli	ng CO2	Emissi	on Rate	ļ.					(272) -	÷ (4) =			88.79	(273)
El ratir	ng (secti	on 14)											40	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2	012 P	Stroma Softwa	a Num are Ver Unit 3	ber: sion:		Versio	on: 1.0.3.4		
Address :	. london		lopony /	laarooo.	Onic O					
1. Overall dwelling dimer	sions:									
Basement			Area	a(m²) 51	(1a) x	Av. He	ight(m) .17	(2a) =	Volume(m³ 110.67) (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+((1e)+(1n	ı)	51	(4)					
Dwelling volume			L		(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	110.67	(5)
2. Ventilation rate:	·								<u> </u>	
Number of chimneys Number of open flues	main heating 0 +	secondar heating	y] + [_] + [0 0] = [] = [total 0 0	x 4	40 = 20 =	0 0	r (6a) (6b)
Number of intermittent fan	S				Γ	2	x ′	10 =	20	(7a)
Number of passive vents						0	x ′	10 =	0	(7b)
Number of flueless gas fire	0	(7c)								
								Air ch	lange <mark>s per</mark> ho	our
Infiltration due to chimneys If a pressurisation test has be Number of storeys in the	0.18	(8)								
Additional infiltration	,						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timb	er frame or	0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pre deducting areas of opening	sent, use the value cor (s); if equal user 0.35	responding to	the great	er wall area	a (after					_
If suspended wooden flo	bor, enter 0.2 (unse	ealed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter	U 							0	(13)
Window infiltration	and doors draugh	stripped		0 25 - [0 2	x (14) ∸ 1	001 -			0	
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(15)
Air permeability value, c	50. expressed in a	ubic metre	s per ho	our per so	ouare m	etre of e	envelope	area	20	= (17)
If based on air permeabilit	y value, then $(18) =$	[(17) ÷ 20]+(8	3), otherwi	se (18) = (16)				1.18	(18)
Air permeability value applies	if a pressurisation test	has been don	e or a deg	gree air pei	meability	is being u	sed		-	
Number of sides sheltered	l								3	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)	x (20) =				0.92	(21)
Infiltration rate modified fo	r monthly wind spe	ed							I	
Jan Feb N	Mar Apr Ma	ıy Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7	- _			. 1				I	
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4		0.05	0.00		4.05		4.10	I	
(zza)m= 1.27 1.25 1	1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Adjuste	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-			_	
Calculate effective air dange rate for the applicable case If mechanical ventilation: If enchanical ventilation with (23b) = (23a) × Fm (equation (N5)), otherwise (23b) = (23a) If balanced with heat recovery, efficiency in % allowing for in-use factor (from Table 4h) = 0 (23a) If balanced mechanical ventilation with heat recovery, (MV-RP) (24a)m = (22b)m + (23b) × [1 – (23c) + 100] (24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<u> </u>	1.17	1.14	1.12	1.01	0.98	0.87	0.87	0.85	0.92	0.98	1.03	1.08	ĺ	
$ \begin{array}{c} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 $	Calcula If me	ate ette echanica	ctive air al ventila	cnange	rate for t	ne appli	cable ca	se						0	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MV/RF) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m $0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 $	lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othei	rwise (23b) = (23a)				(23b)
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) + 100] (24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =					(23c)
$ \begin{array}{c cl} \hline cl \\ cl$	a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	a)m = (22)	2b)m + (23b) x [[,]	1 – (23c)	÷ 100]	(200)
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
$ \begin{array}{c classical conditions of the set of th$	b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery (N	u MV) (24b)m = (22	1 2b)m + (2	23b)		1	
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b) (24c)m -0 0 0 0 0 0 0 0 0 0	, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
$ \begin{array}{c} \text{if } (22b)\text{m} < 0.5 \times (23b), \text{ then } (24c) = (23b); \text{ otherwise } (24c) = (22b) \text{ m} + 0.5 \times (23b) \\ (24c)\text{m} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & $	c) If	whole h	ouse ex	tract ver	ntilation c	or positiv	ve input v	ventilatio	on from c	outside				1	
$ \begin{array}{c} (24c)n & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & $	i	f (22b)n	n < 0.5 ×	(23b), t	then (24o	c) = (23b); otherv	wise (24	c) = (22b	o) m + 0.	5 × (23b))		_	
d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + f(22b)m ² x 0.5] (24d)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.86 0.92 0.98 1.03 1.08 (24d) Effective air change rate - enter (24a) or (24d) or (24d) in box (25) (25)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (25)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 1.17 1.14 1.12 1.01 0.98 0.88 0.88 0.88 0.88 0.92 0.98 1.03 1.08 (25) (26)m = 0.117 0.108 (26) (26) (26) (26) (26) (26) (26) (26)	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	ĺ	(24c)
$\begin{array}{c} \text{if } (226)\text{m} = 1, \text{ then } (224)\text{m} = (225)\text{m} \text{ otherwise } (224)\text{m} = 0.5 + [(225)\text{m} \times 0.5] \\ (24)\text{m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.88 & 0.88 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline \text{Effective air change rate - enter (24a) or (24b) or (24c) or (24c) or (24d) in box (25) \\ \hline \text{(25)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.82 & 0.98 & 1.03 & 1.08 \\ \hline \text{(25)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline \text{(25)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline \text{(25)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.82 & 0.98 & 1.03 & 1.08 \\ \hline \text{(25)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.82 & 0.98 & 1.03 & 1.08 \\ \hline \text{(25)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.82 & 0.98 & 1.03 & 1.08 \\ \hline \text{(26)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.82 & 0.98 & 1.03 & 1.08 \\ \hline \text{(26)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline \text{(26)m} = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.$	d) If	natural	ventilatio	on or wh	ole hous	e positiv	ve input	ventilatio	on from I	oft					
$ \begin{array}{c} [240]m = 1.17 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.88 & 0.88 & 0.92 & 0.92 & 1.03 & 1.08 & (243) \\ \hline \text{Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) \\ \hline \text{C} \end{tabular} \end$	(0,4,1)	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]	1 4 99	4.00	1	(244)
$\begin{array}{c} \text{Lifective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)} \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (25)_{\text{ma}} & 1.47 & 1.14 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (26)_{\text{ma}} & 1.9 & 1.41 & 1.12 & 1.01 & 0.98 & 0.88 & 0.88 & 0.86 & 0.92 & 0.98 & 1.03 & 1.08 \\ \hline (26)_{\text{midows Type 1}} & 1.9 & 1.9 & 1.9 & 1.9 & 1.14 & 1.14 & 1.28 & 1.14 & 1.28$	(24d)m=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	İ	(240)
L2 /r = L1/2 L1/2 <thl1 2<="" th=""> <thl1 2<="" th=""> <thl1 2<="" th=""></thl1></thl1></thl1>	Effec	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in boy	(25)	0.00	4.00	4.00	1	(25)
3. Heat losses and heat loss parameter: ELEMENT Gross area (m?) Openings m² Net Area A, m² U-value W/m2K A X U (W/K) k-value kJ/m²-K A X k kJ/K Doors 19 x 1.4 = 2.66 (27) Windows Type 1 9.03 x/l1/(1.6.)+0.04) = 13.58 (27) Windows Type 2 51 x 0.99 = 50.49 (28) Walls Type1 16.1 9.03 7.11 x 2.1 = 14.33 (29) Walls Type2 16.1 4.79 11.31 x 2.1 = 23.75 (29) Total area of elements, m² 83.24 (31) (31) (32) * (31) Party wall 33.3 0 = 0 (32) * (34) Heat capacity Cm = S(A x k) (26)(30) + (32) = (17.05) (33) (34) (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 (36) (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1	(25)m=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	J	(25)
ELEMENT Gross area (m ²) Openings m ² Net Area A,m ² U-value W/m2K A X k (W/K) K-value KJ/K A X k KJ/K Doors 1.9 A, m^2 W/m2K K-value (W/K) A X k KJ/K (26) Windows Type 1 1.9 A, m^2 W/m2K (W/m2K (27) Windows Type 2 1.14 = 2.66 (27) Floor 51 0.99 = 50.49 (28) Walls Type 1 16.14 9.03 7.11 2.1 = 14.93 (29) Walls Type 2 16.1 4.79 11.31 2.1 = 23.75 (29) Value area of elements, m ² 63.24 (31) (31) Party wall (33) 0 = 0 (32) * * for windows and root windows, use effective window U-value calculated using formula 1/f(1/U-value)+0.04] a given in paragraph 3.2 (31) Party wall 33.3 0 = 0 (32) * * include the areas on both sides of internal walls and partitions Table if (28) (33) (34) (35) (35) (36	3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
Doors 1.9 x 1.4 = 2.66 (26) Windows Type 1 9.03 x1111(1.6)+ 0.04) = 13.58 (27) Windows Type 2 51 x 0.99 = 50.49 (28) Walls Type 1 16.1 9.03 7.11 x 2.1 = 14.93 (29) Walls Type 2 16.1 4.79 11.31 x 2.1 = 23.75 (29) Total area of elements, m ² 83.24 (31) (32) (32) (32) (32) * for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 (31) * include the areas on both sides of internal walls and partitions (26)(30) + (32) = 117.05 (33) Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = 117.05 (33) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 can be used instead of a detailed calculation. 12.8 (36) Thermal mass parameter (TMP = Cm ÷ TF	ELEN		Gros area	ss (m²)	Openin m	gs 2	Net Ar A ,r	rea m²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²·l) K	A X k kJ/K
Windows Type 1 9.03 x111/(1.6) + 0.04) = 13.58 (27) Windows Type 2 2.89 x111/(1.6) + 0.04) = 13.58 (27) Floor 51 x 0.99 = 50.49 (28) Walls Type 1 16.14 9.03 7.11 x 2.1 = 14.93 (29) Walls Type 2 16.1 4.79 11.31 x 2.1 = 23.75 (29) Total area of elements, m ² 83.24 (31) (32) (31) (32) (32) * include the areas on both sides of internal walls and partitions 5 (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) (28)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) (28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K Indicative Value: High 450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) (31) (32) + (32) (36) (37) Total fabric heat loss (1.5 x (31)) <t< td=""><td>Doo<mark>rs</mark></td><td></td><td></td><td></td><td></td><td></td><td>1.9</td><td>x</td><td>1.4</td><td>=</td><td>2.66</td><td></td><td></td><td></td><td>(26)</td></t<>	Doo <mark>rs</mark>						1.9	x	1.4	=	2.66				(26)
Windows Type 2 2.89 x1/1/1(4.8) + 0.04] = 11.64 (27) Floor 51 x 0.99 = 50.49 (28) Walls Type 1 16.14 9.03 7.11 x 2.1 = 14.93 (29) Walls Type 2 16.1 4.79 11.31 x 2.1 = 23.75 (29) Total area of elements, m ² 83.24 (31) (32) * (31) Party wall 33.3 x 0 = 0 (32) * for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ** ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = 0 (34) 450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. 12.8 (36) If details of thermal bridging are not known (36) = 0.15 x (31) 133 + (36) = 129.85 (Win <mark>do</mark> v	ws Type	e 1				9.03	x1	/[1/(1.6)+	0.04] =	13.58				(27)
Floor 51 x 0.99 = 50.49 (28) Walls Type1 16.14 9.03 7.11 x 2.1 = 14.93 (29) Walls Type2 16.1 4.79 11.31 x 2.1 = 23.75 (29) Total area of elements, m ² 83.24 (31) (32) * (31) Party wall 33.3 x 0 = 0 (32) * for windows and roof windows, use effective window U-value calculated using formula 1/(1/U-value)+0.04] as given in paragraph 3.2 ** ** * include the areas on both sides of internal walls and paritions (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = 0 (34) (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. 12.8 (36) Thermal bridges : S (L x Y) calculated using Appendix K (12) 12.8 (36) if details of thermal bridging are not known (36) = 0.15 x (31) (33) + (36) = 129.85 (37) Ventilation heat loss calcula	Windov	ws Type	2				2.89	x1	/[1/(4.8)+	0.04] =	11.64	Fi i			(27)
Walls Type116.149.037.11x2.1=14.93(29)Walls Type216.14.7911.31x2.1=23.75(29)Total area of elements, m² 83.24 (31)Party wall 33.3 x0=0(32)* for windows and roof windows, use effective window U-value calculated using formula 1/(1/U-value)+0.04] as given in paragraph 3.2(31)** include the areas on both sides of internal walls and partitions(26)(30) + (32) =(32)Fabric heat loss, W/K = S (A x U)(26)(30) + (32) =(34)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) =0Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²KIndicative Value: High450For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f(36)can be used instead of a detailed calculation.12.8(35)Thermal bridges : S (L x Y) calculated using Appendix K12.8(36)if details of themal bridging are not known (36) = 0.15 x (31)(38) m = 0.33 x (25) m x (5)(38)Ventilation heat loss calculated monthly(38) m = 0.33 x (25) m x (5)(38)(38)m= 42.61 41.77 40.94 36.76 35.93 32.06 31.34 33.55 35.93 37.6 39.27 (38)(38)m= 172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.91 161.41 165.78 167.44 169.12 <td>Floor</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>51</td> <td>×</td> <td>0.99</td> <td></td> <td>50.49</td> <td>F r</td> <td></td> <td></td> <td>(28)</td>	Floor						51	×	0.99		50.49	F r			(28)
Walls Type216.14.7911.31x2.1=23.75(29)Total area of elements, m2 33.3 x0=0(31)Party wall 33.3 x0=0(32)* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2(31)** include the areas on both sides of internal walls and partitions(26)(30) + (32) =(32)Fabric heat loss, W/K = S (A x U)(26)(30) + (32) =(33)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) =0Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²KIndicative Value: High450For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f(36)can be used instead of a detailed calculation.12.8(36)Thermal bridges : S (L x Y) calculated using Appendix K12.8(36)if details of thermal bridging are not known (36) = 0.15 x (31)(33) + (36) =129.85(37)Ventilation heat loss calculated monthly(38)m = 0.33 x (25)m x (5)(38)m =(37)(38)m= 42.61 41.77 40.94 36.76 35.93 32.06 31.34 33.55 35.93 37.6 39.27 (38)Heat transfer coefficient, W/K(39)m = (37) + (38)m(39)m =(37) + (38)m(39)m =(37) + (38)m(39)m = 172.46 171.62 170.79 166.61 165.78 161.91 161.91 <td< td=""><td>Walls 7</td><td>Гуре1</td><td>16.1</td><td>4</td><td>9.03</td><td></td><td>7.11</td><td> x</td><td>2.1</td><td> = </td><td>14.93</td><td>i F</td><td></td><td>$\exists \vdash$</td><td>(29)</td></td<>	Walls 7	Гуре1	16.1	4	9.03		7.11	x	2.1	=	14.93	i F		$\exists \vdash$	(29)
Total area of elements, m ² B3.24 (31) Party wall 33.3 x 0 = 0 (32) * for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 (32) * include the areas on both sides of internal walls and partitions (26)(30) + (32) = (17.05 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = 0 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K Indicative Value: High 450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (33) + (36) = 12.8 (36) if details of thermal bridges : S (L x Y) calculated using Appendix K (12.8 (36) (37) Ventilation heat loss calculated monthly (38) = 0.33 × (25) m × (5) (38) (39) = 0.33 × (25) m × (5) (38) (38)m = 42.61 41.77 40.94 36.76 35.93 32.06 32.06 31.34 33.55 35.93 37.6 39.27 (38) (39)m = 172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.91 161	Walls 1	Гуре2	16.	1	4.79		11.31	x	2.1		23.75	= i		\dashv	(29)
Party wall 3.3.3 x 0 = 0 (32) * for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (117.05 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K Indicative Value: High (450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K (33) + (36) = (12.8 (36)) if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss calculated monthly (38)m = 0.33 x (25)m x (5) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m = $\frac{12.8 (36)}{42.61 41.77 40.94 36.76 35.93 32.06 32.06 31.34 33.55 35.93 37.6 39.27} (38)$ Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = $172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.19 163.4 165.78 167.44 169.12$	Total a	rea of e	lements	, m²			83.24			I					(31)
* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K Indicative Value: High 450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K 12.8 (36) if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = 129.85 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m = $\frac{1}{42.61}$ $\frac{1}{41.77}$ $\frac{1}{40.94}$ $\frac{1}{36.76}$ $\frac{1}{35.93}$ $\frac{3}{32.06}$ $\frac{3}{32.06}$ $\frac{3}{31.34}$ $\frac{3}{33.55}$ $\frac{1}{35.93}$ $\frac{3}{37.6}$ $\frac{3}{39.27}$ (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.19 161.41 165.78 167.44 169.12	Party v	vall					33.3	x	0		0				(32)
** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K Indicative Value: High 450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K 12.8 (36) if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = 129.85 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m $42.61 41.77 40.94 36.76 35.93 32.06 32.06 31.34 33.55 35.93 37.6 39.27$ (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m $172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.19 163.4 165.78 167.44 169.12$	* for win	dows and	roof wind	ows, use e	effective wil	ndow U-va	alue calcul	ated using	formula 1	I /[(1/U-valu	ie)+0.04] a	as given in	paragraph	 ≀ 3.2	` `
Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 117.05 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²K Indicative Value: High 450 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) (37) Thermal bridges : S (L x Y) calculated using Appendix K 12.8 (36) if details of thermal bridging are not known (36) = 0.15 x (31) (33) + (36) = 129.85 (37) Total fabric heat loss (33) + (36) = 129.85 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38) (38)m= 42.61 41.77 40.94 36.76 35.93 32.06 32.06 31.34 33.55 35.93 37.6 39.27 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (37) + (38)m (38) (39)m = (37) + (38)m (38)	** includ	e the area	as on both	sides of ir	nternal wall	ls and par	titions								
Heat capacity $Cm = S(A \times k)$ ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K Indicative Value: High (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) ran be used instead of a detailed calculation. 12.8 Thermal bridges : S (L x Y) calculated using Appendix K 12.8 if details of thermal bridging are not known (36) = 0.15 x (31) 12.8 Total fabric heat loss (33) + (36) = Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5) (38)m= 42.61 41.77 40.94 36.76 35.93 32.06 31.34 33.55 35.93 37.6 39.27 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m	Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				117.0	(33)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²KIndicative Value: High(35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1fcan be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K(33) + (36) =12.8(36)if details of thermal bridging are not known (36) = 0.15 x (31)Total fabric heat loss(38)m = 0.33 x (25)m x (5)Ventilation heat loss calculated monthly(38)m = 0.33 x (25)m x (5)(38)m =(38)m = 0.33 x (25)m x (5)(38)m = 0.33 x (25)m x (5)(38)m =(37) + (38)m(38)m = (37) + (38)m(39)m = (37) + (38)m(39)m = 172.46171.62170.79166.61165.78161.91161.91161.91161.91161.91161.91161.91161.91161.91161.91161.91161.91161.9112.8(36)(37) + (38)(38) m <td< td=""><td>Heat c</td><td>apacity</td><td>Cm = S(</td><td>(A x k)</td><td></td><td></td><td></td><td></td><td></td><td>((28)</td><td>(30) + (32</td><td>2) + (32a).</td><td>(32e) =</td><td>0</td><td>(34)</td></td<>	Heat c	apacity	Cm = S((A x k)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = 42.61 41.77 40.94 36.76 35.93 32.06 32.06 31.34 33.55 35.93 37.6 39.27 Heat transfer coefficient, W/K (39)m = 172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.19 163.4 165.78 167.44 169.12	Therm	al mass	parame	ter (TM	⁻ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: High		450	(35)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 42.61 41.77 40.94 36.76 35.93 32.06 31.34 33.55 35.93 37.6 39.27 (38) (39)m = $(172.46$ 171.62 170.79 166.61 165.78 161.91 161.91 161.19 163.4 165.78 167.44 169.12	For desi can be u	gn assess Ised inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f		
(33) + (36) = (33) + (36) = (33) + (36) = (33) + (36) = (33) + (36) = (37) (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m (38) m (38) m (39) m = (37) + (38) m (39) m = (37) + (38) m (39) m = (37) + (38) m (39) m = (37) + (38) m	Therma	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						12.8	(36)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = 42.61 41.77 40.94 36.76 35.93 32.06 31.34 33.55 35.93 37.6 39.27 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (37) + (38)m	if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)			(00)	(0.0)				
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec $(38)m =$ 42.61 41.77 40.94 36.76 35.93 32.06 31.34 33.55 35.93 37.6 39.27 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.19 163.4 165.78 167.44 169.12		abric ne	at loss		1					(33) +	(36) =	(05)		129.8	.5 (37)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ventila	tion nea				/	lun	1.1	A	(38)m	= 0.33 × ((25)m x (5)		1	
(39)m= 172.46 171.62 170.79 166.61 165.78 161.91 161.91 161.19 163.4 165.78 167.44 169.12	(38)m-	Jan 42.61	11 77		Apr 36.76	1VIAY	Jun	JUI	Aug	32 55	35.02	1NOV	20.27		(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m= 172.46 171.62 170.79 166.61 165.78 161.91 161.19 163.4 165.78 167.44 169.12	(30)11=	42.01	41.//	40.94	30.70	55.93	32.00	32.00	51.34	33.35	30.93	37.0	39.21	I	(50)
	Heat tr	anster o		$\frac{1}{170.70}$	100.01	105 70	101.01	101.01	101.10	(39)m	= (37) + (37) + (37)	38)m	100.10	1	
Average = $Sum(39)$, $m/12$ = 166.5 (39)	(29)11=	172.40	171.02	170.79	100.01	103.78	101.91	101.91	101.19	103.4	Average =	Sum(39)	12/12=	166 4	5 (39)

Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$														
(40)m=	3.38	3.37	3.35	3.27	3.25	3.17	3.17	3.16	3.2	3.25	3.28	3.32		
L	r of dou		th (Tab						ļ	Average =	Sum(40)1	.12 /12=	3.26	(40)
	lon uay	Feb	Mar		May	lun	lul	Δυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wat	ter heat	ing ener	gy requi	rement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	pancy, № 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	-13.9)2)] + 0.0)013 x (1	ΓFA -13.	1. ⁻ .9)	72		(42)
Annual Reduce t not more	averag he annua that 125	e hot wa al average litres per p	ater usag hot water person per	ge in litre usage by day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed t ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.04		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					1	
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	000.40	
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	otal = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	900.48	(44)
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55		
lf instanta	aneous w	ater heatir	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46,) to (61)	Fotal = Su	m(45) ₁₁₂ =		1180.67	(45)
(46)m=	1 <mark>8.36</mark>	16.06	1 <mark>6</mark> .57	14. <mark>4</mark> 5	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78		(46)
Water s	storage	loss:												
Storage	e volum	e (litres)	includin	ig any so	olar or M	/WHRS	storage	within sa	ame vess	sel	· ·	160		(47)
If common Otherw	nunity h ise if no	eating a stored	nd no ta hot wate	nk in dw er (this ir	/elling, e icludes i	nter 110 nstantar	nitres in	(47) mbi boil	ers) ente	er '0' in (47)			
Water s	storage	loss:	not mate			notantai					,			
a) If ma	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
Temper	rature fa	actor fro	m Table	2b							(C		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=		16	60		(50)
b) If ma Hot wat	anufact ter stora	urer's de age loss	eclared of factor fr	ylinder i om Tabl	oss fact e 2 (kW	or is not h/litre/da	known: w)				0	05		(51)
If comm	nunity h	eating s	ee sectio	on 4.3	0 2 (0.	00		(01)
Volume	factor	from Tal	ole 2a								0.	91		(52)
Temper	rature fa	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (5	53) =	5.	85		(54)
Enter (50) or (54) in (5	5)		_						5.	85		(55)
Water s	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)r	m			L	
(56)m= If cylinder	181.24 r contains	163.7 dedicated	181.24 d solar sto	175.39 rage, (57)i	181.24 m = (56)m	175.39 x [(50) – (181.24 H11)] ÷ (5	181.24 0), else (57	175.39 7)m = (56)	181.24 m where (175.39 H11) is fro	181.24 m Append	lix H	(56)
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)
Primarv	/ circuit	loss (an	nual) fro	m Table	e 3	-	-)		(58)
Primary	/ circuit	loss cal	culated f	or each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	ified by	factor fr	om Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)		L	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for eac	h month	(61)m =	(60) ÷ 3	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat rec	quired for	water h	neating c	alculated	l for eac	h month	(62)m =	• 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		(62)
Solar DI	HW input	calculated	using Ap	pendix G o	r Appendix	H (negati	ve quantity	/) (enter 'C	' if no sola	r contribut	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	S and/or V	WWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from v	vater hea	ter		-	_	-	-	-	-	-	-		
(64)m=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		_
								Out	out from w	ater heate	r (annual)₁	12	4491.37	(64)
Heat g	ains fro	om water	heating	l, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12		(65)
inclu	ıde (57)m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is f	rom com	munity h	eating	
5. Int	ternal g	ains (see	Table	5 and 5a):									
Metab	olic gai	ns (Table	e 5), Wa	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	8 <mark>5.98</mark>	85.98	85.98		(66)
Lightin	g gains	s (calcula	ted in A	ppendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	22.71	20.17	16.4	12.42	9.28	7.84	8.47	11.01	14.77	18.76	21.89	23.34		(67)
Applia	nces ga	ains (ca <mark>lc</mark>	ulated i	n Appen	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22		(68)
Cookir	ng gains	s (calcula	ited in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5				
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6		(69)
Pumps	and fa	ans gains	(Table	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. e	vaporatio	n (nega	ative valu	es) (Tab	le 5)					1			
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78		(71)
Water	heating	g gains (T	able 5)											
(72)m=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02		(72)
Total i	nterna	l gains =		1		(66))m + (67)m	ı ı + (68)m ·	+ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	424.08	421.36	410.08	392.86	376.02	268.73	258.95	264.81	274.22	383.08	402.46	416.37		(73)
6. So	lar gain	is:		1										
Solar g	ains are	calculated	using sol	ar flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	ne applical	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area	l	Flu	Х		g_		FF		Gains	
		Table 6d		m²		Та	ble 6a	Т	able 6b	Т	able 6c		(W)	
North	0.9x	0.77	>	2.8	39	x	0.63	x	0.85	x	0.7	=	12.67	(74)
North	0.9x	0.77	>	2.8	39	x 2	20.32	x	0.85	x	0.7	=	24.22	(74)
North	0.9x	0.77	>	2.8	39	×;	34.53	x	0.85	x	0.7	=	41.15	(74)
North	0.9x	0.77)	2.8	39	x t	55.46	x	0.85	_ x [0.7	=	66.09	(74)
North	0.9x	0.77	>	2.8	39	x	4.72	x	0.85	_ x [0.7	=	89.03	(74)

North	0.9x	0.77	x		2.89	x	7	79.99	x	0.85	x	0.7	=	95.3	31 (74)
North	0.9x	0.77	×		2.89	×	7	74.68	X	0.85	x	0.7	=	88.9	9 (74)
North	0.9x	0.77	x		2.89	x	5	59.25	x	0.85	x	0.7	=	70.0	6 (74)
North	0.9x	0.77	x		2.89	x	۷	11.52	x	0.85	x	0.7	=	49.4	7 (74)
North	0.9x	0.77	x		2.89	×	2	24.19	x	0.85	x	0.7	=	28.8	3 (74)
North	0.9x	0.77	x		2.89	x	1	3.12	x	0.85	x	0.7	=	15.6	3 (74)
North	0.9x	0.77	x		2.89	x		8.86	x	0.85	x	0.7	=	10.5	6 (74)
South	0.9x	0.77	x		9.03	×	4	46.75	x	0.76	x	0.7	=	155.	64 (78)
South	0.9x	0.77	x		9.03	×	7	76.57	x	0.76	x	0.7	=	254.	91 (78)
South	0.9x	0.77	x		9.03	×	9	97.53	x	0.76	x	0.7	=	324	.7 (78)
South	0.9x	0.77	x		9.03	×	1	10.23	x	0.76	x	0.7	=	366.	99 (78)
South	0.9x	0.77	x		9.03	×	1	14.87	x	0.76	x	0.7	=	382.4	42 (78)
South	0.9x	0.77	x		9.03	x	1	10.55	x	0.76	x	0.7	=	368.	03 (78)
South	0.9x	0.77	x		9.03	×	1	08.01	x	0.76	x	0.7	=	359.	59 (78)
South	0.9x	0.77	x		9.03	×	1	04.89	x	0.76	x	0.7	=	349.	21 (78)
South	0.9x	0.77	x		9.03	×	1	01.89	x	0.76	x	0.7	=	339.	19 (78)
South	0.9x	0.77	x		9.03	×	8	32.59	x	0.76	x	0.7	=	274.	94 (78)
South	0.9x	0.77	x		9.03	X	5	55.42	х	0.76	x	0.7	=	184.4	49 (78)
Sout <mark>h</mark>	0.9x	0.77	×		9.03	x		40.4	x	0.76	x	0.7	=	134.	49 (78)
Sola <mark>r</mark> (<mark>gain</mark> s in	watts, <mark>cal</mark>	<mark>cu</mark> lated	d for	each mon	th			(83)m	n = Sum(74)m	<mark>(8</mark> 2)m	1		-	
(83)m=	168.32	279.12	36 <mark>5.85</mark>	433	.08 471.4	6 4	463.34	448.58	419	.81 388.67	303.7	6 200.12	145.05		(83)
Total g	gains – i	nternal an	d sola	r (84	m = (73)r	n +	(83)m	, watts	-			_		-	
(84)m=	592.39	700.48	775.93	825	.94 847.4	7 7	32.08	707.53	684	.62 662.89	686.8	602.59	561.43		(84)
7. Me	ean inter	nal tempe	rature	(hea	ting sease	on)									
Temp	perature	during he	ating p	perio	ds in the li	ving	area	from Tal	ble 9	, Th1 (°C)				21	(85)
Utilis	ation fac	tor for gai	ins for	living	area, h1	,m (s	see Ta	ble 9a)						-	
	Jan	Feb	Mar	A	pr Ma	у	Jun	Jul	A	ug Sep	Oc	t Nov	Dec		
(86)m=	1	0.99	0.99	0.9	0.94		0.9	0.79	0.8	81 0.93	0.98	0.99	1		(86)
Mear	n interna	I temperat	ture in	living	g area T1	(folle	ow ste	ps 3 to 7	7 in T	able 9c)					
(87)m=	18.93	19.13	19.45	19	.9 20.32	2	20.65	20.86	20.	83 20.53	20.04	4 19.42	18.93		(87)
Temp	perature	during he	ating p	oerio	ds in rest o	of dv	velling	from Ta	able 9	9, Th2 (°C)					
(88)m=	19.31	19.32	19.33	19.	37 19.37	7	19.41	19.41	19.	42 19.4	19.3	7 19.36	19.34	7	(88)
Utilis	ation fac	tor for gai	ins for	rest	of dwelling	1 h2	m (se	e Table	.9a)	•	<u>.</u>	•		_	
(89)m=	1	0.99	0.98	0.9	0.91	<u></u>	0.81	0.59	0.6	64 0.87	0.96	0.99	1	7	(89)
Moor			turo in	thou			л Т2 (f	I ollow ste		to 7 in Tab					
(90)m=	17.5	17.71	18.03	18	.5 18.91		19.24	19.38	19.	37 19.13	18.6	5 18.03	17.52	7	(90)
·/···-									L		fLA = Li	ving area ÷ (4) =	0.5	5 (91)
N 4 -									. / 4			- ``			
Mear		temperat		br the	whole dv $\frac{1}{27}$	veilir	$\frac{10}{20.02} = f$		+ (1	$- TLA) \times T2$		2 10.0	10.0	7	(02)
(92)111=	10.3	1 ^{10.0}	10.02	I 19.	21 19.7		∠0.0Z	I ∠0.∠	I 20.	10 1 19.91	1 19.42	<u>~ 10.0</u>	1 10.3	1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.75	18.95	19.27	19.72	20.15	20.47	20.65	20.63	20.36	19.87	19.25	18.75		(93)
8. Spa	ace hea	ting req	uirement	t										
Set Ti the ut	i to the ilisation	mean in factor fo	ternal ter or gains	mperatui using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	ctor for g	ains, hrr	n:										
(94)m=	0.99	0.99	0.98	0.97	0.93	0.87	0.75	0.78	0.91	0.97	0.99	1		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	589.27	693.69	762.21	797.14	785.27	639.01	532.69	535.97	606.28	664.74	596.85	559.01		(95)
Month	nly aver	age exte	ernal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rat	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	2491.39	2410.76	2180.86	1803.4	1400.02	950.76	655.47	682.1	1023	1536.73	2035.28	2461.08		(97)
Space	e heatin	g requir	ement fo	r each n	nonth, k\	Wh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	1415.17	1153.87	1055.48	724.5	457.37	0	0	0	0	648.75	1035.67	1415.14		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	7905.97	(98)
Space	e heatin	g requir	ement in	kWh/m²	/year								155.02	(99)
9a. En	ergy rea	quiremer	nts – Ind	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space	e heati	ng:												-
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	(201) =				1	(202)
Fra <mark>cti</mark>	on of to	tal heati	<mark>ng f</mark> rom	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main s <mark>pa</mark>	ace heat	ing syste	em 1							İ	65.9	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heatin	g requir	ement (c	alculate	d above)									
	1415.17	1153.87	1055.48	724.5	457.37	0	0	0	0	648.75	1035.67	1415.14		
(211)m	n = {[(98	s)m x (20)4)]}x1	00 ÷ (20)6)									(211)
、 ,	2147.46	1750.95	1601.64	1099.4	, 694.03	0	0	0	0	984.45	1571.58	2147.4		
I								Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	=	11996.92	(211)
Space	e heatin	a fuel (s	econdar	v). kWh/	month							I		
= {[(98])m x (20	D1)] } x 1	00 ÷ (20)8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
I								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	_	0	(215)
Water	heating	a										I		
Output	from w	ater hea	ter (calc	ulated al	bove)									
	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		
Efficier	ncy of w	ater hea	ater										55.8	(216)
(217)m=	63.22	63.04	62.67	61.94	60.76	55.8	55.8	55.8	55.8	61.59	62.69	63.24		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m) = (64)	<u>m x 100</u>) ÷ (217)	m										
(219)m=	683.33	613.48	670.32	639.26	661.72	532.36	534.86	554.4	543.23	665.13	652.1	677.03		-
								Tota	I = Sum(2	19a) ₁₁₂ =			7427.22	(219)
Annua	l totals									k	Wh/year		kWh/year	-
Space	neating	tuel use	ed, main	system	1								11996.92	
Water heating fuel used			7427.22											
---	-------------------------------	--------------------------------------	---------------------------------											
Electricity for pumps, fans and electric keep-hot														
central heating pump:		15	6 (230c)											
boiler with a fan-assisted flue		45	5 (230e)											
Total electricity for the above, kWh/year	sum of	(230a)(230g) =	201 (231)											
Electricity for lighting			401.03 (232)											
12a. CO2 emissions – Individual heating systems	including micro-CHP													
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year											
Space heating (main system 1)	(211) x	0.216 =	2591.33 (261)											
Space heating (secondary)	(215) x	0.519 =	0 (263)											
Water heating	(219) x	0.216 =	1604.28 (264)											
Space and water heating	(261) + (262) + (263) + (264)	4) =	4195.61 (265)											
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	104.32 (267)											
Electricity for lighting	(232) x	0.519 =	208.13 (268)											
Total CO2, kg/year		sum of (265)(271) =	4508.06 (272)											
Dwelling CO2 Emission Rate		(272) ÷ (4) =	88.39 (273)											
El rating (section 14)			41 (274)											

		Use	er Details:						
Assessor Name: Software Name:	Stroma FSAP 2012	Prope	Stroma Softwa	a Num are Ver Unit 4	ber: sion:		Versio	n: 1.0.3.4	
Address :	, london								
1. Overall dwelling dimer	isions:								
Basement		A 	srea(m²)	(1a) x	Av. He	ight(m) .18	(2a) =	Volume(m ³ 111.18) (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+	+(1n)	51	(4)					
Dwelling volume				(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	111.18	(5)
2. Ventilation rate:			- 41		4 - 4 - 1				
Number of chimneys Number of open flues	$ \begin{array}{c} \text{main} & \text{sec} \\ \text{heating} & \text{heat} \\ \hline 0 & + \\ \hline 0 & + \\ \hline 0 & + \\ \hline \end{array} $	$\frac{\text{ating}}{0} + \frac{1}{0} + \frac{1}{0}$	other 0 0] = [total 0 0	x 4	40 = 20 =	0 0	r (6a) (6b)
Number of intermittent fan	IS			- F	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)
							Air ch	anges per ho	our
Infiltration due to chimneys If a pressurisation test has be Number of storeys in the Additional infiltration Structural infiltration: 0.2	s, flues and fans = (6a)- en carried out or is intended, e dwelling (ns) 25 for steel or timber fra	+(6b)+(7a)+(7 proceed to (1 ame or 0.35	o)+(7c) = 7), otherwise c	ontinue fro	20 om (9) to (uction	(<i>16)</i> [(9)-	÷ (5) = 1]x0.1 =	0.18 0 0 0 0 0	(8) (9) (10) (11)
if both types of wall are pre deducting areas of opening If suspended wooden flo If no draught lobby, ente	sent, use the value correspo s; if equal user 0.35 oor, enter 0.2 (unsealed er 0.05. else enter 0	onding to the g d) or 0.1 (se	reater wall area ealed), else	a <i>(after</i> enter 0				0	(12) (13)
Percentage of windows	and doors draught strip	oped						0	(14)
Window infiltration	C .		0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, c	50, expressed in cubic	metres per	hour per so	quare m	etre of e	nvelope	area	20	(17)
If based on air permeabilit	y value, then (18) = [(17)	÷ 20]+(8), oth	erwise (18) = (16)				1.18	(18)
Air permeability value applies	if a pressurisation test has b	een done or a	degree air pei	meability	is being us	sed		_	
Shelter factor	1		(20) = 1 - [0.075 x (1	9)] =			2	(19)
Infiltration rate incorporatir	ng shelter factor		(21) = (18)	x (20) =				1	
Infiltration rate modified fo	r monthly wind speed								
Jan Feb M	Mar Apr May	Jun Ju	I Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7								
(22)m= 5.1 5 4	1.9 4.4 4.3	3.8 3.8	3 3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4							I	
(22a)m= 1.27 1.25 1	.23 1.1 1.08	0.95 0.9	5 0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m	-	-	-	_	
~ ' '	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	ĺ	
Calcul If me	ate etter	<i>ctive air</i> al ventila	change	rate for t	ne appli	cable ca	Se						0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othei	wise (23b) = (23a)			0	(23b)
lf bala	anced with	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,				(23c)
a) If	balance	ed mech	, anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	m = (2)	2h)m + (23b) x [*	1 – (23c)	 _ – 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mecha	ı anical ve	entilation	without	heat rec	L Coverv (N	u MV) (24b)m = (22	1 2b)m + ()	1 23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from c	outside				1	
, i	if (22b)n	n < 0.5 ×	(23b), t	then (24d	c) = (23b); otherv	wise (24	c) = (22b) m + 0.	.5 × (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	on from I	oft	-	-	-		
	if (22b)n	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	I	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24 I	d) in boy	(25)				1	
(25)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	/IENT	Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	÷	AXk
D		area	(m²)	m	12	A ,r	n²	VV/m2	ĸ	(VV/	K)	kJ/m ² ·I	۲.	kJ/K
Doors	-					1.9	X	1.4	=	2.66				(26)
Windo	ws Type	€1				9.03	x ¹	/[1/(1.6)+	0.04] =	13.58				(27)
Windo	ws Type	e 2				0.39	x ¹	/[1/(4.8)+	0.04] =	1.57	Ц.		_	(27)
Floor						51	×	0.97	= [49.47				(28)
Walls	Type1	39.	2	0.39		38.81	X	2.1	=	81.5				(29)
Walls	Type2	10.9	99	10.9	3	0.06	X	2.1	=	0.13				(29)
Total a	area of e	elements	, m²			101.1	9							(31)
Party v	wall					16.1	x	0	=	0				(32)
* for win	ndows and	l roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1,	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
Eabric	he the area	as on both N/K		nternal wal TIN	is and pari	titions		(26) (30)	+ (32) =				1 40 04	(22)
Heat c	anacity	Cm - SI	- 0 (~ ^ ′A v k)	0)				()(00)	((28)	$(30) \pm (3)$	2) + (32a)	(32e) -	148.91	(34)
Therm	apacity	narame	(TAN) Iter (TMI	⊃ – Cm ≟	- TFΔ) ir	n k l/m²K			Indica	tive Value	· Hiah	(020) =	450	(34)
For desi	ian assess	sments wh	ere the de	etails of the	construct	ion are not	t known pi	reciselv the	indicative	e values of	TMP in Ta	able 1f	450	(33)
can be ı	used inste	ad of a de	tailed calc	ulation.				, , , , , , , , , , , , , , , , , , , ,						
Therm	al bridg	es : S (L	x Y) cal	culated (using Ap	pendix ł	<						15.2	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)			(2.2)					
i otal fa	abric he	at loss	. 1	1					(33) +	(36) =	(O.F.) (1)		164.11	(37)
ventila	ation hea	at loss ca	aiculated	a monthly	/				(38)m	= 0.33 × (25)m x (5)		1	
(20)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)M=	40.91	45.99	45.08	40.48	39.56	35	35	34.13	30.8	39.56	41.4	43.24	l	(30)
Heat tr	ransfer o	coefficier	nt, W/K	oc :	000	400	4.55	400	(39)m	= (37) + (38)m	0.00	1	
(39)m=	211.02	210.1	209.18	204.58	203.66	199.1	199.1	198.24	200.9	203.66	205.5 Sum(20)	207.34	204.27	(30)
									4	nvelaye =	Jun (38)1	12 / 14=	204.3/	(33)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	4.14	4.12	4.1	4.01	3.99	3.9	3.9	3.89	3.94	3.99	4.03	4.07		
L									,	Average =	Sum(40)1	.12 /12=	4.01	(40)
eamuri]	lan	S IN MOR	ıın (Tab Mər	Apr	May	lun	lul	Διια	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	-7pi -30	31	30	31	31	30	31	30	31		(41)
()	01	20	01		01		01	01		01		01		()
4. Wa	ter heat	ing ener	gy requi	rement:								kWh/ye	ear:	
Assum if TF/ if TF/	ed occu A > 13.9 A £ 13.9	ipancy, N 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	⁻ A -13.9)2)] + 0.(0013 x (⁻	ΓFA -13.	1. 9)	72		(42)
Annual Reduce t not more	averag the annua that 125	e hot wa al average litres per p	ater usag hot water person per	ge in litre usage by day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.04		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ir	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					I	
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54		-
Ener <mark>gy c</mark>	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	900.48	(44)
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55		_
lf instant	aneous w	ater heatir	na at point	of use (no	hot water	r storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1180.67	(45)
(46)m=	18.36	16.06	16.57	14 45	13.86	11.96	11.08	12.72	12.87	15	16.37	17 78		(46)
Water s	storage	loss:	10.01		10.00	11.00			12.01	10	10.01	11.10		(-)
Storage	e volum	e (litres)	includin	ig any so	olar or N	/WHRS	storage	within sa	a <mark>me ve</mark> s	sel		160		(47)
If comn	nunity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Utherw Water	ise if no	o stored	hot wate	er (this ir	ICIUDES I	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared le	oss facto	or is kno	wn (kWł	n/day):)		(48)
Tempe	rature fa	actor fro	m Table	2b		,	• /)		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		16	60		(50)
b) If m	anufact	urer's de	eclared o	ylinder l	oss fact	or is not	known:							
Hot wa	ter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)				0.	05		(51)
Volume	e factor	from Tal	ble 2a	511 4.5							0.	91		(52)
Tempe	rature fa	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	5.	85		(54)
Enter ((50) or (54) in (5	5)								5.	85		(55)
Water s	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(56)
If cylinde	r contains	s dedicated	d solar sto	rage, (57)i	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H I	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)
Primary	/ circuit	loss (an	nual) fro	om Table	3		(=0) -	_ ,			(0		(58)
Primary	/ circuit	loss cal	culated f	or each	month (59)m = ($(58) \div 36$	55 x (41)	m Novlindo	r thermo	etat)			
(1100 (59)m=	128.38	115.95	128.38	124 24	128.38	41 92	43.31	43.31	41.92	128.38	124 24	128.38		(59)
(00)	0.00		0.00							0.00		0.00		()

Combi	loss ca	alculated	for eacl	h month	(61)m =	(60) ÷ 3	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	neating c	alculated	for eac	h month	(62)m =	0.85 × 0	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		(62)
Solar DH	IW input	calculated	using Ap	pendix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	applies	, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		
								Out	out from w	ater heate	r (annual)₁	12	4491.37	(64)
Heat g	ains fro	m water	heating	ı, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12		(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 f	rom com	munity h	neating	
5. Int	ernal g	ains (see	e Table	5 and 5a):									
Metabo	olic dair	ns (Table	e 5). Wa	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	8 <mark>5.98</mark>	85.98	85.98		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	2 <mark>3.08</mark>	20.5	16.67	12.62	9.44	7.97	8.61	11.19	15.02	19.07	22.26	23.72		(67)
Applia	nces ga	ains (calc	ulated i	n Appen	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22		(68)
Cookin	a dains	s (calcula	ted in A		L. equat	ion L15	or L15a	, also se	e Table	5				
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	1	(69)
Pumps	and fa	ns gains	(Table	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses		I vaporatio	n (nega	I ative valu	i les) (Tab	le 5)			ļ	ļ		Į	1	
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78		(71)
Water	heating	L L dains (T	l Table 5)										1	
(72)m=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02]	(72)
Total i	nterna	l aains –			1	(66)	l)m + (67)m	L 1 + (68)m -	L+ (69)m + (L (70)m + (7	L (1)m + (72)		1	. ,
(73)m=	424.45	421.69	410.35	393.06	376.17	268.86	259.09	264.99	274.47	383.39	402.83	416.76]	(73)
6. Sol	ar gain	s:		1	1		1				1			· ,
Solar g	ains are	calculated	using sola	ar flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area	l	Flu	IX		g_		FF		Gains	
		Table 6d		m²		Та	ble 6a	Т	able 6b	Т	able 6c		(W)	
North	0.9x	0.77	×	. 0.:	39	x 1	10.63	x	0.85	×	0.7	=	1.71	(74)
North	0.9x	0.77	×	. 0.:	39	x 2	20.32	x [0.85	= × F	0.7	=	3.27	(74)
North	0.9x	0.77	×		39	x :	34.53	x	0.85		0.7	=	5.55	(74)
North	0.9x	0.77	×	. 0.:	39	x E	55.46	x 🗌	0.85	=	0.7		8.92	(74)
North	0.9x	0.77	×	. 0.:	39	x 7	74.72	x 🗌	0.85	× [0.7	=	12.02	(74)

North 0.9* 0.77 × 0.38 × 73.93 × 0.85 × 0.7 = 12.86 74 North 0.9* 0.77 × 0.38 × 74.68 × 0.85 × 0.7 = 12.01 74 North 0.9* 0.77 × 0.38 × 74.68 × 0.85 × 0.7 = 12.01 74 North 0.9* 0.77 × 0.38 × 141.2 × 0.85 × 0.7 = 0.68 74 North 0.9* 0.77 × 0.38 × 141.2 × 0.85 × 0.7 = 0.68 74 North 0.9* 0.77 × 0.38 × 141.2 × 0.85 × 0.7 = 1.4.3 74 South 0.9* 0.77 × 0.38 × 141.2 × 0.85 × 0.7 = 1.4.3 74 South 0.9* 0.77 × 0.38 × 141.2 × 0.85 × 0.7 = 1.4.3 74 South 0.9* 0.77 × 0.38 × 146.7 × 0.76 × 0.7 = 1.55.64 77 South 0.9* 0.77 × 0.33 × 75.3 × 0.76 × 0.7 = 1.55.64 77 South 0.9* 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 2.411 77 South 0.9* 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 110.55 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 110.55 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 110.55 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 100.84 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.97 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.21 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.21 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.21 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.21 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.21 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 3.64.21 South 0.9* 0.77 × 0.33 × 100.80 × 0.76 × 0.7 = 134.49 South 0.9* 0.77 × 0.33 × 0.54.2 × 0.70 × 0.7 = 134.49 South 0.9* 0.77 × 0.33 × 0.54.2 × 0.76 × 0.7 = 274.94 South 0.9* 0.77 × 0.30 × 0.55.2 × 0.76 × 0.7 = 134.49 South 0.9* 0.77 × 0.38 0.98 0.94 0.57 0.88 0.55 0.98 0.99 1 Mean internal temperature (neuring season) Mean internal temperature (neuring season) Mean internal temperature (neuring season) Mean internal temperature in living area T1 (clow steps 3 to 7 in Table 9.5) (g)m. 16.51 18.71 19.05 18.54 0.91 19.05 19.05 19.06 19.03 19 18.99 18.97 Utilisation factor for gains for irest of dwelling T2 (clow steps 3 to 7 in Table 9.5) (g)m. 16.51 18.71 19.05 18.54 0.93 0.96 0.54																			
North $0.9*$ 0.77 × 0.38 × 74.88 × 0.85 × 0.7 = 12.01 (74 North $0.9*$ 0.77 × 0.38 × 63.25 × 0.85 × 0.7 = 5.53 (7 North $0.9*$ 0.77 × 0.38 × 41.52 × 0.85 × 0.7 = 5.68 (7 North $0.9*$ 0.77 × 0.38 × 41.52 × 0.85 × 0.7 = 3.89 (7 North $0.9*$ 0.77 × 0.38 × 41.52 × 0.85 × 0.7 = 3.89 (7 North $0.9*$ 0.77 × 0.38 × 13.12 × 0.85 × 0.7 = 2.11 (74 North $0.9*$ 0.77 × 0.38 × 42.19 × 0.85 × 0.7 = $2.54.91$ (77 South $0.9*$ 0.77 × 0.38 × 46.75 × 0.75 × 0.7 = 224.91 (78 South $0.9*$ 0.77 × 0.33 × 46.75 × 0.76 × 0.7 = 224.91 (78 South $0.9*$ 0.77 × 0.33 × 46.75 × 0.76 × 0.7 = 224.91 (78 South $0.9*$ 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 368.03 (77 South $0.9*$ 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 368.03 (77 South $0.9*$ 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 388.03 (77 South $0.9*$ 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 388.03 (78 South $0.9*$ 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 388.03 (78 South $0.9*$ 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 349.21 (78 South $0.9*$ 0.77 × 0.33 × 100.89 × 0.76 × 0.7 = 349.21 (78 South $0.9*$ 0.77 × 0.33 × 100.89 × 0.76 × 0.7 = 349.21 (78 South $0.9*$ 0.77 × 0.33 × 100.89 × 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 100.89 × 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 100.89 × 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 100.89 × 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 0.28 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 0.28 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 0.28 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 0.28 0.76 × 0.7 = 274.34 (78 South $0.9*$ 0.77 × 0.33 × 0.28 0.76 0.7 = 124.49 (78 South $0.9*$ 0.77 × 0.33 × 0.38 0.88 0.76 0.7 = 124.49 (78 South $0.9*$ 0.77 × 0.33 0.98 0.98 0.98 0.98 0.98 1 (84 Ca	North	0.9x	0.77	;	ĸ	0.39		x	79	9.99	x	0.85		x	0.7		= [12.86	(74)
North 0.9× 0.77 × 0.39 × 99.25 × 0.85 × 0.7 = 9.53 77 North 0.9× 0.77 × 0.39 × 241.62 × 0.85 × 0.7 = 0.6.8 77 North 0.9× 0.77 × 0.39 × 241.9 × 0.85 × 0.7 = 0.6.8 77 North 0.9× 0.77 × 0.39 × 241.9 × 0.85 × 0.7 = 0.111 74 North 0.9× 0.77 × 0.39 × 0.38 × 0.7 = 0.211 74 South 0.9× 0.77 × 0.30 × 76.57 × 0.76 × 0.7 = 0.24.91 77 South 0.9× 0.77 × 0.03 × 76.57 × 0.76 × 0.7 = 0.24.91 77 South 0.9× 0.77 × 0.03 × 10.23 × 0.76 × 0.7 = 0.24.91 77 South 0.9× 0.77 × 0.03 × 10.23 × 0.76 × 0.7 = 0.24.91 77 South 0.9× 0.77 × 0.03 × 114.87 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 110.85 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 110.85 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 110.85 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 110.86 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 110.86 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 10.86 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.06 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.06 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.99 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.9 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.9 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.7 = 0.366.9 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.366.7 78 South 0.9× 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 0.7 = 0.366.9 78 South 0.9× 0.97 × 0.03 × 0.04 × 0.076 × 0.7 = 0.7 = 0.366.9 78 Mean internal temperature interiming area from Table 9, Th1 (°C) Utilisation factor for gains for fixing area from Table 9, Th1 (°C) Utilisation factor for gains for rest of dwelling from Table 9, Th2 (°C) (89m 18.31 19.41 18.95 18.93 10.01 19.05 19.06 19.03 19 18.97 (UB Utilisation factor for gains for re	North	0.9x	0.77	;	<	0.39		x	74	4.68	x	0.85		x	0.7		= [12.01	(74)
North 0.9: 0.77 × 0.39 × 41.52 × 0.85 × 0.7 = 6.68 74 North 0.9: 0.77 × 0.39 × 44.19 × 0.85 × 0.7 = 1.89 74 North 0.9: 0.77 × 0.39 × 1.31.2 × 0.85 × 0.7 = 1.43 74 North 0.9: 0.77 × 0.39 × 1.31.2 × 0.85 × 0.7 = 1.43 74 South 0.9: 0.77 × 0.33 × 75.57 × 0.76 × 0.7 = 1.55.64 77 South 0.9: 0.77 × 0.33 × 75.57 × 0.76 × 0.7 = 254.91 77 South 0.9: 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.23 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.25 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.25 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.55 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.55 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.55 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.89 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.89 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 110.89 × 0.76 × 0.7 = 366.99 77 South 0.9: 0.77 × 0.33 × 104.89 × 0.76 × 0.7 = 342.42 77 South 0.9: 0.77 × 0.33 × 104.89 × 0.76 × 0.7 = 346.21 77 South 0.9: 0.77 × 0.33 × 104.89 × 0.76 × 0.7 = 346.21 77 South 0.9: 0.77 × 0.33 × 104.89 × 0.76 × 0.7 = 346.41 77 South 0.9: 0.77 × 0.33 × 104.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.33 × 40.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.33 × 40.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.33 × 40.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.33 × 40.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.03 × 40.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.03 × 40.4 × 0.76 × 0.7 = 134.49 78 South 0.9: 0.77 × 0.03 × 0.90 1 1.40 (3)m 4.63 10.60 10.8 10.8 10.6 136.92 166 (30.92 1) Mean internal temperature (heating periods in trest of dwelling from Table 9. Th 1 (°C) Utilisation factor for gains for living area. 11 (follow steps 3 to 7 1 0.8 0.98 0.99 1 1 Mean internal temperature in the rest of dwelling from Table 9. 18.57 Temperature during heating periods in trest of dwelling from Table 9. 19 10.06 10.03 19 18.99 18.97 Utilisation factor for gains for rest of dwelling from Table	North	0.9x	0.77	,	ĸ	0.39		x	59	9.25	x	0.85		x	0.7		= [9.53	(74)
North 0.9x 0.77 x 0.39 x 2419 x 0.85 x 0.7 = 3.89 74 North 0.9x 0.77 x 0.39 x 13.12 x 0.85 x 0.7 = 2.11 74 North 0.9x 0.77 x 0.39 x 6.86 x 0.85 x 0.7 = 1.13 North 0.9x 0.77 x 0.03 x 44.75 x 0.76 x 0.7 = 1.155.64 .76 South 0.9x 0.77 x 0.03 x 44.75 x 0.76 x 0.7 = 324.7 78 South 0.9x 0.77 x 0.03 x 110.23 x 0.76 x 0.7 = 324.7 78 South 0.9x 0.77 x 0.03 x 110.23 x 0.76 x 0.7 = 324.7 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 324.7 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 324.7 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 326.9 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 326.9 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 336.9 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 339.59 78 South 0.9x 0.77 x 0.03 x 110.25 x 0.76 x 0.7 = 339.59 78 South 0.9x 0.77 x 0.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 0.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 0.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 0.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 0.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 0.03 x 104.89 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.18.9 x 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.08 0.96 0.91 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.08 0.96 0.91 0.76 x 0.7 = 144.49 78 South 0.9x 0.77 x 0.03 x 0.08 0.95 0.28 0.98 0.98 0.98 0.98 0.98 0.98 0.98 0.9	North	0.9x	0.77	;	<	0.39		x	4	1.52	x	0.85		x	0.7		= [6.68	(74)
North 0.9x 0.77 x 0.39 x 13.12 x 0.85 x 0.7 = 2.11 74 North 0.9x 0.77 x 0.39 x 4.86 x 0.85 x 0.7 = 1.43 77 South 0.9x 0.77 x 0.03 x 4675 x 0.76 x 0.7 = 1.43 77 South 0.9x 0.77 x 0.03 x 77.5 x 0.76 x 0.7 = 2.5491 78 South 0.9x 0.77 x 0.03 x 77.5 x 0.76 x 0.7 = 2.5491 78 South 0.9x 0.77 x 0.03 x 110.23 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 110.23 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 110.55 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 110.55 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 110.55 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 110.55 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 110.55 x 0.76 x 0.7 = 3.86.99 78 South 0.9x 0.77 x 0.03 x 100.89 x 0.76 x 0.7 = 3.89.99 78 South 0.9x 0.77 x 0.03 x 101.89 x 0.76 x 0.7 = 3.49.21 78 South 0.9x 0.77 x 0.03 x 101.89 x 0.76 x 0.7 = 3.49.21 78 South 0.9x 0.77 x 0.03 x 101.89 x 0.76 x 0.7 = 3.49.21 78 South 0.9x 0.77 x 0.03 x 101.89 x 0.76 x 0.7 = 3.49.21 78 South 0.9x 0.77 x 0.03 x 101.89 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 101.89 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 0.64 2 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 0.64 2 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 0.64 2 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 0.64 2 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 0.64 2 x 0.76 x 0.7 = 1.4449 78 South 0.9x 0.77 x 0.03 x 0.64 78 78 78 78 78 78 78 78 78 78 78 78 78	North	0.9x	0.77	;	<	0.39		x	24	4.19	x	0.85		x	0.7		= [3.89	(74)
North 0.9x 0.77 × 0.38 × 0.88 × 0.85 × 0.7 = 1.43 174 South 0.9x 0.77 × 0.03 × 46.75 × 0.76 × 0.7 = 1.55.64 176 South 0.9x 0.77 × 0.03 × 76.57 × 0.76 × 0.7 = 226.91 778 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 269.9178 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 382.42 78 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 382.42 78 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 382.42 78 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 382.42 78 South 0.9x 0.77 × 0.03 × 110.25 × 0.76 × 0.7 = 382.42 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 382.91 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 382.91 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 339.19 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 339.19 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 339.19 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 339.19 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.4 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 104.4 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.77 × 0.03 × 0.04 × 0.76 × 0.7 = 114.49 78 South 0.9x 0.97 1.06 78 97 70.06 640.76 630.96 0.91 1.07 1.08 1.08 1.08 1.08 1.08 1.08 1.08 1.08	North	0.9x	0.77	;	ĸ	0.39		x	1:	3.12	x	0.85		x	0.7		= [2.11	(74)
South 0.9x 0.77 × 0.03 × 7657 × 0.76 × 0.7 = 155.64 78 South 0.9x 0.77 × 0.03 × 7657 × 0.76 × 0.7 = 254.91 77 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 234.91 78 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 386.99 78 South 0.9x 0.77 × 0.03 × 110.25 × 0.76 × 0.7 = 386.99 78 South 0.9x 0.77 × 0.03 × 110.25 × 0.76 × 0.7 = 386.03 78 South 0.9x 0.77 × 0.03 × 110.55 × 0.76 × 0.7 = 386.03 78 South 0.9x 0.77 × 0.03 × 104.87 × 0.76 × 0.7 = 386.03 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 386.03 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 389.99 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 389.99 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 389.19 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 349.21 78 South 0.9x 0.77 × 0.03 × 104.89 × 0.76 × 0.7 = 2449.47 South 0.9x 0.77 × 0.03 × 0.259 × 0.76 × 0.7 = 144.92 178 South 0.9x 0.77 × 0.03 × 0.5542 × 0.76 × 0.7 = 144.97 South 0.9x 0.77 × 0.03 × 0.5542 × 0.76 × 0.7 = 144.97 South 0.9x 0.77 × 0.03 × 0.5542 × 0.76 × 0.7 = 144.97 South 0.9x 0.77 × 0.03 × 0.5542 × 0.76 × 0.7 = 144.49 78 South 0.9x 0.77 × 0.03 × 0.259 × 0.76 × 0.7 = 144.49 78 South 0.9x 0.77 × 0.03 × 0.259 × 0.76 × 0.7 = 144.49 78 South 0.9x 0.77 × 0.03 × 0.259 × 0.76 × 0.7 = 144.49 78 South 0.9x 0.77 × 0.03 × 0.259 × 0.76 × 0.7 = 144.49 78 South 0.9x 0.77 × 0.03 × 0.259 × 0.76 × 0.7 = 144.49 78 South 0.9x 0.77 × 0.03 × 0.24 0.30.09 37.1 0.28 18.5 18.6 135.92 (8)m 10.9x 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (8)m 10.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (8)m 10.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (8)m 10.81 18.71 18.05 18.53 0.01 0.243 2.072 2.069 2.032 19.74 19.06 18.5 (67 Temperature during heating periods in rest of dwelling from Table 9. Th 12 (C) (8)m 18.83 18.94 18.95 18.99 19 19.05 19.06 19.06 19.06 19.01 19 18.99 18.97 (8)m 18.93 18.94 18.95 18.99 19 19.05 19.06 19.06 19.06 19.01 19 18.99 18.97 (8)m 18.93 0.99 0.99 0.98 0.97 0.3 0.86 0.65 0.69 0.9 0.97 0.99 1 (8)m 14 18.93 18.94 18.95 18.99 19 19.05 19.08	North	0.9x	0.77	;	ĸ	0.39		x	8	3.86	x	0.85		x	0.7		= [1.43	(74)
South 0.9x 0.77 × 0.03 × 0.76 × 0.7 = 254.91 (79 South 0.9x 0.77 × 0.03 × 0.76 × 0.7 = 254.91 (79 South 0.9x 0.77 × 0.03 × 110.23 × 0.76 × 0.7 = 386.47 (77 South 0.9x 0.77 × 0.03 × 110.55 × 0.76 × 0.7 = 386.42 (78 South 0.9x 0.77 × 0.03 × 110.55 × 0.76 × 0.7 = 386.42 (78 South 0.9x 0.77 × 0.03 × 110.55 × 0.76 × 0.7 = 386.42 (78 South 0.9x 0.77 × 0.03 × 106.01 × 0.76 × 0.7 = 386.42 (78 South 0.9x 0.77 × 0.03 × 106.01 × 0.76 × 0.7 = 386.42 (78 South 0.9x 0.77 × 0.03 × 106.01 × 0.76 × 0.7 = 388.42 (78 South 0.9x 0.77 × 0.03 × 101.89 × 0.76 × 0.7 = 338.19 (78 South 0.9x 0.77 × 0.03 × 0.16.8 × 0.76 × 0.7 = 338.19 (78 South 0.9x 0.77 × 0.03 × 0.16.8 × 0.76 × 0.7 = 338.19 (78 South 0.9x 0.77 × 0.03 × 0.55.4 × 0.76 × 0.7 = 338.19 (78 South 0.9x 0.77 × 0.03 × 0.55.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.40.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.40.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.40.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04.4 × 0.76 × 0.7 = 144.49 (78 South 0.9x 0.77 × 0.03 × 0.04 (0.90 (74) 0.06 (0.90 (74) 0.90 (10) (10) (10) 0.90 (10) (10) (10) (10) (10) (10) (10) (10	South	0.9x	0.77	;	ĸ	9.03		x	40	6.75	x	0.76		x	0.7		= [155.64	(78)
South 0.9x 0.77 x 9.03 x 97.53 x 0.76 x 0.7 = 324.7 78 South 0.9x 0.77 x 9.03 x 110.23 x 0.76 x 0.7 = 386.99 78 South 0.9x 0.77 x 9.03 x 114.87 x 0.76 x 0.7 = 382.42 78 South 0.9x 0.77 x 9.03 x 110.55 x 0.76 x 0.7 = 382.42 78 South 0.9x 0.77 x 9.03 x 110.65 x 0.76 x 0.7 = 382.42 78 South 0.9x 0.77 x 9.03 x 110.89 x 0.76 x 0.7 = 394.83 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 344.21 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 344.21 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 344.21 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 344.21 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 344.21 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 344.21 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 774.94 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 0.56.42 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 Solar gains - internal and solar (84)m = (73)m + (83)m , waits (84)m = 581.81 679.87 740.6 78.87 740.6 78.8 0.77 0.6 63.06.9 623.73 62.034 642.22 589.43 652.67 (44 Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m 11 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86)m 12 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86)m 12 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86)m 16.81 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87)m 683 18.84 18.55 18.99 19 190.05 19.05 19.05 19.06 19.03 19 18.99 18.97 (88)m 18.19 48.85 18.99 19 190.09 0.99 0.97 0.99 1 (89)m 6.81 19.4 17.4 19.05 19.53 0.0.65 0.69 0.9 0.97 0.99 1 (89)m 6.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.18 (00 mLa Living area + (4) = 0.47 (91 Mean internal temperature (or the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (90)m 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.64 18.07 18.18 17.62 (92 17.41 17.41 18.16 18	South	0.9x	0.77	;	ĸ	9.03		x	70	6.57	x	0.76		x	0.7		= [254.91	(78)
South 0.9x 0.77 x 9.03 x 110.23 x 0.76 x 0.7 = 386.99 178 South 0.9x 0.77 x 9.03 x 114.87 x 0.76 x 0.7 = 382.42 78 South 0.9x 0.77 x 9.03 x 110.55 x 0.76 x 0.7 = 382.42 78 South 0.9x 0.77 x 9.03 x 108.01 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 339.19 78 South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 274.94 78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 78 South 0.9x 0.97 0.90 1 0.90 0.90 0.90 0.90 0.97 0.99 1 Gamma internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (8) m= 18.51 18.71 19.05 19.53 2.001 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (67 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (8) m= 18.53 18.94 18.95 18.99 19 19.05 19.05 19.06 19.03 19 18.99 18.97 (68 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90) m= 0.99 0.99 0.98 0.97 0.93 0.86 0.65 0.69	South	0.9x	0.77	;	<	9.03		x	9	7.53	x	0.76		x	0.7		= [324.7	(78)
South 0.9x 0.77 × 9.03 × 114.87 × 0.76 × 0.7 = 382.42 178 South 0.9x 0.77 × 9.03 × 110.55 × 0.76 × 0.7 = 386.03 178 South 0.9x 0.77 × 9.03 × 110.80 × 0.76 × 0.7 = 349.21 178 South 0.9x 0.77 × 9.03 × 104.89 × 0.76 × 0.7 = 349.21 178 South 0.9x 0.77 × 9.03 × 104.89 × 0.76 × 0.7 = 349.21 178 South 0.9x 0.77 × 9.03 × 104.89 × 0.76 × 0.7 = 349.21 178 South 0.9x 0.77 × 9.03 × 65.42 × 0.76 × 0.7 = 274.94 178 South 0.9x 0.77 × 9.03 × 55.42 × 0.76 × 0.7 = 184.49 178 South 0.9x 0.77 × 9.03 × 55.42 × 0.76 × 0.7 = 184.49 178 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 134.49 178 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 134.49 178 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 134.49 178 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 134.49 178 Solar gains in watts, calculated for each month (43)m = Sun(74)m(82)m (83)m = 57.36 2.84.17 330.26 376.91 394.44 380.89 37.6 368.74 346.87 278.83 166.6 135.92 Total gains – internal and sola (84)m = (73)m + (83)m, watts (84)m = 581.81 678.87 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84)m = 581.81 679.87 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84)m = 581.81 679.83 740.6 768.97 770.61 649.76 630.69 623.73 620.32 16.62.22 589.43 552.67 (84)m = 1 0.99 0.99 0.98 0.94 0.94 0.97 0.88 0.96 0.98 0.99 1 Generature during heating periods in the living area from Table 9. Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) (80)m = 18.31 18.71 19.05 19.35 10.01 20.43 20.72 20.69 20.32 19.74 19.06 18.6 (87 Temperature during heating periods in rest of dwelling from Table 9. Th2 (°C) (80)m = 18.93 18.94 18.95 18.99 19 19.05 19.05 19.06 19.03 19 18.99 18.97 (89 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m = 16.81 17.01 17.36 17.87 18.34 18.77 18.99 18.97 19.44 18.87 18.18 17.62 (92)m = 17.61 17.61 18.16 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)m = 17.61 17.61 17.81 18.19 19.51 19.8 19.78 19.44 18.87 18.18 17.62	South	0.9x	0.77	;	ĸ	9.03		x	11	0.23	x	0.76		x	0.7		= [366.99	(78)
South 0.9x 0.77 x 9.03 x 110.55 x 0.76 x 0.7 = 368.03 (78 South 0.9x 0.77 x 9.03 x 108.01 x 0.76 x 0.7 = 349.21 (78 South 0.9x 0.77 x 9.03 x 101.89 x 0.76 x 0.7 = 349.21 (78 South 0.9x 0.77 x 9.03 x 101.89 x 0.76 x 0.7 = 349.21 (78 South 0.9x 0.77 x 9.03 x 101.89 x 0.76 x 0.7 = 274.94 (78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 274.94 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 0.77 x 9.03 x 40.4 x 0.76 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 1.84 18.49 (79) (74) 18.5 (87 Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for rest of dwelling from Table 9, Th2 (°C) (8)m= 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (67 Temperature during heating periods in rest of dwelling from Table 9, 10.9 0.99 0.99 0.99 0.98 0.97 0.99 1 (89 Mean internal te	South	0.9x	0.77	2	ĸ	9.03		x	11	4.87	x	0.76		x	0.7		= [382.42	(78)
South 0.9x 0.77 × 9.03 × 108.01 × 0.76 × 0.7 = 339.59 (78 South 0.9x 0.77 × 9.03 × 104.89 × 0.76 × 0.7 = 349.21 (78 South 0.9x 0.77 × 9.03 × 101.89 × 0.76 × 0.7 = 339.19 (78 South 0.9x 0.77 × 9.03 × 101.89 × 0.76 × 0.7 = 339.19 (78 South 0.9x 0.77 × 9.03 × 55.42 × 0.76 × 0.7 = 274.94 (78 South 0.9x 0.77 × 9.03 × 55.42 × 0.76 × 0.7 = 184.49 (78 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 184.49 (78 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 134.49 (78 South 0.9x 0.77 × 9.03 × 40.4 × 0.76 × 0.7 = 134.49 (78 Solar gains in watts, calculated for each month (8)m 57.35 258.17 330.26 375 91 394.84 380.89 37.6 358.74 345.87 278.83 186.6 135.92 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m 581.81 679.87 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84 Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (65 Utilisation factor for gains for living area, h1,m (see Table 9a) Utilisation factor for gains for living area, h1,m (see Table 9a) (80)m 10.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86)m 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in the living from Table 9, Th2 (°C) (80)m 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (80)m 18.93 18.94 18.95 19.99 19 19.05 19.06 19.03 19 18.99 18.97 (88 Mean internal temperature in the rest of dwelling from Table 9a) Hilisation factor for gains for rest of dwelling from Table 9a (90)m 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.69 17.4 16.83 (90 11.4 = Living area + (4) = 0.47 19 1 Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)m 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.76 19.44 18.87 18.18 17.62 (92)m 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.76 19.44 18.47 18.16 17.62	South	0.9x	0.77	2	ĸ	9.03		x	11	0.55	x	0.76		x	0.7		= [368.03	(78)
South 0.9x 0.77 x 9.03 x 104.89 x 0.76 x 0.7 = 349.21 (78 South 0.9x 0.77 x 9.03 x 101.89 x 0.76 x 0.7 = 339.19 (78 South 0.9x 0.77 x 9.03 x 82.59 x 0.76 x 0.7 = 274.94 (78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 274.94 (78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 184.49 (78 South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 184.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 Solar gains in watts, calculated for each month (83)m + Sum(74)m(82)m (8)m= 157.35 [258.17] 390.26 376.91 394.44 380.89 37.16 368.74 346.87 278.83 186.6 135.92 Total gains - internal and solat (84)m = (73)m + (83)m, watts (84)m= 531.81 679.87 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85 Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m= 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 18.33 18.94 18.95 19.99 19 19.05 19.06 19.05 19.06 19.03 19 18.99 18.97 (88 Utilisation factor for gains for rest of dwelling from Table 9, 19 (9.05 19.06 19.03 19 18.99 18.97 (89 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 0.99 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1 (89 Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.76 19.44 18.87 18.18 17.62 (92	South	0.9x	0.77	;	ĸ	9.03		x	10	08.01	x	0.76		x	0.7		= [359.59	(78)
South $0.9x$ 0.77 x 9.03 x 101.89 x 0.76 x 0.7 $=$ 339.19 (78 South $0.9x$ 0.77 x 9.03 x 82.59 x 0.76 x 0.7 $=$ 274.94 (78 South $0.9x$ 0.77 x 9.03 x 55.42 x 0.76 x 0.7 $=$ 274.94 (78 South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 134.49 (78 South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 134.49 (78 South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 134.49 (78 Solar gains in watts, calculated for each month (83)m + Sum(74)m(82)m (83)m = 157.35 258.17 330.26 375.91 94.44 300.89 371.6 358.74 346.87 276.83 186.6 135.92 (83 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 167.35 258.17 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85 Utilisation factor for gains for living area, h1,m (see Table 9a) 30 10.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86) Mean internal temperature in living area 11 (follow steps 3 to 7 in Table 9c) (87)m = 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 18.93 18.94 18.95 18.99 19 19.05 19.05 19.06 19.03 19 18.97 0.99 1 (89 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m = 0.99 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1 (89 Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m = 17.61 17.81 18.16 18.66 19.13 19.55 19.8 19.76 19.44 18.87 18.18 17.62 (92	South	0.9x	0.77	;	ĸ	9.03		x	10)4.89	x	0.76		x	0.7		= [349.21	(78)
South $0.9x$ 0.77 x 0.03 x 82.59 x 0.76 x 0.7 $=$ 274.94 $(78$ South $0.9x$ 0.77 x 0.03 x 55.42 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 $=$ 184.49 $(78$ South $0.9x$ 0.77 0.77 x 9.03 x 40.4 380.89 371.6 356.7 345.87 278.83 186.6 135.92 $(83$ Total gains - internal and solar (84) m $=$ (73) m $+$ (83) m , watts (e4)m 581.81 679.87 740.6 768.97 770.61 689.76 630.69 623.73 620.34 662.22 589.43 552.67 $(84$ 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 $(85$ Mean internal temperature in living area, h1,m (see Table 9a) (86)m 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 $(86Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)(87)$ m 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 $(87Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)(89)$ m 18.93 18.94 18.95 18.99 19 19.05 19.06 19.03 19 18.99 18.97 $(88Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)(90)$ m 16.81 17.01 17.86 17.87 18.34 18.77 18.98 18.97 18.18 17.62 $(92164$ 11.91 11.91 11.91 11.91 11.91 11.91 11.95 119.81 11.97 11.94 11.97 11.91 11.91 11.91 11.91 11.92 11.91 11.91 11.91 11.91	South	0.9x	0.77	,	<	9.03		x	10)1.89	x	0.76		x	0.7		= [339.19	(78)
South 0.9x 0.77 x 9.03 x 55.42 x 0.76 x 0.7 = 184.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 (78 South 0.9x 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 184.49 (78 Solar gains in watts, calculated for each month (83)m + Sum(74)m(82)m (83)m = 157.35 258.17 330.26 375.91 894.44 380.89 371.6 358.74 346.87 278.83 186.6 135.92 (83 Total gains - internal and solar (84)m = (73)m + (83)m , watts (84)m 581.81 679.87 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85 Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (89)m 18.83 18.94 18.95 18.99 19 19.05 19.06 19.06 19.06 19.01 19 18.99 18.97 (88 Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (90)m 10.99 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1 (89 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.83 (90 (1A = Living area +(4) = 0.47 (91 Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.79 19.44 18.87 18.18 17.62 (92)	South	0.9x	0.77	;	ĸ	9.03		x	82	2.59	x	0.76		x	0.7		=	274.94	(78)
South $0.9x$ 0.77 x 9.03 x 40.4 x 0.76 x 0.7 = 134.49 (78 Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m 157.35 258.17 330.26 375.91 394.44 380.89 371.6 358.74 345.87 278.83 186.6 135.92 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m 581.81 679.87 740.6 766.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85 Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m 18.93 18.94 18.95 18.99 19 19.05 19.06 19.03 19 18.99 18.97 (88 Utilisation factor for gains for rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.83 (90 ILA = Living area + (4) = 0.47 (91 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.83 (90 ILA = Living area + (4) = 0.47 (91 Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)	South	0.9x	0.77	;	ĸ	9.03		x	5	5.42	х	0.76		x	0.7		= [184.49	(78)
Solar gains in watts, calculated for each month (B3)m = Sum(74)m(B2)m (B3)m = Sum(74)m(B2)m (B3)m = 157.35 258.17 330.26 375.91 394.44 380.89 371.6 358.74 345.87 278.83 186.6 135.92 Total gains – internal and solar (84)m = (73)m + (83)m, watts (B3)m = St.81 679.87 740.6 766.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (B4)m = St.81 679.87 740.6 766.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (B4)m = St.81 679.87 740.6 766.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (B4)m = St.81 552.67 (B5)m = St.	South	0.9x	0.77	;	k	9.03		x	4	0.4	x	0.76		x	0.7		= [134.49	(78)
Solar gains in watts, calculated for each month (83)m - Sum(74)m(82)m (83)m - 157.35 258.17 330.26 375.91 94.44 380.89 371.6 356.74 345.87 278.83 186.6 135.92 (83)m Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 581.81 679.87 740.6 768.97 770.61 649.76 630.69 623.73 620.34 662.22 589.43 552.67 (84)m Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)m Utilisation factor for gains for living area, h1,m (see Table 9a) Mar Apr May Jun Jul Aug Sep Oct Nov Dec 80.99 1 (86)m 1 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 1 (86)m (87)m Table 9c) (87)m Table 9c) (88)m Table 9c) (89)m Table 9c) (88)m Table 9c) (89)m Table 9c) (88)m Table 9c) (88)m Table 9c) (88)m Table 9c) (88)m Ta																			
	Sola <mark>r (</mark>	<mark>gain</mark> s in	watts, <mark>ca</mark>	lculate	d	for each me	onth	_			(83)m	n = Sum(74))m(<mark>8</mark> 2)m	_				
Total gams - internal and solar (84) m = (73)m + (83)m , watts (84) m = $581.81 - 679.87 - 740.6 - 768.97 - 770.61 - 649.76 - 630.69 - 623.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 523.73 - 620.34 - 662.22 - 589.43 - 552.67 - 523.73 - 620.74 - 663.73 - 620.75 - 6$	(83)m=	157.35	258.17	330.26		375.91 394	4.44	3	80.89	371.6	358	.74 345.8	37 2	278.83	186.6	135.9	92		(83)
	l otal g	jains – II	nternal ar	nd sola	ar	(84)m = (73)	3)m ·	+ (8	83)m ,	watts									(2.4)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85 Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.99 1 (86 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87) 18.51 18.71 19.05 19.05 19.06 19.03 19 18.99 18.55 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 18.93 18.94 18.95 18.99 19 19.05 19.06 19.03 19 18.99 18.97 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89) (89) (89)m= 0.99	(84)m=	581.81	679.87	740.6	L	768.97 770	0.61	6	49.76	630.69	623	.73 620.3	34 6	662.22	2 589.43	552.6	67		(84)
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85 Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86 (86)m= 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86 (87)m= 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 18.93 18.94 18.95 18.99 19 19.05 19.06 19.03 19 18.97 (88 Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89 (89 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.83	7. Me	ean inter	nal temp	erature	e (heating sea	ason)											
Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 0.99 0.99 0.98 0.96 0.94 0.87 0.88 0.95 0.98 0.99 1 (86 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 18.51 18.71 19.05 19.53 20.01 20.43 20.72 20.69 20.32 19.74 19.06 18.5 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 18.93 18.94 18.99 19 19.05 19.06 19.03 19 18.97 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1 (89 (89)m= 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1 (89	Temp	perature	during he	eating	pe	eriods in the	e livi	ng	area f	rom Tak	ole 9	, Th1 (°C))					21	(85)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Utilis	ation fac	tor for ga	ins for	· liv	ving area, ł	1,m	ı (s	ee Tal	ble 9a)	·				-1				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Jan	Feb	Mar	\downarrow	Apr N	/lay		Jun	Jul	A	ug Se	p	Oct	Nov	De	ЭC		
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) $(87)m=$ 18.5118.7119.0519.5320.0120.4320.7220.6920.3219.7419.0618.5(87)Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) $(88)m=$ 18.9318.9418.9518.991919.0519.0519.0619.031918.9918.97(88)Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) $(89)m=$ 0.990.990.980.970.930.860.650.690.90.970.991(89)Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)(90)m=16.8117.0117.8718.3418.7718.9818.9718.6618.0917.416.83(90)Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2(92)m=17.6117.8118.1618.6519.1319.5519.819.7819.4418.8718.1817.62(92)	(86)m=	1	0.99	0.99		0.98 0.	96	(0.94	0.87	0.8	38 0.95	5	0.98	0.99	1			(86)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Mear	interna	l tempera	ature ir	۱ li	ving area T	⁻ 1 (fo	ollo	w step	os 3 to 7	7 in T	able 9c)							
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)(88)m=18.9318.9418.9518.991919.0519.0619.031918.9918.97(88Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)(89)m= 0.99 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1(89Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)(90)m=16.8117.0117.3617.8718.3418.7718.9818.9718.6618.0917.416.83(90Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2(92)m=17.6117.8118.1618.6519.1319.5519.819.7819.4418.8718.1817.62(92	(87)m=	18.51	18.71	19.05		19.53 20	.01	2	20.43	20.72	20.	69 20.3	2	19.74	19.06	18.5	5		(87)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Temp	erature	during he	eating	pe	eriods in res	st of	dw	velling	from Ta	able 9	9, Th2 (°C	C)						
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.99 0.99 0.98 0.97 0.93 0.86 0.65 0.69 0.9 0.97 0.99 1 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90) (90)m= 16.81 17.01 17.36 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.83 (90) FLA × T1 + (1 – fLA) × T2 (92)m= 17.61 17.81 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)	=m(88)	18.93	18.94	18.95		18.99 1	19	1	9.05	19.05	19.	06 19.0	3	19	18.99	18.9	7		(88)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Utilis	ation fac	tor for ga	ins for	· re	est of dwell	ing,	h2,	,m (se	e Table	9a)								
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 16.81 17.01 17.87 18.34 18.77 18.98 18.97 18.66 18.09 17.4 16.83 (90 Image: FLA string area + (4) = 0.47 (91 Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.61 17.81 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92	(89)m=	0.99	0.99	0.98	Τ	0.97 0.	93		0.86	0.65	0.6	69 0.9		0.97	0.99	1			(89)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Mear	interna	l tempera	ature ir	n tł	ne rest of d	welli	ina	T2 (fc	ollow ste	eps 3	to 7 in Ta	able	9c)					
fLA = Living area \div (4) = (91 Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)	(90)m=	16.81	17.01	17.36	T	17.87 18	.34	1	8.77	18.98	18.	97 18.6	6	18.09	17.4	16.8	3		(90)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 17.61 17.81 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)		L	LI			I		1	I		I	I	fLA	۱ = Liv	ring area ÷ (4	4) =	\dashv	0.47	(91)
(92)m = 17.61 17.81 18.16 18.65 19.13 19.55 19.8 19.78 19.44 18.87 18.18 17.62 (92)	Mear	interna	l tempera	ature (f	'nr	the whole	dwo	llin	a) = ti	Δ 🗙 Τ1	+ (1	_ fl Δ) γ ⁻	Т2				L		
	(92)m=	17.61	17.81	18.16	Ť	18.65 19	.13	1	9.55	19.8	19.	78 19.4	4	18.87	18.18	17.6	2		(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.06	18.26	18.61	19.1	19.58	20	20.25	20.23	19.89	19.32	18.63	18.07		(93)
8. Spa	ace hea	ting req	uiremen	t										
Set Ti the ut	i to the ilisation	mean int factor fo	ternal te or gains	mperatu using Ta	re obtain able 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	ו:										
(94)m=	0.99	0.99	0.98	0.97	0.94	0.91	0.81	0.83	0.93	0.97	0.99	0.99		(94)
Usefu	Il gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	578.14	672.76	727.91	746.09	726.85	589.19	510.25	516.2	576.2	642.09	583.21	549.75		(95)
Month	nly aver	age exte	ernal terr	nperature	e from Ta	able 8	10.0	40.4		10.0	74	10		(00)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	(00)	10.6	7.1	4.2		(90)
Heat	2904 1	12807.46	an interr	1 $\frac{1}{2087.04}$	1605.46	Lm , vv =	=[(39)m] 727.02	x [(93)m 759.83	- (96)m	1775.66	2370 29	2875 98		(97)
Space	heatin		ement fo		$\frac{1000.40}{1000.40}$	//h/moni	h = 0.02	24 x [(97)	m = (95))ml x (4^{\prime})	1)m	2010.00		(07)
(98)m=	1730.51	1434.52	1342.58	965.48	653.69	0	0.02			843.37	1286.7	1730.72		
				I				Tota	l per vear	(kWh/vear) = Sum(9	8)1 59 12 =	9987.56	(98)
Space	e heatin	g require	ement ir	ı kWh/m²	/year					(,(-	- /	195.83](99)
9a En	erav red		nts – Ind	ividual h	eating s	ustems i	ncludina	micro-C	HP)]
Snac	e heati	na.					nciuunig		, , ,					
Fracti	on of s	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of s	bace hea	at from n	nain syst	em(s)			(20 <mark>2)</mark> = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sv	stem 1			(204) = (2	02) × [1 –	(203)] =			1] (204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								65.9	(206)
Efficie	ency of	seconda	rv/suppl	ementar	v heatin	n system	n %						0] (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aua	Sep	Oct	Nov	Dec	kWh/vea	ar
Space	e heatin	g require	ement (d	calculate	d above)							1	
	1730.51	1434.52	1342.58	965.48	653.69	0	0	0	0	843.37	1286.7	1730.72		
(211)m	n = {[(98	s)m x (20)4)]}x´	100 ÷ (20)6)									(211)
	2625.97	2176.81	2037.29	1465.07	991.94	0	0	0	0	1279.78	1952.5	2626.28		
I				•				Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	=	15155.63	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)]	00 ÷ (20)8)										
(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	9												
Output	132.03	$\frac{1}{38671}$	$\frac{1}{120.09}$	$1_{395,94}$	bove)	207.06	208.45	300 35	303 12	109.62	108 70	128 16		
Efficier		ater hea	420.03	333.34	402.03	297.00	230.43	303.33	303.12	403.02	400.79	420.10	55.8	7(216)
(217)m-	63.6	63.46	63 17	62.6	61 65	55.8	55.8	55.8	55.8	62.22	63.14	63.62	00.0	(217)
Fuel fo	r water	heating	k\//h/m	onth	01.00	00.0	00.0	00.0	00.0	02.22	00.14	00.02		()
(219)m	n = (64)	<u>m x 10</u>) ÷ (217)m										
(219)m=	679.28	609.37	664.97	632.45	652.12	532.36	534.86	554.4	543.23	658.36	647.4	673.04		_
								Tota	I = Sum(2)	19a) ₁₁₂ =			7381.84	(219)
Annua	l totals									k	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								15155.63	

Water heating fuel used			7381.84	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45	=	(230e)
Total electricity for the above kWh/year	sum of (230a)(230g) =		` (231)
Electricity for lighting	× ·		407.00	(222)
			407.66	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	3273.62	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	1594.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =		4868.09	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	104.32	(267)
Electricity for lighting	(232) x	0.519 =	211.57	(268)
Total CO2, kg/year	sum	of (265)(271) =	5183.99	(27 <mark>2)</mark>
Dwelling CO2 Emission Rate	(272)) ÷ (4) =	101.65	(273)
El rating (section 14)			35	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2 Dr	oportu	Stroma Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.3.4	
	london	PI	openy <i>F</i>	Address.	Unit 5					
1 Overall dwelling dime	nsions:									
Basement			Area	1(m²)	(1a) x	Av. He	ight(m) .08	(2a) =	Volume(m³ 522.24) (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)) 1	28	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	522.24	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	$ \begin{array}{ccc} main & so \\ heating & h \\ \hline 0 & + \\ \hline 0 & + \\ \end{array} $	econdary neating 0 0	/ · · · · · · · · · · · · · · · · · · ·	0 0] = [total 0 0	x 2	40 = 20 =	m³ per hou 0 0	r (6a) (6b)
Number of intermittent far	ns					3	x ′	10 =	30	(7a)
Number of passive vents					Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fir	res				Ē	0	X 4	⁴⁰ = Air ch	0 ange <mark>s per</mark> ho	(7c)
Infiltration due to chimney If a pressurisation test has be Number of storeys in th	vs, flues and fans = (6 een carried out or is intende ne dwelling (ns)	a)+(6b)+(7a ed, proceed	a)+(7b)+(7 to (17), o	(c) = htherwise c	ontinue fre	30 om (9) to ((16)	÷ (5) =	0.06	(8) (9)
Additional infiltration Structural infiltration: 0. if both types of wall are pri deducting areas of openin	25 for steel or timber resent, use the value corres rgs); if equal user 0.35	frame or ponding to	0.35 for	masonr er wall area	y constr a (after	uction	[(9)·	-1]x0.1 =	0	(10) (11)
If suspended wooden fi	loor, enter 0.2 (unseal	ed) or 0.7	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, eise enter 0	rinned							0	(13)
Window infiltration	s and doors draught si	nppeu		0.25 - [0.2	x (14) ÷ 1	001 =			0	-(14)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	= (15) $=$ (16)
Air permeability value,	q50, expressed in cub	oic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	20	(17)
If based on air permeabili	ty value, then (18) = [(1	7) ÷ 20]+(8), otherwis	se (18) = (16)		·		1.06	(18)
Air permeability value applies	s if a pressurisation test has	s been done	e or a deg	ree air per	meability	is being u	sed			_
Number of sides sheltere	d			(20) 4 [0 07E v (4	0)]			2	(19)
Shelter factor	in a choltor footor			(20) = 1 - [(21) - (19)	0.075 X (1	9)] =			0.85	(20)
Infiltration rate incorporati	ing shelter lactor	J		(21) = (10)	x (20) =				0.9	(21)
	Mar Apr May		lul	Διια	Son	Oct	Nov	Dec		
Monthly overage wind an	and from Table 7		Jui	Aug	Oep	001		Dec		
$(22)m = \begin{bmatrix} 5.1 \\ 5 \end{bmatrix}$		3.8	3.8	3.7	4	4.3	4.5	4.7		
			2.0	5.7			I			
Wind Factor $(22a)m = (22a)m = (2$	2)m ÷ 4 1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
	I						Į	1		

Adjusted infiltr	ation rate	e (allowi	ng for sł	nelter an	d wind s	peed) =	: (21a) x	(22a)m				_	
1.15	1.12	1.1	0.99	0.97	0.85	0.85	0.83	0.9	0.97	1.01	1.06		
Calculate effe	ctive air i	change i tion:	rate for t	he appli	cable ca	se							(22.0)
If exhaust air h		uon. Ising Anny	andix N (2	(23a) – (23a	a) v Emv (e	austion (I	N5)) othe	rwise (23h	u) – (23a)			0	(238)
If balanced with	heat reco		iency in %	allowing f	or in-use f	actor (fron	n Table 4h) –) – (23a)			0	(230)
) = (0)	0h)	00h) [4 (00-)	0	(23c)
							HR) (248	a = (2)	20)m + (. 1	23D) × [⁻	1 - (23C)) ÷ 100]]	(242)
		0			0	0					0	J	(24d)
					neat rec		VIV) (240 1	m = (22)	20)m + (/ 	23D)		1	(24b)
	0	0		0	0	0	0		0	0	0	J	(240)
C) IT Whole n if (22b)r	$r \sim 0.5 x$	(23b) t	itilation (hen (24)	or positiv	e input \); otherv	/entilatio	c) = (22)	outside	5 v (23h	N)			
(24c)m = 0		0		0		0	$\frac{1}{1}$ 0				0	1	(24c)
d) If natural	vontilatio					vontilati	on from l		Ů	Ů		J	
if (22b)r	n = 1, the	en (24d)	m = (22)	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m ² x	0.5]				
(24d)m= 1.15	1.12	1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06]	(24d)
Effective air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	ld) in bo	k (25)					
(25)m= 1.15	1.12	1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06		(25)
2 Heat loopa	a and ha	at loop i						•					_
					Not Ar	00					k volu		
	area	(m^2)	Openin	ys 2			U-val	ue	AAU		K-value	5	
	alou			I-	А,	n r	VV/m2	2K	(VV/ł	K)	kJ/m ² ·	K	kJ/K
Doo <mark>rs Ty</mark> pe 1	aroa	(111)			2.8	П ²	VV/m2	2K =	(VV/I 3.92	K)	kJ/m²-	ĸ	kJ/K (26)
Doo <mark>rs Ty</mark> pe 1 Doors Type 2	ulou				2.8	П ² Х	W/m2	:К = = =	(VV/I 3.92 2.1	K)	kJ/m ² ·	ĸ	kJ/K (26) (26)
Doors Type 1 Doors Type 2 Windows Type	e 1				2.8 1.5	x x x x	VV/m2 1.4 1.4 /[1/(4.8)+	2K = = = 0,04] =	(W/ł 3.92 2.1 69.87	K)	kJ/m²-	ĸ	KJ/K (26) (26) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type	e 1				A, I 2.8 1.5 17.35 2.48	x x x x x1 x1	VV/m2 1.4 /[1/(4.8)+ /[1/(1.6)+	2K = 0.04] =	(W/ł 3.92 2.1 69.87 3.73		kJ/m²-I	K	kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type	e 1 e 2 e 3				A, I 2.8 1.5 17.35 2.48 15	x x x x1 x1 x1	VV/m2 1.4 /[1/(4.8)+ /[1/(1.6)+ /[1/(4.8)+	<pre>!K = = 0.04] = 0.04] = 0.04] =</pre>	(W/ł 3.92 2.1 69.87 3.73		kJ/m²+	K	kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor	e 1 e 2 e 3				A,I 2.8 1.5 17.35 2.48 1.5 1.5	x x x1 x1 x1 x1	VV/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	<pre>!K = = 0.04] = 0.04] = 0.04] =</pre>	(W/I 3.92 2.1 69.87 3.73 6.04		kJ/m²-I		kJ/K (26) (26) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor	2 ≥ 3				A, I 2.8 1.5 17.35 2.48 1.5 128	x x x1 x1 x1 x1 x1	VV/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1	!K = = 0.04] = 0.04] = 0.04] = = = =	(W/H 3.92 2.1 69.87 3.73 6.04 101.12		kJ/m²-		kJ/K (26) (27) (27) (27) (27) (28)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1	2 2 3 74.2	6	18.8	5	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41	x x x1 x1 x1 x1 x1 x1 x2 x	VV/m2 1.4 1.4 /[1/(4.8)+ /[1/(1.6)+ /[1/(4.8)+ 0.79 2.1	!K = 0.04] = 0.04] = 0.04] = = = = = = = =	(W/I 3.92 2.1 69.87 3.73 6.04 101.12 116.36		kJ/m²-1		kJ/K (26) (27) (27) (27) (27) (28) (29)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2	1 0 1 ⇒ 2 ⇒ 3	6	18.8 ¹ 5.28	5	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12	x x x1 x1 x1 x1 x1 x2 x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28	!K = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = =	(W/H 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51		kJ/m²-		kJ/K (26) (27) (27) (27) (27) (28) (29) (29)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3	 1 2 3 74.2 46.4 71.1 	6 4 6	18.8 ¹ 5.28 1.5	5	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66	x x x1 x1 x1 x1 x1 x2 x x x x x x x x	W/m2 1.4 1.4 (1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1	!K = 0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type4	$\begin{array}{c} 1 \\ 2 \\ 2 \\ 3 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline$	6 4 6 4	18.83 5.28 1.5 0	5	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34	x x x x x x x x x x x x x x x x x x x	VV/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3	!K = 0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type4 Roof	$ \begin{array}{c} 1 \\ 2 \\ 2 \\ 3 \\ \end{array} $ $ \begin{array}{c} 74.2 \\ 46.4 \\ \overline{71.1} \\ \overline{5.34} \\ \overline{17} \\ \end{array} $	6 4 6 4	18.84 5.28 1.5 0 0	5	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17	x x x1 x2 x3 x4	W/m2 1.4 1.4 1.4 (1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3 0.1	!K = 0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 1.7		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (29) (30)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type4 Roof Total area of e	$ \begin{array}{c} 1 \\ 2 \\ 2 \\ 3 \\ \end{array} $ $ \begin{array}{c} 74.2 \\ 46.4 \\ \hline 71.1 \\ 5.34 \\ \hline 17 \\ \end{array} $ elements	6 4 6 4 , m ²	18.8 5.28 1.5 0 0	5	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.10	Implement X X X	W/m2 1.4 1.1 0.79 2.1 0.28 2.1 0.3 0.1	! = .0.04] = .0.04] = .0.04] = .0.04] =	(WV/I 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 1.7		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type3 Walls Type3 Walls Type4 Roof Total area of e Party wall	$ \begin{array}{c} 1 \\ 2 \\ 2 \\ 2 \\ $	6 4 6 4 , m ²	18.83 5.28 1.5 0	5	A, 1 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.10 22.1	$ \begin{array}{c} $	W/m2 1.4 1.1 0.28 2.1 0.3 0.1 0	!K = 0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 1.7		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type3 Walls Type3 Walls Type3 Walls Type4 Roof Total area of e Party wall	$\begin{bmatrix} 1 \\ 2 \\ 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} 74.2 \\ 46.4 \\ \hline 71.1 \\ 5.34 \\ \hline 17 \\ elements$	6 4 6 4 , m ² bws, use e sides of ir	18.8 5.28 1.5 0 0 0 0 0 0 0 0 0 0 0 0	5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.10 22.1 alue calcula titions	Implement X X X	VV/m2 1.4 0.79 2.1 0.28 2.1 0.3 0.1 0	:K : 0.04] =	(WV/I 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 1.7 0 <i>u</i> e)+0.04 <i>J</i> a	<	paragraph		 kJ/K (26) (27) (27) (27) (27) (29) (29) (29) (29) (29) (30) (31) (32)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type3 Walls Type3 Walls Type3 Walls Type4 Roof Total area of e Party wall * for windows and ** include the area Fabric heat los	$\begin{array}{c} 1 \\ 2 \\ 2 \\ 3 \\ \hline 74.2 \\ \hline 46.4 \\ \hline 71.1 \\ \hline 5.34 \\ \hline 17 \\ 17 \\$	6 4 6 4 , m ² bws, use e sides of ir = S (A x	18.83 5.28 1.5 0 0 effective winternal walk	5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	A, I 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.10 22.1 alue calculations	Implement X X X	VV/m2 1.4 0.79 2.1 0.28 2.1 0.3 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	$\begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 1.7 0 <i>Je)+0.04] a</i>	<)	kJ/m².	K	 kJ/K (26) (27) (27) (27) (27) (29) (29) (29) (29) (29) (30) (31) (32)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type3 Walls Type4 Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity	$\begin{array}{c} 1 \\ 2 \\ 2 \\ 3 \\ \hline \\ 74.2 \\ \hline \\ 46.4 \\ \hline \\ 71.1 \\ \hline \\ 5.34 \\ \hline \\ 17 \\ \hline \\ 10 \\ 17 \\ \hline \\ 17 \\ \hline \\ 17 \\ \hline \\ 17 \\ \hline \\ 17 \\ \hline \\ 10 \\ 17 \\ \hline \\ 17 \\ 17$	6 4 6 4 , m ² bws, use e sides of ir = S (A x A x k)	18.84 5.28 1.5 0 0 effective wi internal walk	5 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	A, 1 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.10 22.1 alue calculations	Implement X X X	VV/m2 1.4 1.1 0.28 2.1 0.28 2.1 0.3 0.1 0 0 formula 1 (26)(30)	$\begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ $	(WV/I 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 1.7 0 <i>Je</i>)+0.04] a	<pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre> <pre></pre>	kJ/m ² .	K	kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (31) (32) 24 (33)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

52 (

if detail	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)			(22) .	(26) -			540.04	
Ventil	ablic he	at loss of	alculator	monthly	M.				(38)m	(30) =	25)m x (5)		516.24	(37)
ventile	Jan	Feb	Mar	Apr	y Mav	Jun	Jul	Αυα	Sen		Nov	Dec	1	
(38)m=	197.5	193.63	189.76	170.4	166.62	149	149	145.73	155.79	166.62	174.27	182.01		(38)
Heat t	ransfer o	ı coefficier	nt W/K		ļ				(39)m	= (37) + (3	1 38)m	ļ	1	
(39)m=	713.74	709.87	705.99	686.64	682.86	665.24	665.24	661.97	672.02	682.86	690.5	698.25]	
									,	Average =	Sum(39)1	₁₂ /12=	686.26	(39)
Heat I	oss para	meter (H	HLP), W	′m²K					(40)m	= (39)m ÷	(4)			
(40)m=	5.58	5.55	5.52	5.36	5.33	5.2	5.2	5.17	5.25	5.33	5.39	5.46		_
Numb	er of day	/s in mo	nth (Tab	le 1a)						Average =	Sum(40)1	12 /12=	5.36	(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. W	ater hea	ting ene	rgy requ	irement:								kWh/y	ear:	
Accur		IDODOV	NI										1	(40)
if TF	FA > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0)013 x (⁻	TFA -13.	2. .9)	89	J	(42)
if TF	-A £ 13.	9, N = 1											_	
Annua	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36 a water us	se target o	10	2.83		(43)
not mor	e that 125	litres per	person pe	day (all w	ater use, l	hot and co	ld)		a water at	se larger o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	ter usage i	n litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from	Table 1c x	(43)					1	
(44)m=	113.11	109	104.88	100.77	96.66	92.55	92.55	96.66	100.77	104.88	109	113.11		
			<u> </u>							Total = Su	m(44) ₁₁₂ =	=	1 <mark>2</mark> 33.94	(44)
Energy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	_	
(45)m=	167.74	146.71	151.39	131.98	126.64	109.28	101.27	116.2	117.59	137.04	149.59	162.45		_
lf instar	tanoous	ator hooti	na ot point	of uso (n	hot wata	r storago)	ontor 0 in	boyos (16) to (61)	Total = Su	m(45) ₁₁₂ =	=	1617.89	(45)
ii iiistai						siorage),							1	(40)
(46)m= Water	25.16 storage	22.01	22.71	19.8	19	16.39	15.19	17.43	17.64	20.56	22.44	24.37		(46)
Storag	ge volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		160	1	(47)
If com	, munity h	eating a	and no ta	ink in dw	vellina, e	nter 110) litres in	(47)					1	
Other	wise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:											_	
a) If n	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature factor from Table 2b												0		(49)
Energy lost from water storage, kWh/year (4								(48) x (49)	=		1	60		(50)
b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWb/litre/day)											0	05	1	(51)
If com	munity h	eating s	see secti	on 4.3		,	~ 1 /				L0.	00	1	
Volum	, ne factor	from Ta	ble 2a								0.	91]	(52)
Temp	erature f	actor fro	m Table	2b							0.	78]	(53)
Energ	y lost fro	m water	⁻ storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	5.	85]	(54)
Enter	(50) or	(54) in (5	55)				5.85						(55)	

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(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	lix H	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24]	(57)
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				-	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m					_	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
Total h	eat requ	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=	477.36	426.36	461	431.61	436.26	326.59	325.82	340.76	334.9	446.66	449.22	472.06]	(62)
Solar DI	-IW input o	calculated	using App	endix G oı	r 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 \	NWHRS	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=	477.36	426.36	461	431.61	436.26	326.59	325.82	340.76	334.9	446.66	449.22	472.06		
								Outp	out from w	ater heate	r (annual)₁	12	4928.59	(64)
Hea <mark>t g</mark>	ains froi	m water	heating,	kWh/m	onth 0.2	<mark>5 ´</mark> [0.85	× (45)m	+ (61)n	n] + 0.8 x	د [(4 <mark>6)m</mark>	+ (57)m	+ (59)m]	
(65)m=	158.48	141.5 <mark>4</mark>	153.04	143.27	144.8 <mark>1</mark>	<mark>6</mark> 9.87	68.32	73 .29	72.63	148.27	149.13	156.72		(65)
inclu	ıde (57)ı	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ate <mark>r is fr</mark>	om com	<mark>mu</mark> nity h	neating	
inclu 5. Int	ıde (57)ı ternal ga	m in calo ains (see	culation Table 5	of (65)m 5 and 5a	only if c):	ylinder is	s in the c	dwelling	or hot w	ater is fr	rom com	munity h	neating	
inclu 5. Int Metabo	ıde (57)ı ternal ga olic gain	m in calo ains (see as (Table	culation Table 5), Wat	of (65)m and 5a	only if c):	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	neating	
inclu 5. Int Metab	ıde (57)ı ternal ga olic gain Jan	m in calo ains (see s (Table Feb	culation Table { 5), Wat Mar	of (65)m o and 5a ts Apr	only if c): May	ylinder is Jun	s in the o	dwelling	or hot w Sep	ater is fr Oct	om com	munity h Dec	neating	
inclu 5. Int Metabo (66)m=	ide (57)i ternal ga olic gain Jan 144.48	m in calo ains (see s (Table Feb 144.48	culation Table 5 5), Wat Mar 144.48	of (65)m 5 and 5a ts Apr 144.48	only if c): May 144.48	ylinder is Jun 144.48	s in the c Jul 144.48	dwelling Aug 144.48	or hot w Sep 144.48	ater is fr Oct 144.48	Nov	munity h Dec 144.48	neating	(66)
inclu 5. Int Metabo (66)m= Lightin	ide (57)i iernal ga olic gain Jan 144.48 g gains	m in calo ains (see s (Table Feb 144.48 (calcula	ted in Ap	of (65)m and 5a ts Apr 144.48 opendix	only if c): May 144.48 L, equati	Jun 144.48	s in the o Jul 144.48 r L9a), a	Aug 144.48 Iso see	or hot w Sep 144.48 Table 5	Oct	Nov	Dec	neating	(66)
inclu 5. Inf Metabo (66)m= Lightin (67)m=	ide (57)i ernal ga olic gain Jan 144.48 g gains 45.52	m in calo ains (see s (Table Feb 144.48 (calcula 40.43	ted in Apple 32.88	of (65)m and 5a ts Apr 144.48 opendix 24.89	only if c): 144.48 L, equati 18.61	Jun 144.48 ion L9 ol 15.71	5 in the o Jul 144.48 r L9a), a 16.97	Aug 144.48 Iso see 22.06	or hot w Sep 144.48 Table 5 29.61	Oct 144.48 37.6	om com Nov 144.48 43.88	Dec 144.48 46.78	heating	(66) (67)
inclu 5. Int Metabo (66)m= Lightin (67)m= Applia	ide (57)i ernal ga olic gain Jan 144.48 g gains 45.52 nces ga	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc	ted in Ap 32.88 culated in Ap	of (65)m and 5a ts Apr 144.48 opendix 24.89 Append	only if c): May 144.48 L, equati 18.61 dix L, eq	Jun 144.48 ion L9 of 15.71 uation L	Jul 144.48 r L9a), a 16.97 13 or L1	Aug 144.48 Iso see ⁻ 22.06 3a), also	or hot w Sep 144.48 Table 5 29.61 o see Ta	Oct 144.48 37.6 ble 5	Nov 144.48	Dec 144.48 46.78	heating	(66) (67)
inclu 5. int Metabo (66)m= Lightin (67)m= Appliat (68)m=	ide (57)i ernal ga olic gain Jan 144.48 g gains 45.52 nces ga 295.29	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36	ted in Ap 32.88 culated in 25), Wat Mar 144.48 ted in Ap 32.88 culated in 290.64	of (65)m 5 and 5a ts Apr 144.48 5 pendix 24.89 6 Append 274.2	only if c): 144.48 L, equati 18.61 dix L, eq 253.45	Jun 144.48 ion L9 of 15.71 uation L ² 233.94	Jul 144.48 r L9a), a 16.97 13 or L1 220.91	Aug 144.48 Iso see 22.06 3a), also 217.85	or hot w Sep 144.48 Table 5 29.61 29.61 225.57	ater is fr Oct 144.48 37.6 ble 5 242.01	Nov 144.48 43.88 262.76	Dec 144.48 46.78 282.26	heating	(66) (67) (68)
inclu 5. int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir	ide (57)i ernal ga olic gain Jan 144.48 g gains 45.52 nces ga 295.29 ng gains	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula	ted in Ap 290.64 291, Wat 144.48 144.48 144.48 144.48 144.48 144.48 144.48	of (65)m and 5a ts Apr 144.48 opendix 24.89 Append 274.2 opendix	only if c): 144.48 L, equati 18.61 dix L, eq 253.45 L, equat	Jun 144.48 ion L9 or 15.71 uation L 233.94 ion L15	Jul 144.48 r L9a), a 16.97 13 or L13 220.91 or L15a)	Aug 144.48 Iso see 22.06 3a), also 217.85), also se	or hot w Sep 144.48 Table 5 29.61 29.61 225.57 ee Table	ater is fr Oct 144.48 37.6 ble 5 242.01 5	OM COM Nov 144.48 43.88 262.76	Dec 144.48 46.78 282.26	heating	(66) (67) (68)
inclu 5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m=	ide (57)i ernal ga olic gain 144.48 g gains 45.52 nces ga 295.29 ng gains 37.45	m in calo ains (see Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula 37.45	culation Table 5 5), Wat Mar 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45	of (65)m and 5a ts Apr 144.48 opendix 24.89 Appendix 274.2 opendix 37.45	only if c): 144.48 L, equati 18.61 dix L, eq 253.45 L, equat 37.45	Jun 144.48 ion L9 of 15.71 uation L 233.94 ion L15 37.45	S in the o Jul 144.48 r L9a), a 16.97 13 or L13 220.91 or L15a) 37.45	Aug 144.48 Iso see 22.06 3a), also 217.85), also se 37.45	or hot w Sep 144.48 Table 5 29.61 29.61 225.57 225.57 20 Table 37.45	ateris fr Oct 144.48 37.6 ble 5 242.01 5 37.45	Nov 144.48 43.88 262.76 37.45	Dec 144.48 46.78 282.26 37.45	heating	(66) (67) (68) (69)
inclu 5. int Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps	ide (57) ernal ga olic gain Jan 144.48 g gains 45.52 nces ga 295.29 ng gains 37.45 s and far	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula 37.45 ns gains	culation Table (5), Wat 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45 (Table (of (65)m and 5a ts 144.48 ppendix 24.89 Append 274.2 ppendix 37.45 5a)	only if c): 144.48 L, equati 18.61 dix L, eq 253.45 L, equat 37.45	Jun 144.48 ion L9 of 15.71 uation L 233.94 ion L15 37.45	s in the o Jul 144.48 r L9a), a 16.97 13 or L13 220.91 or L15a) 37.45	Aug 144.48 Iso see 22.06 3a), also 217.85 , also se 37.45	or hot w Sep 144.48 Table 5 29.61 225.57 ee Table 37.45	ater is fr Oct 144.48 37.6 ble 5 242.01 5 37.45	OM COM Nov 144.48 43.88 262.76 37.45	Dec 144.48 46.78 282.26 37.45	heating	(66) (67) (68) (69)
inclu 5. int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	ide (57)i ernal ga olic gain 144.48 g gains 45.52 nces gai 295.29 ng gains 37.45 s and far 10	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calcula 298.36 (calcula 37.45 ns gains 10	Culation Table (5), Wat Mar 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45 (Table (10	of (65)m and 5a ts Apr 144.48 opendix 24.89 Appendix 274.2 opendix 37.45 5a) 10	only if c): 144.48 L, equat 18.61 dix L, eq 253.45 L, equat 37.45	Jun 144.48 ion L9 of 15.71 uation L 233.94 ion L15 37.45	Jul 144.48 r L9a), a 16.97 13 or L13 220.91 or L15a) 37.45	Aug 144.48 Iso see 22.06 3a), also 217.85), also se 37.45	or hot w Sep 144.48 Table 5 29.61 29.61 225.57 20 Table 37.45 10	ater is fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10	0m com Nov 144.48 43.88 262.76 37.45	Dec 144.48 46.78 282.26 37.45	heating	(66) (67) (68) (69) (70)
inclu 5. int Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses	ide (57) ernal ga olic gain Jan 144.48 g gains 45.52 nces ga 295.29 ng gains 37.45 s and far 10 s e.g. ev	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula 37.45 ns gains 10 raporatic	ted in Ap 290.64 (Table 5), Wat 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45 (Table 5 10 on (nega	of (65)m 5 and 5a ts Apr 144.48 ppendix 24.89 a Append 274.2 ppendix 37.45 5a) 10 tive valu	only if c): 144.48 L, equati 18.61 dix L, eq 253.45 L, equat 37.45 10 es) (Tab	Jun 144.48 ion L9 of 15.71 uation L 233.94 ion L15 37.45 10 le 5)	s in the o Jul 144.48 r L9a), a 16.97 13 or L1: 220.91 or L15a) 37.45	Aug 144.48 Iso see 22.06 3a), also 217.85), also se 37.45	or hot w Sep 144.48 Table 5 29.61 225.57 ee Table 37.45	ate r is fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10	Nov 144.48 43.88 262.76 37.45	Dec 144.48 46.78 282.26 37.45	heating	(66) (67) (68) (69) (70)
inclu 5. int Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	ide (57)i ernal ga olic gain Jan 144.48 g gains 45.52 nces gai 295.29 ng gains 37.45 and far 10 s e.g. ev -115.58	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula 37.45 ns gains 10 raporatic -115.58	Culation Table (5), Wat Mar 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45 (Table (10 on (nega -115.58	of (65)m and 5a ts 144.48 opendix 24.89 Appendix 274.2 opendix 37.45 5a) 10 tive valu -115.58	only if c): 144.48 L, equati 18.61 dix L, equati 253.45 L, equati 37.45 10 es) (Tab -115.58	ylinder is Jun 144.48 ion L9 of 15.71 uation L 233.94 ion L15 37.45 10 le 5) -115.58	s in the o Jul 144.48 r L9a), a 16.97 13 or L13 220.91 or L15a) 37.45 10	Aug 144.48 Iso see 22.06 3a), also 217.85), also se 37.45 10	or hot w Sep 144.48 Table 5 29.61 29.61 225.57 ee Table 37.45 10	ater is fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10 -115.58	OM COM Nov 144.48 43.88 262.76 37.45 10 -115.58	Dec 144.48 46.78 282.26 37.45 10 -115.58	heating	(66) (67) (68) (69) (70) (71)
inclu 5. int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water	ide (57)i ernal ga olic gain 144.48 g gains 45.52 nces gai 295.29 ng gains 37.45 s and far 10 s e.g. ev -115.58 heating	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calcula 298.36 (calcula 37.45 ns gains 10 raporatic -115.58 gains (T	Culation Table 5 5), Wat Mar 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45 (Table 5 10 on (nega -115.58 Table 5)	of (65)m and 5a ts Apr 144.48 opendix 24.89 Appendix 274.2 opendix 37.45 5a) 10 tive valu -115.58	only if c): 144.48 L, equat 18.61 dix L, equat 253.45 L, equat 37.45 10 es) (Tab -115.58	ylinder is Jun 144.48 ion L9 or 15.71 uation L 233.94 ion L15 37.45 10 le 5) -115.58	Jul 144.48 r L9a), a 16.97 13 or L12 220.91 or L15a) 37.45 10	Aug 144.48 Iso see 22.06 3a), also 217.85 0, also se 37.45 10 -115.58	or hot w Sep 144.48 Table 5 29.61 29.61 29.61 29.61 225.57 29.61 225.57 20.61 225.57 20.61 225.57 20.61 225.57 20.61 225.57 20.61 225.57 20.61 225.57 20.61 225.57 20.61	ateris fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10 -115.58	Nov 144.48 43.88 262.76 37.45 10 -115.58	Dec 144.48 46.78 282.26 37.45 10 -115.58	heating	(66) (67) (68) (69) (70) (71)
inclu 5. inf Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ide (57) ernal ga olic gain Jan 144.48 g gains 45.52 nces ga 295.29 ng gains 37.45 s and far 10 s e.g. ev -115.58 heating 213	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula 37.45 ns gains 10 raporatic -115.58 gains (T 210.63	Culation Table (5), Wat Mar 144.48 ted in Ap 32.88 culated in 290.64 ated in A 37.45 (Table (10 on (nega -115.58 Table 5) 205.7	of (65)m 5 and 5a ts Apr 144.48 ppendix 24.89 a Append 274.2 ppendix 37.45 5a) 10 tive valu -115.58	only if c): 144.48 L, equati 18.61 dix L, equati 253.45 L, equati 37.45 10 es) (Tab -115.58	ylinder is Jun 144.48 ion L9 or 15.71 uation L 233.94 ion L15 37.45 10 le 5) -115.58 97.04	s in the o Jul 144.48 r L9a), a 16.97 13 or L1: 220.91 or L15a) 37.45 10 -115.58 91.83	Aug 144.48 Iso see 22.06 3a), also 217.85), also se 37.45 10 -115.58 98.51	or hot w Sep 144.48 Table 5 29.61 225.57 20 See Ta 225.57 20 Table 37.45 10 -115.58	ater is fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10 -115.58 199.29	OM COM Nov 144.48 43.88 262.76 37.45 10 -115.58 207.12	Dec 144.48 46.78 282.26 37.45 10 -115.58 210.64	heating	 (66) (67) (68) (69) (70) (71) (72)
inclu 5. int Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total i	ide (57)i ernal ga olic gain 144.48 g gains 45.52 nces ga 295.29 ng gains 37.45 and far 10 s e.g. ev -115.58 heating 213 nternal	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calc 298.36 (calcula 37.45 ns gains 10 raporatic -115.58 gains (T 210.63 gains =	Culation Table 5 5), Wat Mar 144.48 ted in Ap 32.88 culated in A 37.45 (Table 5 10 on (nega -115.58 Table 5) 205.7	of (65)m and 5a ts Apr 144.48 opendix 24.89 Appendix 274.2 opendix 37.45 5a) 10 tive valu -115.58	only if c): 144.48 L, equati 18.61 dix L, equati 253.45 L, equati 37.45 10 es) (Tab -115.58 194.64	ylinder is Jun 144.48 ion L9 of 15.71 uation L 233.94 ion L15 37.45 10 le 5) -115.58 97.04 (66)	s in the c Jul 144.48 r L9a), a 16.97 13 or L1 220.91 or L15a) 37.45 10 -115.58 91.83 m + (67)m	Aug 144.48 Iso see 22.06 3a), also 217.85 0, also se 37.45 10 -115.58 98.51 + (68)m +	or hot w Sep 144.48 Table 5 29.61 29.61 29.61 29.61 225.57 ee Table 37.45 10 -115.58 100.88 + (69)m + 1	ater is fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10 -115.58 199.29 (70)m + (7	OM COM Nov 144.48 43.88 262.76 37.45 10 -115.58 207.12 1)m + (72)	Dec 144.48 46.78 282.26 37.45 10 -115.58 210.64	heating	 (66) (67) (68) (69) (70) (71) (72)
inclu 5. inf Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m= Total i (73)m=	ide (57)i ernal ga olic gain 144.48 g gains 45.52 nces gai 295.29 ng gains 37.45 s and far 10 s e.g. ev -115.58 heating 213 nternal 630.16	m in calo ains (see s (Table Feb 144.48 (calcula 40.43 ins (calcula 37.45 ns gains (calcula 37.45 ns gains 10 aporatic -115.58 gains (T 210.63 gains = 625.76	Culation Table (5), Wat Mar 144.48 ted in Ag 32.88 culated in A 37.45 (Table 5 10 on (nega -115.58 Table 5) 205.7	of (65)m 5 and 5a ts Apr 144.48 ppendix 24.89 a Appendix 274.2 ppendix 37.45 5a) 10 tive valu -115.58 198.99	only if c): 144.48 L, equati 18.61 dix L, equati 253.45 L, equati 37.45 10 es) (Tab -115.58 194.64	ylinder is Jun 144.48 ion L9 or 15.71 uation L 233.94 ion L15 37.45 10 le 5) -115.58 97.04 (66) 423.04	s in the o Jul 144.48 r L9a), a 16.97 13 or L1: 220.91 or L15a) 37.45 10 -115.58 91.83 m + (67)m 406.06	Aug 144.48 Iso see 22.06 3a), also 217.85), also se 37.45 10 -115.58 98.51 + (68)m - 414.76	or hot w Sep 144.48 Table 5 29.61 225.57 20 Table 37.45 10 -115.58 100.88 + (69)m + 1 432.41	ate r is fr Oct 144.48 37.6 ble 5 242.01 5 37.45 10 -115.58 199.29 (70)m + (7 555.24	OM COM Nov 144.48 43.88 262.76 37.45 10 -115.58 207.12 1)m + (72) 590.11	Munity h	heating	 (66) (67) (68) (69) (70) (71) (72) (73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ition:	Access Factor Table 6d	-	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.48	×	10.63) ×	0.76	×	0.7] =	9.72	(74)
North	0.9x	0.77	x	2.48	×	20.32	x	0.76	×	0.7	=	18.58	(74)
North	0.9×	0.77	x	2.48	×	34.53	x	0.76	×	0.7] =	31.57	(74)
North	0.9x	0.77	x	2.48	×	55.46	x	0.76	×	0.7] =	50.71	(74)
North	0.9x	0.77	x	2.48	×	74.72	x	0.76	×	0.7	=	68.31	(74)
North	0.9x	0.77	x	2.48	×	79.99	x	0.76	×	0.7] =	73.13	(74)
North	0.9x	0.77	x	2.48	×	74.68	x	0.76	×	0.7] =	68.28	(74)
North	0.9x	0.77	x	2.48	x	59.25	x	0.76	x	0.7] =	54.17	(74)
North	0.9x	0.77	x	2.48	×	41.52	x	0.76	×	0.7	j =	37.96	(74)
North	0.9x	0.77	x	2.48	x	24.19	x	0.76	x	0.7	1 =	22.12	– (74)
North	0.9x	0.77	x	2.48	×	13.12	x	0.76	×	0.7	1 =	11.99	(74)
North	0.9x	0.77	x	2.48	×	8.86	x	0.76	×	0.7	1 =	8.1	(74)
South	0.9×	0.77	x	17.35	x	46.75	x	0.85	x	0.7	i =	334.46	(78)
South	0.9x	0.77	x	17.35	×	76.57	x	0.85	×	0.7	i =	547.77	(78)
South	0.9×	0.77	x	17.35	x	97.53	x	0.85	x	0.7	i =	697.76	(78)
South	0.9×	0.77	x	17.35	×	110.23	x	0.85	х	0.7	1	788.62	(78)
Sout <mark>h</mark>	0.9×	0.77	x	17.35	x	114.87	x	0.85	x	0.7	i -	821.79	(78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	110.55	i 🖌	0.85	x	0.7	i =	790.86	- (78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	108.01	x	0.85	x	0.7	1 =	772.72	(78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	104.89	x	0.85	x	0.7	=	750.42	– (78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	101.89	×	0.85	x	0.7	i =	728.89	 (78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	82.59	x	0.85	x	0.7	i =	590.82	(78)
South	0.9×	0.77	x	17.35	×	55.42	x	0.85	×	0.7	i =	396.45	(78)
South	0.9x	0.77	x	17.35	×	40.4	x	0.85	×	0.7	1 =	289.01	– (78)
West	0.9×	0.77	x	1.5	x	19.64	x	0.85	x	0.7	i =	12.15	(80)
West	0.9x	0.77	x	1.5	×	38.42	x	0.85	x	0.7	1 =	23.76	(80)
West	0.9x	0.77	x	1.5	×	63.27	x	0.85	×	0.7	1 =	39.13	(80)
West	0.9x	0.77	x	1.5	×	92.28	x	0.85	×	0.7	i =	57.08	(80)
West	0.9×	0.77	x	1.5	×	113.09	x	0.85	×	0.7	j =	69.95	(80)
West	0.9×	0.77	x	1.5	x	115.77	x	0.85	x	0.7	i =	71.6	(80)
West	0.9×	0.77	x	1.5	x	110.22	x	0.85	x	0.7	i =	68.17	(80)
West	0.9x	0.77	x	1.5	×	94.68	x	0.85	×	0.7	1 =	58.56	(80)
West	0.9x	0.77	x	1.5	×	73.59	x	0.85	×	0.7] =	45.52	(80)
West	0.9x	0.77	x	1.5	×	45.59	x	0.85	×	0.7	j =	28.2	(80)
West	0.9x	0.77	x	1.5	x	24.49	İ x	0.85	×	0.7	j =	15.15	(80)
West	0.9x	0.77	x	1.5	×	16.15	l x	0.85	×	0.7	i =	9.99	(80)

Solar g	ains in	watts, ca	alculated	for eacl	n month			(83)m = S	um(74)m .	(82)m			
(83)m=	356.33	590.11	768.46	896.41	960.05	935.6	909.17	863.14	812.37	641.13	423.6	307.1	(83)
Total g	ains – ir	nternal a	nd solar	(84)m =	- (73)m -	+ (83)m	, watts						-
(84)m=	986.49	1215.87	1374.02	1470.83	1503.08	1358.63	1315.23	1277.91	1244.77	1196.37	1013.71	923.13	(84)

7. Me	an interi	nal temp	oerature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)					1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.99	0.98	0.96	0.93	0.94	0.98	0.99	1	1		(86)
Moon	intornal	ltompor	aturo in	living or			rac 2 to 7	in Tabl						
(87)m=	17 71	17 92	18.32	18.91	19.51	20.09	20 47	20.43	19.94	19 19	18.38	17 72		(87)
(01)			10.02	10.01	10.01	20.00	20.11	20.10	10.01	10.10	10.00			()
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling I	from Ta	ble 9, Tl	h2 (°C)					(22)
(88)m=	18.21	18.23	18.24	18.32	18.33	18.4	18.4	18.41	18.37	18.33	18.3	18.27		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.98	0.96	0.9	0.69	0.74	0.93	0.98	1	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	15.52	15.74	16.15	16.78	17.39	18	18.31	18.29	17.85	, 17.07	16.25	15.57		(90)
I									f	LA = Livin	g area ÷ (4	4) =	0.36	(91)
Maan	intornal	ltompor	oturo (fo	r tho wh	olo duvol	lling) – fl		. (1 fl	A) v T2			I		
	16 31	16.53		17.55	18 15	1111(1) = 11		+(1-1)	A) X I Z	17.84	17.02	16.34		(92)
	adjustr	pont to t	10.35	internal	tompor	ature fro	m Table	19.00			17.02	10.54		(02)
(93)m-	16.76	16.98	17 38	18	18.6	19.2	19 54	19.51	19.05	18.29	17 47	16 79		(93)
8 Sn	ace heat	ting regu	lirement	10	10.0	10.2	10.04	10.01	10.00	10.23	11.41	10.75		()
Set Ti	to the r	nean int	ernal ter	mperatur	e obtain	ed at ste	ep 11 of	Table 9	so tha	t Ti m=()	76)m an	d re-calo	ulate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a				5, 50 tha		o)iii aii			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>	tion fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.99	0.98	0.96	0.93	0.85	0.87	0.95	0.98	0.99	1		(94)
Usefu	l gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	982.85	1207.99	1359	1442.67	1447.35	1262.27	1113.71	1108.35	1181.78	1175.37	1007.69	920.36		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	8893.68	8572.23	7682.38	6247.56	4712.87	3060.62	1956.11	2060.92	3329.04	5249.41	7160.31	8794.12		(97)
Space	e heating	g require	ement fo	r each m	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	5885.65	4948.76	4704.59	3459.52	2429.54	0	0	0	0	3031.09	4429.89	5858.08		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	34747.13	(98)
Space	e heating	g require	ement in	kWh/m²	/year								271.46	(99)
9a <u>. En</u>	er <u>gy re</u> g	uir <u>emer</u>	nts <u>– Ind</u> i	ivid <u>ual h</u>	eat <u>ing s</u> v	yst <u>ems i</u>	ncl <u>uding</u>	mi <u>cro-C</u>	CHP)					
Space	e heatin	ng:												
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sve	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain sna	o ace heat	ina svste	em 1								65.9	(206)
Efficia	nov of a		ny/ounol	omontor	v hootin	a eveter	0/							
		BOUIUd	i y/suppl	emental	y neating	y system	ı, <i>1</i> 0						U	(200)

	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))	1		-	1			1	
	5885.65	4948.76	4704.59	3459.52	2429.54	0	0	0	0	3031.09	4429.89	5858.08		
(211)m	$n = \{[(98)]$)m x (20	4)] } x 1	00 ÷ (20)6) 2696 74	0	0		0	4500 52	6700.44	0000.05	1	(211)
	0931.19	7509.51	7130.99	5249.05	3000.71	0	0	Tota	l (kWh/vea	4599.55 ar) = Sum(2	211)	0009.33	52727.06	7(211)
Space	e heatin	a fuel (s	econdar	v) kWh/	month					, ,	/15,1012		02121.00](=)
= {[(98])m x (20)1)]}x1	00 ÷ (20)8)										
(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)												
Output	477.36	ater hea 426.36	ter (calc 461	ulated al 431.61	00VE) 436.26	326.59	325.82	340.76	334.9	446.66	449.22	472.06		
Efficier	ncy of w	i ater hea	l Iter										55.8	(216)
(217)m=	65.02	64.97	64.85	64.6	64.13	55.8	55.8	55.8	55.8	64.4	64.82	65.02		(217)
Fuel fo	r water	heating,	kWh/m	onth									<u>.</u>	
(219)m	1 = (64)	<u>m x 100</u> 656.27) ÷ (217) 710.85	m 668.1	680.24	585.29	583.9	610.67	600.18	693.54	693.03	726]	
(- /								Tota	I = Sum(2	19a) ₁₁₂ =			7942.27	(219)
Ann <mark>ua</mark>	I totals									k	Wh/year		kWh/year	
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								52 <mark>727.06</mark>]
Wat <mark>er</mark>	heating	fuel use	d										7942.27]
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								-
centra	al heatir	ng pump										156		(230c)
boi <mark>ler</mark>	with a f	an-assis	sted flue									45	í	(230e)
Total e	lectricit	y for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			201	(231)
Electric	city for l	ighting											803.82] (232)
12a. (CO2 em	issions ·	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHP)					-1
						En	0101/			Emico	ion foo	1ar	Emissiana	
						kW	/h/year			kg CO	2/kWh		kg CO2/yea	ır
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	11389.04	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	1715.53	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + (264) =	L			13104.58	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23 [.]	1) x			0.5	19	=	104.32	(267)
Electric	city for l	ighting				(232	2) x			0.5	19	=	417.18	_ (268)
Total C	:02, kg/	/year							sum o	f (265)(2	271) =		13626.08	(272)
Dwelli	ng CO2	Emissi	on Rate	•					(272)	÷ (4) =			106.45	(273)
El ratir	ig (secti	ion 14)											20	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2	2012 P	roperty	Stroma Softwa	a Num are Ver Unit 7	ber: sion:		Versio	n: 1.0.3.4	
Address :	. london		roporty /	laarooo.	OTHE T					
1. Overall dwelling dimer	sions:									
Basement			Area	a(m²) 82	(1a) x	Av. He	ight(m) .05	(2a) =	Volume(m³ 250.1) (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+	(1e)+(1n	n)	82	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	250.1	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	main heating 0 +	secondar heating	y] + [] + [0 0] = [total 0 0	x 4	40 = 20 =	m ³ per hou	r (6a) (6b)
Number of intermittent fan	S					2	x ′	10 =	20	(7a)
Number of passive vents						0	x ′	10 =	0	(7b)
Number of flueless gas fire	es					0	X 4	40 =	0	(7c)
								Air ch	ange <mark>s per</mark> ho	our
Infiltration due to chimneys If a pressurisation test has be	s, flues and fans = en carried out or is inte	: (6a)+(6b)+(7 ended, proceed	(a)+(7b)+(7 d to (17), c	7c) = otherwise c	continue fre	20 om (9) to ((16)	÷ (5) =	0.08	(8)
Number of storeys in the Additional infiltration	e dwelling (ns)	or frome or	0.25 for			uction	[(9)	-1]x0.1 =	0	(9) (10)
if both types of wall are pre deducting areas of opening	sent, use the value co. sent, is equal user 0.35	rresponding to	the great	er wall area	y constr a (after	uction			0	(11)
If suspended wooden flo	oor, enter 0.2 (uns	ealed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter	0							0	(13)
Percentage of windows	and doors draugh	t stripped		0.25 [0.2	$\mathbf{v}(14) \cdot 1$	001 -			0	(14)
Infiltration rate				(8) + (10)	× (14) ÷ 1	(00) = 2) + (13) -	+ (15) -		0	(15)
Air permeability value of	50 expressed in (cubic metre	s ner ho	ur ner so	nuare m	etre of e	nvelone	area	0	(10)
If based on air permeabilit	v value. then (18) =	= [(17) ÷ 20]+(8	3), otherwi	se (18) = (16)		invelope	uicu	1.08	-1(17)
Air permeability value applies	if a pressurisation test	has been don	e or a deg	gree air pei	meability	is being u	sed		1.00	
Number of sides sheltered	l								2	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)	x (20) =				0.92	(21)
Infiltration rate modified fo	r monthly wind spe	eed					i		l	
Jan Feb N	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7				i		i	i	l	
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4		0.07	0.00		4.05		4.10	l	
(22a)m= 1.27 1.25 1	.23 1.1 1.0	b 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltra	tion rate	e (allowii	ng for sł	nelter ar	nd wind s	speed) =	= (21a) x	(22a)m				_		
_ [1.17	1.15	1.12	1.01	0.99	0.87	0.87	0.85	0.92	0.99	1.03	1.08			
Calcula	ate effect	tive air (change r	ate for t	he appli	icable ca	ise	-		-		-	-		
II Me				ndiv N (2	(25) = (22)		oquation (N5)) othe	nuico (22h	(220))	(23a)
		at pump t			(230) = (230)	a) × FIIIV (6		m Tabla 4k	(23L)) = (23a))	(23b)
						ior in-use i			1) =			(22)	(0.01)	(23c)
a) If I		d mecha	anical ve	ntilation	with he	at recove	ery (MV	HR) (24a	a)m = (22	2b)m + () T	23b) × [*	1 – (23c)) ÷ 100] 1		(24a)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24a)
b) If I	balanced	d mecha	anical ve	ntilation	without	heat red	covery (MV) (24) T	o)m = (22	2b)m + (2 1	23b)		1		(2.41)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24b)
c) If v	whole ho	use ex	tract ven	tilation of	or positiv	ve input	ventilati	on from	outside	F (00)	、				
	r (22b)m	< 0.5 ×	(23b), ti	nen (240	c) = (230); otnerv	wise (24	HC) = (22	b) m + 0.	.5 × (230)		1		(24a)
(24c)m=	0	0	<u> </u>	0	0	0	0	0	0	0	0	0			(240)
d) If r if	natural v f (22b)m	entilation = 1, the	on or who en (24d)i	ole hous m = (22l	se positi b)m othe	ve input erwise (2	ventilati 24d)m =	on from 0.5 + [(2	loft 22b)m² x	0.5]			_		
(24d)m=	1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08			(24d)
Effec	ctive air o	change	rate - en	ter (24a) or (24	b) or (24	c) or (24	1d) in bo	x (25)	-	-	-	_		
(25)m=	1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08			(25)
3 Hea	at losses	and he	at loss r	aramet	er.							_			_
ELEM	IENT	Gros	65 (m²)	Openin	lgs	Net Ar	rea m²	U-val W/m2	ue 2K	A X U	K)	k-value	e K	A X kJ/	(k K
Doors ⁻	Type 1		()			1.1,1		3		54					(26)
Doors -	Type 2					1.0	\equiv			2.24	Ħ				(26)
Window	ws Type	1				5.56		L	- 0.041 -	2.27	H				(27)
Window		2				5.56		или и оро	0.041	22.39	El .				(27)
Window	vs Type	2				4			0.04] =	16.11	_				(27)
	vs type	3				1.21	X	I/[I/(4.0)+	- 0.04] =	4.87	╡,				(27)
Floor						82	×	1.25	=	102.5	_				(28)
Walls T	ype1	79.8	5	12.5	7	67.28	3 X	2.1	=	141.29					(29)
Walls T	ype2	20.2	23	1.6		18.63	3 X	2.1	=	39.12					(29)
Roof		19.7	7	0		19.77	7 X	2.3	=	45.47					(30)
Total a	rea of el	ements	, m²			201.8	5								(31)
Party w	all					16.8	x	0	=	0					(32)
Party w	all					5.8	x	0	=	0			- - -		(32)
* for wind	dows and r e the areas	oof winde s on both	ows, use e sides of in	ffective wi ternal wal	indow U-v Is and par	alue calcul titions	lated using	g formula :	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	n 3.2		
Fabric I	heat loss	s, W/K =	= S (A x	U)	,			(26)(30) + (32) =				379	.39	(33)
Heat ca	apacity C	2m = S('Axk)	,					((28).	(30) + (32	2) + (32a).	(32e) =)	`´´ (34)
Therma	al mass i	barame	ter (TMF	9 = Cm -	÷ TFA) ii	ר kJ/m²K			Indica	tive Value	: High			50	(35)
For desig	gn assessr	nents wh	ere the det	ails of the	construct	tion are no	t known p	recisely th	e indicative	e values of	TMP in Ta	able 1f	L		``` <i>`</i> '
Therma	al bridae	s : S (L	x Y) calc	culated	usina Ar	opendix I	к						15	.4	(36)
	-30	- (-	,		5 1										

if details of thermal bridging are not known $(36) = 0.15 \times (31)$

Total fa	abric hea	at loss							(33) +	(36) =			397.79	(37)
Ventila	tion hea	t loss ca	alculated	I monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	96.6	94.7	92.81	83.34	81.45	72.65	72.65	71.02	76.04	81.45	85.23	89.02		(38)
Heat tra	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	494.39	492.49	490.6	481.13	479.24	470.44	470.44	468.81	473.83	479.24	483.02	486.81		
Heat lo	ss para	meter (H	HLP). W/	′m²K					ر (40)m	Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	480.87	(39)
(40)m=	6.03	6.01	5.98	5.87	5.84	5.74	5.74	5.72	5.78	5.84	5.89	5.94]	
									/	L Average =	Sum(40) _{1.}	₁₂ /12=	5.86	(40)
Numbe	er of day	s in mor	nth (Tab	le 1a)	Mov	lun	11	A	San	Oct	Nov	Dee	1	
(41)m-	Jan 31	28	1VIA1 31	Арі 30	1VIAY	30 30	31	Aug 31	30	31	30	21 21		(41)
(41)11=	51	20	51	30	51	50	51	51	30	51	- 50	51	J	(++)
4 304														
4. Wa	ter heat	ing ener	gy requi	rement:								KVVh/y	ear:	
Assum	ed occu	pancy, I	N					.			2	.5]	(42)
if TF. if TF.	A > 13.9 A £ 13.9	9, N = 1 9 N = 1	+ 1.76 x	[1 - exp	(-0.0003	649 x (TF	-A -13.9)2)] + 0.0)013 x (TFA -13.	9)			
Annual	averag	e hot wa	ater usa	ge in litre	s per da	y Vd,av	erage =	(25 x N)	+ 36		93	.57		(43)
Reduce :	the annua	l average litres per r	hot water	usage by { day (all w	5% if the d	welling is	designed t Id)	to achieve	a water us	se target o	f			
			berson per						0				1	
Hot wate	Jan Jan ir	Feb litres per	Mar day for ea	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	(43)	Sep	Oct	Nov	Dec		
(44)m-	102.93	99.18	95.44	91 7	87.95	84 21	84.21	87.95	91 7	95.44	99.18	102.93	1	
(++)	102.00	33.10	00.44	01.7	01.00	04.21	04.21	01.00		Total = Su	m(44)1_12 =	102.00	1122.82	(44)
Ener <mark>gy</mark> a	content of	hot water	used - cal	culated mo	onthly $=$ 4.	190 x Vd,r	n x nm x D	0Tm / 3600	kWh/mor	oth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	152.63	133.5	137.76	120.1	115.24	99.44	92.15	105.74	107	124.7	136.12	147.82		
lf instant	aneous w	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)	-) to (61)	Total = Su	m(45) ₁₁₂ =	=	1472.19	(45)
(46)m=	22.9	20.02	20.66	18.01	17.29	14.92	13.82	15.86	16.05	18.71	20.42	22.17]	(46)
Water	storage	loss:											J	
Storage	e volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ime ves	sel		160]	(47)
If comr	nunity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)		(
Otherw Water	vise it no	stored	hot wate	er (this in	ICIUDES I	nstantar	ieous co	mbi boile	ers) ente	er '0' in (47)			
a) If m	anufacti	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0	1	(48)
Tempe	rature fa	actor fro	m Table	2b		,						0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=		16	60		(50)
b) If m	anufact	urer's de	eclared o	ylinder l	oss facto	or is not	known:						J 1	
Hot wa	ter stora	age loss	factor fr	om Tabl	e 2 (kWl	h/litre/da	ıy)				0.	05		(51)
Volume	e factor	eaung S from Tal	ee sectio ble 2a	011 4.3							0	91	1	(52)
Tempe	rature fa	actor fro	m Table	2b							0.	78	1	(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	5.	85	i	(54)
Enter	(50) or (54) in (5	5)								5.	85]	(55)

Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(56)
If cylind	er contain	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	lix H	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)
Prima	ry circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Prima	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water he	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	462.25	413.15	447.37	419.73	424.85	316.75	316.7	330.29	324.31	434.32	435.75	457.43		(62)
Solar D	HW input	calculated	using App	endix G o	r 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 \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter	-	-	-		-	-	_	-	-		
(64)m=	462.25	413.15	447.37	419.73	424.85	316.75	316.7	330.29	324.31	434.32	435.75	457.43		_
								Outp	out from w	ater heate	r (annual)₁	12	4782.9	(64)
Hea <mark>t g</mark>	jains fro	m water	heating,	kWh/m	onth 0.2	5	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	153.45	137.15	148.51	139.32	141.0 <mark>2</mark>	<mark>6</mark> 6.6	65.29	69.81	69.11	144.16	144.65	151.85		(65)
inclu	ude (57)	m in calo	culation of	of (65)m	only if c	ylinder is	s in t <mark>he c</mark>	dwelling	or hot w	rate <mark>r is f</mark> r	om com	<mark>mu</mark> nity h	eating	
5. In	ternal ga	ains (see	e Table {	and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99		(66)
Lightir	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 oi	r L9a), a	lso see	Table 5					
(67)m=	35.93	31.91	25.95	19.65	14.69	12.4	13.4	17.42	23.38	29.68	34.64	36.93		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	_	_		
(68)m=	223.57	225.89	220.04	207.6	191.89	177.12	167.26	164.94	170.78	183.23	198.94	213.71		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5			_	
(69)m=	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5		(69)
Pumps	s and fa	ns gains	(Table 5	ōa)									-	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losse	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	le 5)					-	-		
(71)m=	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99		(71)
Water	heating	gains (1	able 5)										-	
(72)m=	206.25	204.09	199.6	193.5	189.54	92.5	87.75	93.83	95.99	193.77	200.9	204.1		(72)
Total	internal	gains =				(66)	m + (67)m	n + (68)m +	+ (69)m +	(70)m + (7	1)m + (72)	m	-	
·		•												
(73)m=	536.25	532.39	516.1	491.24	466.61	352.51	338.91	346.68	360.64	477.18	504.98	525.23		(73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4	x	10.63	x	0.85	x	0.7] =	17.54	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.85	x	0.7] =	33.52	(74)
North	0.9x	0.77	x	4	x	34.53	×	0.85	x	0.7] =	56.95	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.85	x	0.7] =	91.48	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.85	x	0.7	=	123.23	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.85	x	0.7] =	131.92	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.85	x	0.7] =	123.17	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.85	x	0.7	=	97.72	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.85	x	0.7	=	68.47	(74)
North	0.9x	0.77	x	4	x	24.19	×	0.85	x	0.7] =	39.9	(74)
North	0.9x	0.77	x	4	x	13.12	×	0.85	x	0.7] =	21.64	(74)
North	0.9x	0.77	x	4	x	8.86	×	0.85	x	0.7] =	14.62	(74)
East	0.9x	1	x	5.56	x	19.64	×	0.85	x	0.7] =	45.03	(76)
East	0.9x	1	x	5.56	x	38.42	×	0.85	x	0.7] =	88.08	(76)
East	0.9x	1	x	5.56	x	63.27	×	0.85	x	0.7	=	145.06	(76)
East	0.9x	1	x	5.56	×	92.28	x	0.85	х	0.7		211.56	(76)
East	0.9x	1	x	5.56	x	113.09	x	0.85	x	0.7] =	259.27	(76)
East	0.9x	1	x	5.56	x	115.77	×	0.85	x	0.7] =	265.41	(76)
East	0.9x	1	x	5.56	x	110.22	x	0.85	x	0.7	=	252.68	(76)
East	0.9x	1	x	5.56	x	94.68	x	0.85	x	0.7	=	217.05	(76)
East	0.9x	1	x	5.56	x	73.59	×	0.85	x	0.7] =	168.71	(76)
East	0.9x	1	x	5.56	x	45.59	x	0.85	x	0.7	=	104.52	(76)
East	0.9x	1	x	5.56	x	24.49	×	0.85	x	0.7] =	56.14	(76)
East	0.9x	1	x	5.56	x	16.15	×	0.85	x	0.7] =	37.03	(76)
West	0.9x	0.77	x	1.21	x	19.64	x	0.85	x	0.7] =	9.8	(80)
West	0.9x	0.77	x	1.21	x	38.42	x	0.85	x	0.7	=	19.17	(80)
West	0.9x	0.77	x	1.21	x	63.27	x	0.85	x	0.7] =	31.57	(80)
West	0.9x	0.77	x	1.21	x	92.28	x	0.85	x	0.7	=	46.04	(80)
West	0.9x	0.77	x	1.21	x	113.09	x	0.85	x	0.7	=	56.42	(80)
West	0.9x	0.77	x	1.21	x	115.77	x	0.85	x	0.7] =	57.76	(80)
West	0.9x	0.77	x	1.21	x	110.22	x	0.85	x	0.7] =	54.99	(80)
West	0.9x	0.77	x	1.21	x	94.68	x	0.85	x	0.7	=	47.24	(80)
West	0.9x	0.77	x	1.21	x	73.59	×	0.85	×	0.7] =	36.72	(80)
West	0.9x	0.77	x	1.21	x	45.59	×	0.85	x	0.7	=	22.75	(80)
West	0.9x	0.77	x	1.21	×	24.49	x	0.85	x	0.7	=	12.22	(80)
West	0.9x	0.77	x	1.21	x	16.15	x	0.85	x	0.7] =	8.06	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m			
(83)m=	72.36	140.77	233.58	349.08	438.93	455.1	430.84	362.01	273.9	167.16	90	59.71	(83)
Total g	ains – ir	nternal a	nd solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	608.61	673.16	749.68	840.32	905.54	807.61	769.75	708.68	634.54	644.34	594.98	584.94	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	a, h1,m	(see Ta	ıble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	0.99	0.98	0.97	0.94	0.96	0.99	0.99	1	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	bllow ste	ns 3 to 7	r in Tabl	e 9c)					
(87)m=	17.53	17.7	18.1	18.71	19.36	19.97	20.38	20.31	19.78	19	18.19	17.53		(87)
· <i>·</i>			L				(
I emp	erature		l 10.01	erioas ir					12 (°C)	10.00	10.05	10.02		(88)
(00)11=	10	10	18.01	18.07	16.06	10.13	16.13	16.14	10.11	10.00	18.05	18.03		(00)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	n2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.99	0.96	0.9	0.69	0.76	0.95	0.99	1	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	15.2	15.37	15.77	16.42	17.07	17.7	18.04	18.01	17.51	16.72	15.9	15.22		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.53	(91)
Mean	internal	l temper	ature (fo	r the wh	ole dwel	lina) – fl		+ (1 – fl	Δ) v T2					
(92)m=	16.44	16.61	17.01	17.64	18.29	18.9	19.28	19.24	18.72	17.93	17.12	16.45		(92)
Apply	adiustr	nent to t	he mear	internal	temper	ature fro	m Table	4e whe	re appro	poriate				, , ,
(93)m=	16.89	17.06	17.46	18.09	18.74	19.35	19.73	19.69	19.17	18.38	17.57	16.9		(93)
8. Spa	ace hea	tina rea	uirement											
Set Ti	to the r	nean int	ernal ter	nperatur	e 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	ble 9a				, - , - , - , - , - , - , - , - , - , -	, (-,			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>	ation fac	tor for g	ains, hm	1										
(94)m=	1	1	0.99	0.99	0.97	0.95	0.89	0.91	0.97	0.99	0.99	1		(94)
Usefu	l gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	606.45	669.92	743.89	828.04	877.96	763.89	686.12	647.73	616.24	636.79	591.98	583.11		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	oss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	6222.25	5987.33	5376.85	4419.66	3372.58	2236.89	1473.99	1540.12	2400.33	3729.75	5056.09	6180.59		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Nh/mont	th = 0.02	24 x [(97])m – (95)m] x (4′	1)m			
(98)m=	4178.15	3573.3	3446.93	2585.97	1856	0	0	0	0	2301.17	3214.16	4164.53		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	25320.2	(98)
Space	e heating	g require	ement in	kWh/m²	/year								308.78	(99)
9a <u>. En</u>	ergy <u>re</u> g	uir <u>emer</u>	nts <u>– Ind</u> i	ivid <u>ual h</u>	eat <u>ing s</u> v	/st <u>ems i</u>	ncl <u>uding</u>	mi <u>cro-C</u>	:HP)					
Space	e heatir	ng:					0							
Fracti	on of sp	ace hea	at from s	econdar	/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on 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	ina svste	em 1								65.9	(206)
Efficie	ancy of c	acondo	ny/eunni		v heating	n evetar	ר %						00.0	(208)
		Joounua	' y suppi	enenial	y neating	9 3931011	1, 70						U	(200)

			_	_						_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g requir	ement (o	alculate	d above))							I	
	4178.15	3573.3	3446.93	2585.97	1856	0	0	0	0	2301.17	3214.16	4164.53		
(211)m	n = {[(98)m x (20)4)] } x 1	100 ÷ (20)6)								I	(211)
	6340.14	5422.3	5230.54	3924.08	2816.39	0	0	0	0	3491.91	4877.33	6319.46		
~		/						Tota	п (күүп/уеа	ar) =5um(2	211) _{15,1012}	-	38422.15	(211)
	e heatin	g fuel (s	econdar	'y), kWh/ າຊາ	month									
- ([(90 (215)m=	0		00 ÷ (20	0	0	0	0	0	0	0	0	0		
								Tota	l I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	1												
Output	from w	ater hea	ter (calc	ulated a	bove)	·								
	462.25	413.15	447.37	419.73	424.85	316.75	316.7	330.29	324.31	434.32	435.75	457.43		_
Efficier	ncy of w	ater hea	ater										55.8	(216)
(217)m=	64.73	64.69	64.56	64.28	63.75	55.8	55.8	55.8	55.8	64.06	64.51	64.74		(217)
Fuel fo	or water	heating,	, kWh/m	onth										
(219)m=	714.09	638.69	692.98	653.01	666.43	567.65	567.56	591.92	581.2	677.99	675.52	706.57		
			1			1	1	Tota	l = Sum(2	19a) ₁₁₂ =			7733.61	(219)
Ann <mark>ua</mark>	I totals									k	Wh/year		kWh/year	_
Space	heating	fuel use	ed, main	system	1								38 <mark>422.15</mark>	
Wat <mark>er</mark>	heating	fuel use	ed										7733.61	7
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								_
centra	al heatin	ng pump	:									156		(230c)
boiler	with a f	an-assi	sted flue									15		(230e)
Total		uf as the		k/M/b/voo	r			sum	of (230a)	(230a) –		40	201	(2000) T(224)
	ectricity		above,	күүп/уеа	ſ			Sum	01 (2004).	(2009) –			201	
Electric	city for li	ighting											634.57	(232)
12a. (CO2 em	issions	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHP)					
						En	ergy			Emiss	ion fac	tor	Emissions	
						k٧	/h/year			kg CO	2/kWh		kg CO2/yea	ar
Space	heating	(main s	system 1)		(21	1) x			0.2	16	=	8299.18	(261)
Space	heating	(secon	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	1670.46	(264)
Space	and wa	ter heat	ing			(26	1) + (262)	+ (263) + (264) =				9969.64	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	104.32	(267)
Electric	city for li	ighting				(23)	2) x			0.5	19	=	329.34	(268)
Total C	CO2, kg/	/year							sum o	of (265)(2	271) =		10403.3	(272)
Dwelli	ng CO2	Emissi	ion Rate	•					(272)	÷ (4) =			126.87	(273)
EI ratir	ng (secti	on 14)											18	(274)

			User D	etails:										
Assessor Name: Software Name:	Stroma FSAP	2012	roperty	Stroma Softwa	a Num are Ver	ber: sion:		Versic	on: 1.0.3.4					
Address :	london		ioperty /	-1001633.	Onit O									
1. Overall dwelling dimer	sions:													
Basement			Area	a(m²) 70	(1a) x	Av. He	ight(m) 3.5	(2a) =	Volume(m ³ 245	') (3a)				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)	+(1e)+(1r	n)	70	(4)			1						
Dwelling volume	, , , , , , , , , , , ,		´		(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	245	(5)				
2. Ventilation rate:														
Number of chimneys Number of open flues	main heating 0	secondar heating + 0 + 0	y] + [_] + [0 0] = [] = [total 0 0	x 4	40 = 20 =	m ³ per hou	(6a) (6b)				
Number of intermittent fan	s					2	x ′	10 =	20	(7a)				
Number of passive vents						0	x ′	10 =	0	(7b)				
Number of flueless gas fire	es					0	X 4	40 =	0	(7c)				
Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $\times 20 =$ 0 Number of intermittent fans 2 $\times 10 =$ 20 $\times 10 =$ 20 Number of passive vents 0 $\times 10 =$ 0 $\times 10 =$ 0 Number of flueless gas fires 0 $\times 40 =$ 0 $\times 40 =$ 0 Air changes perInfiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 \div (5) = 0.08 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) 0														
Infiltration due to chimney	s, flues and fans	= (6a)+(6b)+(7	′a)+(7b)+(1	7c) =	Г	20	<u> </u>	÷ (5) =	0.08	(8)				
If a pressurisation test has be Number of storeys in the Additional infiltration	en carried out or is ir e dwelling (ns)	ntended, proceed	d to (17), c	otherwise c	continue fr	om (9) to ((16) [(9)·	-1]x0.1 =	0	(9) (10)				
if both types of wall are pre deducting areas of opening If suspended wooden flo	esent, use the value of time gs); if equal user 0.35 por, enter 0.2 (un	corresponding to 5 isealed) or 0.	the greate	er wall are	y constr a (after enter 0	uction			0	(11) (12)				
If no draught lobby, ente	er 0.05, else ente	er O							0	(13)				
Percentage of windows	and doors draug	ht 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	150, expressed in	n cubic metre	s per ho	our per so	quare m	etre of e	envelope	area	20	(17)				
If based on air permeabilit	y value, then (18)	$) = [(17) \div 20] + (8)$	3), otherwi	se (18) = (16) moobility	ia haina u	and		1.08	(18)				
Number of sides sheltered		St has been don	le of a deg	liee all pei	meaning	is being u	seu		1	(19)				
Shelter factor				(20) = 1 -	0.075 x (1	9)] =			0.92	(20)				
Infiltration rate incorporation	ng shelter factor			(21) = (18)	x (20) =				1	(21)				
Infiltration rate modified fo	r monthly wind s	peed								_				
Jan Feb I	Var Apr N	/lay Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Monthly average wind spe	ed from Table 7													
(22)m= 5.1 5 4	4.9 4.4 4	.3 3.8	3.8	3.7	4	4.3	4.5	4.7						
Wind Factor (22a)m = (22)m ÷ 4			r										
(22a)m= 1.27 1.25 1	.23 1.1 1.	.08 0.95	0.95	0.92	1	1.08	1.12	1.18						

Adjuste	ed infilti	ration rat	e (allow	ing for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
<u> </u>	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18]	
Calcula If me	ate effe echanic	<i>ctive air</i> al ventila	change	rate for t	he appli	cable ca	se						0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If bala	anced wit	h heat reco	overy: effic	ciency in %	allowing f	or in-use f	actor (from	n Table 4h) =	, , ,			0	(23c)
a) If	balance	ed mech	anical v	entilation	with hea	at recove	erv (MVI	HR) (24a	a)m = (2)	2b)m + ((23b) x [[,]	1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	ed mech	ı anical v	entilation	without	heat rec	: overv (N	и ЛV) (24b	m = (22)	1 2b)m + ((23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	nouse ex	tract ve	ntilation c	or positiv	e input v	ventilatic	n from o	outside	I	!		1	
í	f (22b)r	m < 0.5 >	‹ (23b),	then (24c	c) = (23b); other	vise (24	c) = (22k	o) m + 0	.5 × (23k	c)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural	ventilatio	on or wh	nole hous	e positiv	e input	ventilatio	on from I	oft					
i	f (22b)r	m = 1, th	en (24d)m = (22t	o)m othe	rwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]	1	1	1	
(24d)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93		1.08	1.13	1.18	J	(240)
Effec	ctive air	change	rate - e	nter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)	4.00	4.40	4.40	1	(25)
(25)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18		(25)
3. He	at l <mark>osse</mark>	es and he	eat loss	paramete	er:									
ELEN	1ENT	Gros	SS	Openin	gs	Net Ar	ea	U-valu	ue	AXU		k-value	e la la la la la la la la la la la la la	A X k
Doore		area	(m²)	m	2	A,r	n²	vv/m2	κ.	(/ / /	K)	KJ/M ² ·I	ĸ	KJ/K
Minde		a 1				1.9		3	=	5.7	H			(20)
VVIndov	ws Typ	el				8.7		/[1/(4.8)+	0.04] =	35.03				(27)
vvindov	ws Typ	e 2				6.5	x1/	/[1/(4.8)+	0.04] =	26.17	Ц.			(27)
Window	ws Typ	e 3				2.2	x1,	/[1/(4.8)+	0.04] =	8.86				(27)
Floor						70	x	1.25	=	87.5			\exists	(28)
Walls		116	.5	19.3		97.2	x	2.1	=	204.12	2			(29)
Roof		26.	7	0		26.7	X	2.3	=	61.41				(30)
Total a	rea of e	elements	, m²			213.2	2							(31)
Party v	vall					24.2	x	0	=	0				(32)
Party v	vall					8.6	x	0	=	0				(32)
* for win ** includ	dows and le the are	d roof wind as on both	ows, use sides of i	effective wi nternal wall	ndow U-va 's and part	ilue calcul itions	ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	n 3.2	
Fabric	heat lo	ss, W/K	= S (A x	: U)				(26)(30)) + (32) =				428.	8 (33)
Heat c	apacity	Cm = S	(A x k)						((28).	(30) + (3	2) + (32a).	(32e) =	0	(34)
Therma	al mass	s parame	eter (TM	P = Cm ÷	- TFA) in	⊨kJ/m²K			Indica	tive Value	: High		450	(35)
For desig	gn asses Ised inste	sments wh ead of a de	ere the de tailed calc	etails of the culation.	constructi	on are noi	t known pr	ecisely the	e indicative	e values of	f TMP in Ta	able 1f		
Therma	al bridg	es : S (L	x Y) ca	Iculated u	using Ap	pendix l	<						84.8	3 (36)
if details	of therm	al bridging	are not ki	nown (36) =	= 0.15 x (3	1)								
Total fa	abric he	eat loss							(33) +	(36) =			513.	6 (37)
Ventila	tion he	at loss ca	alculate	d monthly	/				(38)m	= 0.33 ×	(25)m x (5))	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	l	

(38)m=	103.14	101.11	99.09	88.98	86.96	76.95	76.95	75.05	80.89	86.96	91	95.05		(38)
Heat tr	ansfer c	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	616.73	614.71	612.69	602.58	600.56	590.54	590.54	588.65	594.49	600.56	604.6	608.64		
				/ 21/					(10)	Average =	Sum(39)1	12 /12=	602.11	(39)
Heat Id	ss para		ΗLΡ), W/ Το 75	/m²K	0.50	0.44	0.44	0.44	(40)m	= (39)m ÷	(4)			
(40)m=	8.81	8.78	8.75	8.61	8.58	8.44	8.44	8.41	8.49	8.58	8.64	8.69	9.6	
Numbe	er of day	vs in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 / 12=	0.0	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ar:	
Accum		nonov	NI											(40)
if TF.	A > 13.9	9, N = 1	+ 1.76 x	: [1 - exp	(-0.0003	849 x (TF	- A -13.9)2)] + 0.0)013 x (TFA -13.	9) <u>2.</u>	.25		(42)
if TF	A £ 13.9	9, N = 1												
Annual Reduce	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	se target o	87	.55		(43)
not more	that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)		a mator at	io la gol o				_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	<mark>9</mark> 6.3	92.8	<mark>8</mark> 9.3	85.79	82.29	78.79	78.79	82.29	85.79	89.3	92.8	<mark>9</mark> 6.3		
										Total = Sui	m(44) ₁₁₂ =		1050.55	(44)
Energy o	content of	hot water	used - cal	lculated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	142.81	124.9	128.89	112.37	107. <mark>8</mark> 2	93.04	86.22	98.93	100.12	116.67	127.36	138.3		_
lf instant	aneous w	ater heati	na at noin	t of use (no	hot water	r storage)	enter () in	hoxes (46) to (61)	Tota <mark>l = Su</mark>	n(45) ₁₁₂ =	=	1377.43	(45)
(46)m	21 42	40.74			46.47	12.00	42.02	14.94	15.00	175	10.1	20.75		(46)
Water	storage	loss:	19.33	10.00	10.17	13.90	12.93	14.04	15.02	17.5	19.1	20.75		(40)
Storage	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		160		(47)
If comr	nunity h	eating a	and no ta	ank in dw	velling, e	nter 110	litres in	(47)						
Otherw	vise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:	ممامتمط ا	a a a fa at			(dev)							(10)
a) II M		urer s de	eciared i	OSS IACIO	or is kno	wn (kvvr	1/day):					0		(48)
Tempe	rature i	actor Iro	m Table					$(40) \times (40)$				0		(49)
b) If m	anufact	urer's de	eclared of	e, kvvn/ye cvlinder l	ear oss fact	or is not	known:	(40) X (49)) =		1	60		(50)
Hot wa	ter stora	age loss	factor fi	rom Tabl	e 2 (kW	h/litre/da	ıy)				0.	.05		(51)
If comr	nunity h	eating s	ee secti	on 4.3										
Volume	e factor	from Ta	ble 2a	. 2h							0.	.91		(52)
Tempe	rature i	actor Iro	m rabie						(50) (50)	0.	.78		(53)
Energy	iost fro (50) or (m watei (54) in (P	r storage	e, KVVh/ye	ear			(47) x (51)) x (52) x (53) =	5.	85		(54)
Water	storage	ادہ 200	culated	for each	month			((56)m = 0)	55) × (41)	m	5.	00		(55)
	104 04	160 7	104.04	175 00	104.04	175.00	101 04	194.04		101 04	175.00	101 04		(56)
(oo)m= If cylinde	r contains	s dedicate	d solar sto	rage. (57)	$\eta = (56)m$	x [(50) – (H11)] - (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	(00)
()	404.04	400 7	404.04	475.00	404.04	475.00	404.04	404.04	(00)	404.04	475.00		-	(57)
(57)m=	181.24	163.7	181.24	1/5.39	181.24	1/5.39	181.24	181.24	1/5.39	181.24	175.39	181.24		(57)

Primar	y circuit	loss (ar	nnual) fro	om Table	93							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss ca	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	452.43	404.56	438.5	412	417.44	310.35	310.77	323.49	317.42	426.29	426.99	447.92		(62)
Solar Dł	HW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (G)	-	-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter									_		
(64)m=	452.43	404.56	438.5	412	417.44	310.35	310.77	323.49	317.42	426.29	426.99	447.92		_
								Outp	out from wa	ater heate	r (annual)₁	12	4688.14	(64)
Heat g	ains froi	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	« [(46)m	+ (57)m	+ (59)m]	
(65)m=	150.19	134.29	145.56	136.75	138.55	64.47	63.32	67.55	66.82	141.5	141.74	148.69		(65)
inclu	ıde (57)ı	n in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternai ga	ains (see	Table 5	5 and 5a):									
Metab	olic gain	s (Table	e 5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	112.31	112.3 <mark>1</mark>	11 <mark>2.31</mark>	112 <mark>.31</mark>	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31		(66)
Ligh <mark>tin</mark>	g gains	(calcula	ted in Ap	opendix	L, equati	ion L9 oi	r L9a), a	lso see [·]	Table 5			-		
(67)m=	29.9	26.56	21.6	16. <mark>35</mark>	12.22	10.32	11.15	14.49	19.45	24.7	28.83	30.73		(67)
Applia	nces gai	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5				
(68)m=	197.3	199.34	194.19	183.2	169.34	156.31	147.6	145.55	150.71	161.7	175.56	188.59		(68)
Cookir	ng gains	(calcula	Ited in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5	•	•		
(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23		(69)
Pumps	and far	ns gains	(Table											
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84		(71)
Water	heating	gains (T	able 5)											
(72)m=	201.86	199.84	195.64	189.93	186.23	89.54	85.1	90.79	92.81	190.18	196.86	199.85		(72)
Total i	nternal	gains =	:			(66)	m + (67)m	• n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m		
(73)m=	495.75	492.44	478.12	456.18	434.48	322.86	310.55	317.53	329.67	443.27	467.94	485.87		(73)
6. So	lar gains	s:												
Solar g	ains are c	alculated	using sola	r flux from	Table 6a a	and associ	iated equa	itions to co	onvert to th	ie applicat	ole orientat	tion.		

Orientat	ion:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	8.7	x	10.63	×	0.85	x	0.7	=	38.15	(74)
North	0.9x	0.77	x	8.7	×	20.32	×	0.85	x	0.7	=	72.9	(74)

North	0.9x	0.77	x	8.	7	x	3	34.53	x	0.85	x	0.7		= [123.87	(74)
North	0.9x	0.77	x	8.	7	x	5	5.46	x	0.85	×	0.7		=	198.97	(74)
North	0.9x	0.77	x	8.	7	x	7	4.72	x	0.85	x	0.7		=	268.03	(74)
North	0.9x	0.77	x	8.	7	x	7	'9.99	x	0.85	x	0.7		=	286.93	(74)
North	0.9x	0.77	x	8.	7	x	7	4.68	x	0.85	x	0.7		=	267.89	(74)
North	0.9x	0.77	x	8.	7	x	5	59.25	x	0.85	x	0.7		=	212.54	(74)
North	0.9x	0.77	x	8.	7	x	4	1.52	x	0.85	x	0.7		=	148.93	(74)
North	0.9x	0.77	x	8.	7	x	2	24.19	x	0.85	x	0.7		=	86.78	(74)
North	0.9x	0.77	x	8.	7	x	1	3.12	x	0.85	x	0.7		=	47.06	(74)
North	0.9x	0.77	x	8.	7	x	6	8.86	x	0.85	x	0.7		= [31.8	(74)
South	0.9x	0.77	x	2.	2	x	4	6.75	x	0.85	x	0.7		= [42.41	(78)
South	0.9x	0.77	x	2.	2	x	7	6.57	x	0.85	x	0.7		=	69.46	(78)
South	0.9x	0.77	x	2.	2	x	g	97.53	x	0.85	x	0.7		=	88.48	(78)
South	0.9x	0.77	x	2.	2	x	1	10.23	x	0.85	x	0.7		= [100	(78)
South	0.9x	0.77	x	2.	2	x	1	14.87	x	0.85	x	0.7		= [104.2	(78)
South	0.9x	0.77	x	2.	2	x	1	10.55	x	0.85	×	0.7		= [100.28	(78)
South	0.9x	0.77	x	2.	2	x	1	08.01	x	0.85	x	0.7		= [97.98	(78)
South	0.9x	0.77	x	2.	2	x	1	04.89	x	0.85	x	0.7		= [95.15	(78)
South	0.9x	0.77	×	2.	2	х	1	01.89	x	0.85	x	0.7		=	92.42	(78)
South	0.9x	0.77	×	2.	2	х	8	32.59	x	0.85	x	0.7		= [74.92	(78)
South	0.9x	0.7 <mark>7</mark>	x	2.	2	x	5	5.42	x	0.85	x	0.7		= [50.27	(78)
South	0.9x	0.77	×	2.	2	x		40.4	x	0.85	x	0.7		= [36.65	(78)
West	0.9x	0.77	x	6.	5	x	1	9.64	x	0.85	x	0.7		= [52.64	(80)
West	0.9x	0.77	x	6.	5	x	3	8.42	x	0.85	×	0.7		= [102.97	(80)
West	0.9x	0.77	x	6.	5	x	6	3.27	x	0.85	x	0.7		=	169.58	(80)
West	0.9x	0.77	x	6.	5	x	g	2.28	x	0.85	x	0.7		=	247.33	(80)
West	0.9x	0.77	x	6.	5	x	1	13.09	x	0.85	x	0.7		= [303.11	(80)
West	0.9x	0.77	x	6.	5	x	1	15.77	x	0.85	x	0.7		=	310.29	(80)
West	0.9x	0.77	x	6.	5	x	1	10.22	x	0.85	x	0.7		= [295.4	(80)
West	0.9x	0.77	x	6.	5	x	g	94.68	x	0.85	x	0.7		= [253.75	(80)
West	0.9x	0.77	x	6.	5	x	7	'3.59	x	0.85	x	0.7		=	197.23	(80)
West	0.9x	0.77	x	6.	5	x	4	5.59	x	0.85	x	0.7		=	122.19	(80)
West	0.9x	0.77	x	6.	5	x	2	24.49	x	0.85	x	0.7		= [65.64	(80)
West	0.9x	0.77	x	6.	5	x	1	6.15	x	0.85	x	0.7		= [43.29	(80)
Solar	aaine in	watte calc	hatelu	for eac	h mont	h			(83)m	-Sum(74)m	(82)m					
(83)m=	133.2	245.33 3	81.93	546.29	675.34	1 (697.5	661.27	561	.44 438.59	283.8	8 162.96	111.	73		(83)
Total g	gains – i	nternal and	d solar	(84)m =	- = (73)r	<u>ו</u> + (83)m	, watts					1			
(84)m=	628.95	737.76 8	860.05	1002.47	1109.8	2 1	020.36	971.82	878	.96 768.25	727.1	5 630.9	597	.6		(84)
7. Me	ean inter	nal temper	rature	(heating	seasc	n)										
Tem	perature	during hea	ating p	eriods i	n the liv	/ing	area	from Tab	ole 9,	, Th1 (°C)				[21	(85)
Utilis	ation fac	ctor for gair	ns for l	iving ar	ea, h1,	m (s	ее Та	ıble 9a)						-		

Apr

May

Jun

Jul

Aug

Mar

Feb

Jan

Oct

Nov

Dec

Sep

(86)m=	1	0.99	0.99	0.98	0.97	0.94	0.91	0.93	0.97	0.99	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	16.72	16.94	17.44	18.18	18.97	19.72	20.22	20.14	19.49	18.52	17.52	16.71		(87)
Temp	erature	durina h	eating p	eriods ir	n rest of	dwellina	from Ta	able 9. Ti	h2 (°C)					
(88)m=	18	18	18	18	18	18	18	18	18	18	18	18		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)						
(89)m=	0.99	0.99	0.99	0.97	0.94	0.85	0.61	0.69	0.92	0.98	0.99	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	n Now ste	ens 3 to 7	7 in Tabl	e 9c)				
(90)m=	14.54	14.76	15.25	15.98	16.77	17.48	17.89	17.85	17.27	16.32	15.33	14.52		(90)
									f	L LA = Livin	g area ÷ (4	4) =	0.81	(91)
Moon	interna	l tompor	atura (fo	r tha wh	olo dwo	llina) – fl	Δ 🗸 Τ1	⊥ (1 _ fl	Δ) ~ T2			L		
(92)m=	16.3	16.52	17.02	17.75	18.55	19.3	19.78	19.7	19.06	18.1	17.1	16.29		(92)
Apply	adjustn	nent to t	L he mear	internal	temper	L ature fro	l m Table	4e, whe	ere appro	opriate				
(93)m=	16.75	16.97	17.47	18.2	19	19.75	20.23	20.15	19.51	18.55	17.55	16.74		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	i to the r	mean int	ernal ter	mperatu	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	ble 9a		<u> </u>							
Litilioc	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	0.98	0.97	0.95	0.92	0.87	0.9	0.95	0.98	0.99	0.99		(94)
Usefu	l gains.	hmGm	. W = (9	4)m x (84	4)m	0.02		0.0	0.00	0.00	0.00	0.00		(-)
(95)m=	624.51	730.37	846.46	974.5	1053.65	939.84	849.96	788.7	733.51	712	624.76	593.84		(95)
Month	nly avera	age exte	rnal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	1 <mark>0.6</mark>	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	7681.26	7420.99	6719.07	5606.86	4385.48	3038.91	2141.58	2208.32	3217.27	4773.77	6320.23	7633.26		(97)
Space	e heatin	g require	ement fo	r each n	honth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	5250.22	4496.1	4369.23	3335.3	2478.88	0	0	0	0	3021.96	4100.74	5237.33		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	32289.75	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								461.28	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:										Г		
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system	(000)	(004)				0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								65.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	ear
Space	e heatin	g require	ement (c	alculate	d above))								
	5250.22	4496.1	4369.23	3335.3	2478.88	0	0	0	0	3021.96	4100.74	5237.33		
(211)m	ı = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)									(211)
	7966.95	6822.61	6630.09	5061.16	3761.58	0	0	0	0	4585.67	6222.67	7947.38		_
								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	48998.1	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (20	01)]}x 1	00 ÷ (20	8)		_				-		_	_	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,101}	2=	0	(215)
Water	heating	l												
Output	452.43	404.56	ter (calc 438.5	ulated al	oove) 417.44	310.35	310.77	323.49	317.42	426.29	426.99	447.92]	
Efficier	L of w	ater hea	ter										55.8	(216)
(217)m=	64.97	64.93	64.83	64.61	64.22	55.8	55.8	55.8	55.8	64.46	64.79	64.97		(217)
Fuel fo (219)m	r water n = (64)	heating, m x 100	kWh/mo) ÷ (217)	onth m								•		
(219)m=	696.39	623.07	676.39	637.62	649.96	556.18	556.93	579.72	568.86	661.35	658.99	689.39		
								Tota	I = Sum(2	19a) ₁₁₂ =			7554.86	(219)
Annua	l totals	fuelues	d main	avetam	1					k	Wh/yea	r	kWh/yea	<u>'</u>
Space	neating	iuei use	a, main	system	1								48998.1	4
Water	heating	fuel use	d										7554.86	
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t							_	
centra	al heatin	g pump:										156		(230c)
boiler	with a f	an-assis	ted flue									45		(230 <mark>e</mark>)
Tota <mark>l e</mark>	lectricity	/ for the	above, I	kWh/yea	r			sum	of (230a).	<mark>(2</mark> 30g) =			201	(231)
Electric	city for li	ghting											528.07	(232)
12a. (CO <mark>2 em</mark>	issions -	– Individ	ual h <mark>eat</mark> i	ng syste	ems inclu	uding mi	cro-CHP			_			
						Fn	erav			Fmiss	ion fac	tor	Emissions	
						kW	/h/year			kg CO	2/kWh		kg <mark>CO2/</mark> ye	ar
Space	heating	(main s	ystem 1)		(211) x			0.2	16	=	10583.59	(261)
Space	heating	(second	dary)			(215	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	1631.85	(264)
Space	and wa	ter heati	ng			(261) + (262)	+ (263) + (264) =				12215.44	(265)
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t (231	l) x			0.5	19	=	104.32	(267)
Electric	city for li	ghting				(232	2) x			0.5	19	=	274.07	(268)
Total C	02, kg/	year							sum o	of (265)(2	271) =		12593.83	(272)
Dwelli	ng CO2	Emissi	on Rate	ļ					(272)	÷ (4) =			179.91	(273)
EI ratir	ng (secti	on 14)											6	(274)

		Us	er Details:						
Assessor Name: Software Name: S	troma FSAP 2012	Dropo	Stroma Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.3.4	
Addross	ondon	Рюре	eny Address.	Unit 9					
1 Overall dwelling dimension	uns:								
Basement	лю,		Area(m²) 124	(1a) x	Av. He	ight(m) .37	(2a) =	Volume(m³ 293.88) (3a)
Total floor area $TFA = (1a)+($	1b)+(1c)+(1d)+(1e)+	·(1n)	124	(4)					
Dwelling volume				(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	293.88	(5)
2. Ventilation rate:		-	_		_				
Number of chimneys Number of open flues	main sec heating hea 0 + 0 +	ondary ating 0 + 0 +	other 0 0] = [total 0 0	x 2	40 = 20 =	m³ per hou 0	r (6a) (6b)
Number of intermittent fans				Γ	2	x ´	10 =	20	(7a)
Number of passive vents				Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fires				Ē	0	X 4	40 = Air ch	0 anges per ho	(7c)
Infiltration due to chimneys, f	lues and fans = (6a)- carried out or is intended,	+(6b)+(7a)+(7 proceed to (7b)+(7c) = 17), otherwise c	ontinue fro	20 om (9) to ((16)	÷ (5) =	0.07	(8)
Number of storeys in the d Additional infiltration Structural infiltration: 0.25 f <i>if both types of wall are presen</i>	w <mark>elling</mark> (ns) for steel or timber fra t, use the value correspo	ame or 0.38 nding to the g	5 for masonr greater wall area	y constr a (after	uction	[(9)-	-1]x0.1 =	0 0 0	(9) (10) (11)
deducting areas of openings); If suspended wooden floor	if equal user 0.35 enter 0.2 (μηsealed	1) or () 1 (s	ealed) else	enter ()				0	
If no draught lobby, enter 0	.05. else enter 0							0	(12)
Percentage of windows an	d doors draught strip	ped						0	(14)
Window infiltration	0 1		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, q50	, expressed in cubic	metres pe	er hour per so	quare m	etre of e	nvelope	area	20	(17)
If based on air permeability v	alue, then (18) = [(17)	÷ 20]+(8), otł	nerwise (18) = (16)				1.07	(18)
Air permeability value applies if a	pressurisation test has b	een done or a	a degree air pei	meability	is being u	sed			-
Number of sides sheltered			(20) = 1 - [0.075 x (1	9)] =			1	(19)
Infiltration rate incorporating	shelter factor		(21) = (18)	x (20) =	-74			0.92	$\Box_{(21)}^{(20)}$
Infiltration rate modified for m	onthly wind speed		() ()	()				0.99	
Jan Feb Mar	Apr Mav	Jun Ju	ul Aua	Sep	Oct	Nov	Dec		
Monthly average wind speed	from Table 7			1					
(22)m= 5.1 5 4.9	4.4 4.3	3.8 3.	8 3.7	4	4.3	4.5	4.7		
Wind Factor $(22a)m = (22)m$	⊥ I I	1	I		L	1	1		
(22a)m= 1.27 1.25 1.23	1.1 1.08	0.95 0.9	95 0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m	-	-		_	
~ ' '	1.26	1.23	1.21	1.09	1.06	0.94	0.94	0.91	0.99	1.06	1.11	1.16		
Calcula If me	ate etter	ctive air al ventila	change	rate for t	he appli	cable ca	ISE						0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)), othei	rwise (23b) = (23a)			0	(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,			0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	ı)m = (22	2b)m + ()	23b) x [⁻	1 – (23c)	÷ 1001	(200)
(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	covery (N	и ЛV) (24b)m = (22	1 2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If	whole h	iouse ex	tract ver	tilation of	or positiv	ve input v	ventilatio	on from c	outside				1	
í	if (22b)n	n < 0.5 ×	(23b), t	hen (240	c) = (23b); otherv	wise (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	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from I	oft					
i	if (22b)n	n = 1, th	en (24d)	m = (22t	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	1.26	1.23	1.21	1.09	1.06	0.94	0.94	0.92	0.99	1.06	1.11	1.16		(240)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24)	c) or (24	d) in boy	(25)	4.00		4.40	1	(25)
(25)m=	1.26	1.23	1.21	1.09	1.06	0.94	0.94	0.92	0.99	1.06	1.11	1.16		(25)
3. He	at l <mark>osse</mark>	s and he	at loss	oaramete	er:									
ELEN		Gros are <mark>a</mark>	ss (m²)	Openin m	gs 2	Net Ar A ,r	rea m²	U-valı W/m2	le K	A X U (W/I	K)	k-value kJ/m²·l	e K	A X k kJ/K
Doo <mark>rs</mark>						1.6	x	1.4	= [2.24				(26)
Win <mark>do</mark>	<mark>ws</mark> Type	ə1				5.49	x1.	/[1/(4.8)+	0.04] =	22.11				(27)
Windo	ws Type	e 2				4.7	x1.	/[1/(4.8)+	0.04] =	18.93	F			(27)
Walls 7	Type1	11.8	5	1.6		10.25	5 X	2.1		21.52	F r			(29)
Walls ⁻	Type2	122	2	10.19	ə	111.8	1 X	1.27	= [142.22			\dashv	(29)
Roof		68.	1	0		68.1	x	2.3		156.63			7 6	(30)
Total a	area of e	elements	, m²			201.9	5		I					(31)
Party v	wall					4.8	x	0	= [0				(32)
* for win	dows and le the area	l roof winde	ows, use e sides of ir	effective wi	ndow U-va	alue calcul	lated using	formula 1,	L /[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2]、 /
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				363.6	i5 (33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	⁻ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: High		450	(35)
For desi can be u	ign asses: Jsed inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	K						30.4	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			394.0	15 <mark>(37)</mark>
Ventila	ation hea	at loss ca	alculated	monthly	/	i			(38)m	= 0.33 × (25)m x (5))	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	122.16	119.76	117.37	105.39	103	91.2	91.2	88.99	95.82	103	107.79	112.58]	(38)
Heat tr	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m	-		
(39)m=	516.21	513.81	511.42	499.44	497.04	485.25	485.25	483.03	489.86	497.04	501.83	506.62		
										Average =	Sum(39)1	12 /12=	498.9) (3 9)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	4.16	4.14	4.12	4.03	4.01	3.91	3.91	3.9	3.95	4.01	4.05	4.09		
Ľ						<u> </u>			/	L Average =	Sum(40)1	.12 /12=	4.02	(40)
Numbe	r of day	/s in moi	nth (Tab	le 1a)					i		i		1	
_	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wat	ter heat	ting ener	gy requi	irement:								kWh/ye	ear:	
Assume if TFA	ed occu A > 13.9 A £ 13.9	upancy, I 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	88]	(42)
Annual Reduce t not more	averag he annua that 125	e hot wa al average litres per p	ater usag hot water person per	ge in litre usage by s day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	102 f	2.54]	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					-	
(44)m=	112.8	108.69	104.59	100.49	96.39	92.29	92.29	96.39	100.49	104.59	108.69	112.8		
Ener <mark>gy c</mark>	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,i	m x nm x D	0Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1230.5	(44)
(45)m=	1 <mark>6</mark> 7.27	146.3	150.97	131.62	126.29	108.98	100.98	115.88	117.26	13 <mark>6.66</mark>	149.18	161.99		
If instants		votor booti		of upp (pp	hatwata		antar 0 in	haven (46	-	Total = Su	m(45) ₁₁₂ =	:	1613.38	(45)
	aneous w		ig at point	or use (no		slorage),		boxes (40						(40)
(46)m= Water s	25.09	21.94	22.64	19.74	18.94	16.35	15.15	17.38	17.59	20.5	22.38	24.3		(46)
Storage	e volum	e (litres)	includir	ng any so	olar or M	/WHRS	storage	within sa	a <mark>me ve</mark> s	sel		160		(47)
If comm	nunity h	eating a	nd no ta	ink in dw	velling, e	nter 110) litres in	(47)						
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water s	storage	loss:												
a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				()		(48)
Temper	rature fa	actor fro	m Table	2b							()		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		16	60		(50)
b) If ma	anufact	urer's de	eclared of	cylinder l	oss fact	or is not	known:						1	
	unity h	aye ioss leating s	ee secti	on 43		n/ntre/ua	iy)				0.	05		(51)
Volume	e factor	from Ta	ble 2a	011 4.0							0	91]	(52)
Tempe	rature fa	actor fro	m Table	2b							0.	78		(53)
Enerav	lost fro	m water	storage	. kWh/ve	ear			(47) x (51) x (52) x (53) =	5	85		(54)
Enter (50) or ((54) in (5	55)	, ., ,							5.	85		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = ((55) × (41)ı	m			1	
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(56)
If cylinde	r contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – ([[H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l lix H	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24]	(57)
Primary	/ circuit	loss (an	inual) fro	om Table	93						()		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m =	(58) ÷ 36	65 × (41)	m					
(mod	ified by	factor fi	om Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	a cylinde	r thermo	stat)		1	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$															
(61)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(61)
Total h	neat rec	uired for	water h	neating c	alculated	l fo	r eacl	h month	(62)m	= 0.85 ×	(45)m +	· (46)m +	(57)m +	(59)m + (61)m	
(62)m=	476.89	425.95	460.58	431.24	435.9	32	26.29	325.54	340.43	334.57	446.28	448.8	471.61]	(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		(63)
Output	t from w	vater hea	ter												
(64)m=	476.89	425.95	460.58	431.24	435.9	32	26.29	325.54	340.43	334.57	446.28	448.8	471.61]	
Output from water heater (annual) 4924.08 (64)												(64)			
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)n	n + (57)m	+ (59)m	n]	
(65)m=	158.32	141.41	152.9	143.15	144.69	6	9.77	68.23	73.18	72.52	148.14	148.99	156.56]	(65)
inclu	ude (57))m in calo	ulation	of (65)m	only if a	ylir	nder i	s in the c	dwelling	g or hot w	ater is	from com	munity ł	neating	
5. In	ternal g	ains (see	e Table	5 and 5a):	-				-			-	-	
Metab	olic gai	ns (Table	5) Wa	otts	, 										
motab	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	143.88	143.88	143.88	143.88	143.88	14	43.88	143.88	143.88	143.88	14 <u>3.88</u>	143.88	143.88		(66)
Liahtin	a dains	(calcula	ted in A	ppendix	L. equat	ion	L9 o	r L9a), a	lso see	Table 5	-		· · · ·		
(67)m=	51.64	45.87	37.3	28.24	21.11	1	7.82	19.26	25.03	33.6	42.66	49.79	53.08	1	(67)
Annlia		ins (calc	ulated i	n Appen	dix L ea	uat	tion L	13 or 1 1	(3a) als	so see Ta	ble 5	1		1	
(68)m=	290.33	293.35	285.75	269.59	249.19	2:	30.01	217.2	214.19	221.78	237.95	258.35	277.52	1	(68)
Cookir			ted in (Appendix		ior	1 15	or 15a)			5			1	
(69)m=	37.39	37 39	37.39	37 39	37 39		7.39	37.39	37.39	37.39	37.39	37.39	37.39	1	(69)
Dump	and fo		(Table	50)	0.100			01100	01100	01100	01100		01100		()
(70)m-				10	10		10	10	10	10	10	10	10	1	(70)
							F)	10	10	10	10	10		J	()
(71)-	5 e.y. e						0) 115 1	115 1	115 1	115.1	1151	115 1	115.1	1	(71)
(71)11=	-115.1	-115.1	-115.1	-115.1	-115.1	-	115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	J	(71)
vvater	neating	gains (1		100.00	404.40		20.0	04.7	00.00	400.70	400.44	000.00	040.44	1	(72)
(72)11=	212.0	210.43	205.51	190.02	194.40		90.9	91.7	90.30	100.73	(70)	200.93	210.44	J	(12)
Iotal	nterna	I gains =	00470	570.04	540.04		(66)	m + (67)m	1 + (68)m	1 + (69)m +	(70)m + ((1)m + (12)		1	(72)
(73)m=	630.93	625.8	604.73	572.81	540.94	4	20.9	404.33	413.75	432.27	555.88	591.23	617.2		(73)
0. Solar (iai gain	S.	usina sol	ar flux from	Table 6a	and	associ	iated equa	tions to (convert to th	ne annlica	ble orientat	tion		
	ation:	Access F	actor	Ares		and	Flu	Y		a		FF		Gains	
onona		Table 6d	aotor	m²	L		Tal	ole 6a		9_ Table 6b	-	Fable 6c		(W)	
North	0.9x	0 77	<u> </u>	5	49	×	1	0.63) <u>x</u> [0.85	× [07		24 07	7(74)
North	0.9x	0.77			10	Ϋ́		0.00		0.85		0.7	=	/	$ \Box_{(74)}^{(1)} $
North	0.0A	0.77	=	·	10	Ŷ		.0.52		0.00	╡ᆠ┟	0.7	$= \frac{1}{2}$	70 17	
North	0.04	0.77	(40		3 	5 46		0.00	╡╏╏	0.7	$= \frac{1}{2}$	125.56	
North	0.98	0.77	<u> </u>		40	^		4.70		0.05	╡╏	0.7		120.00	
North	0.9X	0.77)	5.4	49	*	/	4.72		0.85	× _	0.7	=	169.14	(74)

North	0.9x	0.77		x	5.4	9	x	7	9.99	x	0.85	x	0.7	=	181.06	(74)
North	0.9x	0.77		x	5.4	9	x	7	4.68	x	0.85	x	0.7	=	169.05	(74)
North	0.9x	0.77		x	5.4	9	x	5	59.25	x	0.85	x	0.7	=	134.12	(74)
North	0.9x	0.77		x	5.4	9	x	4	1.52	x	0.85	x	0.7	=	93.98	(74)
North	0.9x	0.77		x	5.4	9	x	2	24.19	x	0.85	x	0.7	=	54.76	(74)
North	0.9x	0.77		x	5.4	9	x	1	3.12	x	0.85	x	0.7	=	29.69	(74)
North	0.9x	0.77		x	5.4	9	x	6	8.86	x	0.85	x	0.7	=	20.07	(74)
South	0.9x	0.77		x	4.1	7	x	4	6.75	x	0.85	x	0.7	=	90.6	(78)
South	0.9x	0.77		x	4.	7	x	7	6.57	x	0.85	x	0.7	=	148.39	(78)
South	0.9x	0.77		x	4.	7	x	g	97.53	x	0.85	x	0.7	=	189.02	(78)
South	0.9x	0.77		x	4.	7	x	1	10.23	x	0.85	x	0.7	=	213.63	(78)
South	0.9x	0.77		x	4.	7	x	1	14.87	x	0.85	x	0.7	=	222.62	(78)
South	0.9x	0.77		x	4.	7	×	1	10.55	x	0.85	x	0.7	=	214.24	(78)
South	0.9x	0.77		x	4.	7	x	1	08.01	x	0.85	x	0.7	=	209.32	(78)
South	0.9x	0.77		x	4.	7	x	1	04.89	x	0.85	x	0.7	=	203.28	(78)
South	0.9x	0.77		x	4.	7	x	1	01.89	x	0.85	x	0.7	=	197.45	(78)
South	0.9x	0.77		x	4.	7	x	8	32.59	x	0.85	x	0.7	=	160.05	(78)
South	0.9x	0.77		x	4.7	7	×	5	5.42	х	0.85	x	0.7	=	107.4	(78)
South	0.9x	0.77		x	4.	7	x	· ·	40.4	x	0.85	x	0.7	-	78.29	(78)
Solar	naine in	watte co	deulat	bod	for eac	mon	th			(83)m	- Sum(74)m	(82)m				
(83)m=	114.68	194.39	267.1	8	339.19	391.7	5 3	395.3	378.37	337	7.4 291.43	214.8	1 137.09	98.36	1	(83)
Total g	gains – i	nternal a	nd so	lar	(84)m =	: (73)n	ו 1 + (83)m	, watts			-				
(84)m=	745.61	820.19	871.9	01	912	932.6	3 E	316.2	782.7	751	.15 723.7	770.6	9 728.32	715.56]	(84)
7. Me	ean inter	nal temp	eratu	re (heating	seaso	n)			•						
Temp	perature	during h	eating	g pe	eriods ir	the li	ving	area	from Tat	ole 9	, Th1 (°C)				21	(85)
Utilis	ation fac	ctor for g	ains fo	or li	ving are	a, h1,	m (s	ee Ta	ble 9a)							
	Jan	Feb	Ma	r	Apr	Ma	γÌ	Jun	Jul	A	ug Sep	Oc	t Nov	Dec]	
(86)m=	1	1	1		1	0.99		0.99	0.97	0.9	98 0.99	1	1	1		(86)
Mear	n interna	l temper	ature	in li	iving are	a T1	(follo	w ste	ps 3 to 7	7 in T	able 9c)				-	
(87)m=	18.27	18.41	18.72	2	19.2	19.7	2	20.18	20.51	20.	47 20.06	19.45	5 18.81	18.28]	(87)
Temp	berature	during h	eating	g pe	eriods ir	rest o	of dw	elling	from Ta	able 9	9, Th2 (°C)			1	1	
(88)m=	18.92	18.93	18.94	4	18.99	19	1	19.04	19.04	19.	05 19.02	19	18.98	18.96]	(88)
Utilis	ation fac	tor for a	ains fo	or re	est of d	velling	ı. h2	.m (se	e Table	9a)	•		•		-	
(89)m=	1	1	1		1	0.99	,, <u>_</u>	0.97	0.89	0.9	0.98	1	1	1]	(89)
Moor			aturo	in t	ho rost	of dwc		T2 (f	l ollow ste	1	to 7 in Tak			Į	1	
(90)m=	16.56	16.71	17.03	3	17.54	18.04		12 (1	18.87	18.	84 18.42	17.8	17.14	16.59	1	(90)
×									ļ			fLA = Li	ving area ÷ (4) =	0.3	(91)
N <i>A</i>		1.40.0000.000		/4-		ا- مام	ر مالاند	~) ('	ι Λ Τ 4			-				` `
		1722	ature 17 5/	(ior ₄ T				9) = 1		+(1	$-ILA) \times I_2$	100	17.64	17 1	1	(02)
(32)11=	17.07	17.22	17.54	*	10.04	10.04		0.00	19.00	1 19.	0.92	1 10.3	17.04	''.'		(32)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.52	17.67	17.99	18.49	18.99	19.5	19.81	19.78	19.37	18.75	18.09	17.55		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	n:										
(94)m=	1	1	1	1	0.99	0.98	0.94	0.95	0.99	1	1	1		(94)
Usefu	ıl gains,	hmGm ,	, W = (9	4)m x (8-	4)m				r					
(95)m=	744.75	818.82	869.58	907.45	922.05	797.09	734.88	714.29	713.65	766.91	727.03	714.86		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8			r				I	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m I	– (96)m]			I	
(97)m=	6825.39	6561.1	5874.27	4788.1	3625.37	2377.56	1559.99	1633.97	2580.05	4049.26	5517.53	6764.07		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k\	/Vh/mont	h = 0.02	24 x [(97])m – (95)m] x (4′	1)m		I	
(98)m=	4524	3858.82	3723.5	2794.07	2011.27	0	0	0	0	2442.07	3449.16	4500.61		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	27303.48	(98)
Space	e heatin	g require	ement in	kWh/m²	?/year								220.19	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Sp <mark>ac</mark>	e heatir	ng:												_
Fracti	ion of sp	bace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	at from n	<mark>nain s</mark> yst	em(s)			(202) = 1 -	(201) =				1	(202)
Fracti	on of to	tal hea <mark>ti</mark> i	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1										65.9	(206)			
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						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))								
	4524	3858.82	3723.5	2794.07	2011.27	0	0	0	0	2442.07	3449.16	4500.61		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)						_			(211)
	6864.95	5855.56	5650.22	4239.86	3052	0	0	0	0	3705.71	5233.93	6829.45		
								Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}		41431.68	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)] } x 1	00 ÷ (20)8)	-	-		-	-	-		-		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	I.	0	(215)
Water	heating)												-
Output	from w	ater hea	ter (calc	ulated a	bove)				r				l .	
	476.89	425.95	460.58	431.24	435.9	326.29	325.54	340.43	334.57	446.28	448.8	471.61		-
Efficier	ncy of w	ater hea	iter										55.8	(216)
(217)m=	64.78	64.74	64.61	64.34	63.84	55.8	55.8	55.8	55.8	64.11	64.55	64.79		(217)
Fuel for water heating, kWh/month														
(219)m	1 = (64)	m x 100) ÷ (217) 712 84	m 670.23	682 70	584 74	583.4	610.00	599 59	696 14	695 23	727 03		
(213)11=	/ 50.14	007.99	112.04	010.23	002.19	004.74	000.4	Tota	= Sum(2)	19a). =	000.20	121.33	7057 11	(210)
											kWh/uoor			
Space heating fuel used, main system 1										41431.68	1			
Space neating tuel used, main system 1 41431.68														

Water heating fuel used			7957.11												
Electricity for pumps, fans and electric keep-hot															
central heating pump:		1	56 (230c)												
boiler with a fan-assisted flue			45 (230e)												
Total electricity for the above, kWh/year	sum of (201 (231)													
Electricity for lighting			911.99 (232)												
12a. CO2 emissions – Individual heating systems	including micro-CHP														
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year												
Space heating (main system 1)	(211) x	0.216 =	8949.24 (261)												
Space heating (secondary)	(215) x	0.519 =	0 (263)												
Water heating	(219) x	0.216 =	1718.74 (264)												
Space and water heating	(261) + (262) + (263) + (264	l) =	10667.98 (265)												
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	104.32 (267)												
Electricity for lighting	(232) x	0.519 =	473.32 (268)												
Total CO2, kg/year		sum of (265)(271) =	11245.62 (272)												
Dwelling CO2 Emission Rate		(272) ÷ (4) =	90.69 (273)												
El rating (section 14)			27 (274)												
			User D	etails:											
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Assessor Name: Software Name:	Stroma FSAP 2	012	roportu	Stroma Softwa	a Num are Ver	ber: sion:		Versic	n: 1.0.3.4						
Address :	london	Г	iopeny /	-001655.											
1. Overall dwelling dimer	sions:														
Basement			Area	a(m²) 79	(1a) x	Av. He	ight(m) 2.6	(2a) =	Volume(m³ 205.4) (3a)					
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+	(1e)+(1r	n)	79	(4)			1							
Dwelling volume	, , , , , , , , ,		´		(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	205.4	(5)					
2. Ventilation rate:		-		_											
Number of chimneys Number of open flues	main heating 0 +	secondar heating	y] + [_] + [_	0 0] = [] = [total 0 0		40 = 20 =	m ³ per hou	r (6a) (6b)					
Number of intermittent far	S					2	x ′	10 =	20	(7a)					
Number of passive vents						0	x ′	10 =	0	(7b)					
Number of flueless gas fir	es				Ľ	0	X	40 =	0	(7c)					
	The of intermittent fans The of passive vents The of flueless gas fires 0 x 10 = 0 0 x 10 = 0 Air cha														
Infiltration due to chimney	ber of open flues 0 + 0 + 0 = 0 × 20 = ber of intermittent fans 2 × 10 = ber of passive vents 0 × 10 = ber of flueless gas fires 0 × 40 = ber of flueless gas fires 0 × 40 = control of the test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) tember of storeys in the dwelling (ns) ditional infiltration [(9)-1]x0.1 =														
Number of storeys in the Additional infiltration Structural infiltration: 0.2	e dwelling (ns) 25 for steel or timb	er frame or	0.35 for	· masonr	y constr	uction	[16) [(9)·	-1]x0.1 =	0	(9) (10) (11)					
if both types of wall are pre deducting areas of opening	esent, use the value cor gs); if equal user 0.35	responding to	the great	er wall are	a (after					` ´					
If suspended wooden fl	oor, enter 0.2 (uns	ealed) or 0.	1 (seale	d), else	enter 0				0	(12)					
If no draught lobby, ente	er 0.05, else enter	U							0						
Window infiltration	and doors draugh	l sinpped		0.25 - [0.2	x (14) ÷ 1	001 =			0	-(14)					
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	-1(10)					
Air permeability value, o	50, expressed in a	ubic metre	s per ho	our per so	uare m	etre of e	envelope	area	20	(17)					
If based on air permeabilit	y value, then (18) =	[(17) ÷ 20]+(8	3), otherwi	se (18) = (16)				1.1	(18)					
Air permeability value applies	if a pressurisation test	has been don	e or a deg	gree air pei	meability	is being u	sed								
Number of sides sheltered	ł			(00)	0.075 (4	0.1			1	(19)					
Shelter factor				(20) = 1 - [0.075 X (1	9)] =			0.92	(20)					
Infiltration rate incorporation	ng shelter factor			(21) = (18)	x (20) =				1.02	(21)					
Infiltration rate modified to	r monthly wind spe	ed			0	0.1			l						
	viar Apr ivia	ay Jun	Jui	Aug	Sep	Oct	INOV	Dec							
Monthly average wind spe	ed from Table 7		2.0	0.7	А	4.0	A F	47	l						
(22)m= 5.1 5 2	+.9 4.4 4.3	3.8	3.ర	3.1	4	4.3	4.5	4./							
Wind Factor (22a)m = (22 (22a)m 127 125 1)m ÷ 4	3 0.05	0.95	0.02	1	1 08	1 12	1 1 2							
(220)III- 1.27 1.23 I	.20 1.1 1.00	0.90	0.90	0.92	I	1.00	1.12	1.10							

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-	-			
	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19		
Calcul If m	ate etter	ctive air	change	rate for t	he appli	cable ca	se						0	(220)
lf exh	aust air h	eat pump i	usina App	endix N. (2	3b) = (23a	i) × Fmv (e	equation (I	N5)) . othei	rwise (23b) = (23a)			0	(23a)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(23c)
a) If	balance	d mech:	, anical ve	ntilation	with he	at recove	∍rv (MVI	HR) (24a	n)m = (2)	2h)m + (23h) x [1	l – (23c)	 ∸ 1001	(200)
(24a)m=				0	0	0			0			0		(24a)
b) If	balance	d mech:	I anical ve	Intilation	without	heat rec	L coverv (N	L MV) (24b	l = (2)	I 2b)m + (L 23b)			
(24b)m=	0	0		0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	ract ver	tilation o	or positiv	re input v	ı ventilatio	on from c	utside					
0)	if (22b)n	n < 0.5 ×	(23b), 1	hen (240	c) = (23b); otherv	wise (24	c) = (22b	o) 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	on from l	oft	•	•			
	if (22b)n	n = 1, the	en (24d)	m = (22	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		r	1	
(24d)m=	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)	i		i		
(25)m=	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	oaramete	er:									
	/ENT	Gros	s	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e l	AXk
_		area	(m²)	m	2	A ,r	n²	W/m2	K	(VV/	K)	kJ/m ² ·l	<	kJ/K
Doors						1.6	×	1.4	=	2.24				(26)
Windo	ws Type	e 1				3.12	x1	/[1/(4.8)+	0.04] =	12.56				(27)
Windo	ws Type	e 2				3.66	x1	/[1/(4.8)+	0.04] =	14.74				(27)
Walls	Type1	89.2	2	6.78		82.42	<u>x</u>	1.27	=	104.83				(29)
Walls	Type2	26.6	63	1.6		25.03	3 X	2.1	=	52.56				(29)
Roof		46.	5	0		46.5	x	2.3	=	106.95				(30)
Total a	area of e	lements	, m²			162.3	3							(31)
Party v	wall					5.3	x	0	=	0				(32)
* for win	idows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	
** incluc	le the area	as on both	sides of in	nternal wal	ls and part	titions		(00) (00)	(22)					
Fabric	heat los	SS, W/K =	= S (A x	U)				(26)(30)	(32) =	(0.0)			293.89	(33)
Heat c	apacity	Cm = S((A X K)			1 1/ 21/			((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
I nerm	al mass	parame		$P = Cm + \frac{1}{2}$	- IFA) Ir	i KJ/M²K			Indica	tive Value	: High	- h l = 15	450	(35)
ror desi can be ι	ign assess used inste	sments wn ad of a dei	ere the de tailed calc	talis of the ulation.	construct	on are not	t known pi	recisely the	e indicative	e values of	TMPINT	adie 11		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						24.8	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			318.69	(37)
Ventila	ation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	87.72	86	84.28	75.68	73.96	65.41	65.41	63.77	68.8	73.96	77.4	80.84		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	406.41	404.69	402.97	394.37	392.65	384.1	384.1	382.46	387.49	392.65	396.09	399.53		
										Average =	Sum(39)1	12 /12=	393.96	(39)

Heat los	ss para	meter (H	ILP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	5.14	5.12	5.1	4.99	4.97	4.86	4.86	4.84	4.9	4.97	5.01	5.06		
L	r of dov		oth (Tab	0 10)			1		ļ	Average =	Sum(40)1.	12 /12=	4.99	(40)
	lan	Feb	Mar	Δnr	May	lun	l Iul	Δυσ	Sen	Oct	Nov	Dec		
(41)m-	31	28	1VIA1 31	Арі 30	1VIA y	30	31	7.09 31	30	31	30	31		(41)
(41)11-	51	20	51	50	51	50		51	50	51	50	51		(41)
4. Wat	er heat	ing ener	gy requi	rement:								kWh/ye	ear:	
Assume if TFA if TFA	ed occu \ > 13.9 \ £ 13.9	pancy, f), N = 1), N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ГFA -13.	<u>2</u> . 9)	44		(42)
Annual Reduce ti not more	averag he annua that 125	e hot wa I average litres per p	ater usag hot water person per	ge in litre usage by s day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed t ld)	(25 x N) to achieve	+ 36 a water us	se target o	92 f	.24		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water	r usage ir	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	101.46	97.77	94.08	90.39	86.7	83.01	83.01	86.7	90.39	94.08	97.77	101.46		_
Ener <mark>gy c</mark> o	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600	ן kWh/mon	Fotal = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1106.83	(44)
(45)m=	1 <mark>5</mark> 0.46	131.59	135.79	118.39	113.6	<mark>9</mark> 8.02	90.83	104.23	105.48	122.93	134.18	145.71		
lf inclosed		a ta n haa sii		-f	hadwada		antan O in	L		Fotal = Su	m(45) ₁₁₂ =		1 <mark>4</mark> 51.23	(45)
it instanta	aneous w	ater neatir	ng at point	of use (no	o not water	storage),	enter 0 in	boxes (46)) to (61)					(10)
(46)m= Water s	22.57	19.74	20.37	17.76	17.04	14.7	13.63	15.64	15.82	18.44	20.13	21.86		(46)
Storage	e volum	e (litres)	includin	g any so	olar or M	/WHRS	storage	within sa	ame vess	sel		160		(47)
If comm	nunity h	eating a	nd no ta	nk in dw	elling, e	nter 110) litres in	(47)						()
Otherwi	ise if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water s	torage	loss:												
a) If ma	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temper	ature fa	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		16	60		(50)
D) II ma Hot wat	er stora	urer s de age loss	factor fr	om Tabl	e 2 (kW	or is not h/litre/da	KNOWN: av)				0	05		(51)
If comm	nunity h	eating s	ee sectio	on 4.3	• = (.,	~) /				0.	00		(0.)
Volume	factor	from Tal	ble 2a								0.	91		(52)
Temper	ature fa	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	5.	85		(54)
Enter (50) or (54) in (5	5)								5.	85		(55)
Water s	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)r	n				
(56)m=	181.24 r contains	163.7 dedicated	181.24 d solar sto	175.39 rage, (57)ı	181.24 n = (56)m	175.39 x [(50) – (181.24 [H11)] ÷ (5	181.24 0), else (57	175.39 7)m = (56)i	181.24 m where (175.39 H11) is fro	181.24 m Append	ix H	(56)
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)
Primarv	v circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primary	circuit	loss cal	culated f	or each	month (59)m = ((58) ÷ 36	65 × (41)	m				•	
(mod	ified by	factor fr	om Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for ea	ch	month ((61)m =	(60)) ÷ 36	65 × (41)	m						
(61)m=	0	0	0		0	0		0	0	0	0	0	0	0		(61)
Total h	neat rec	quired for	water	he	ating ca	alculated	d fo	r each	n month	(62)m =	= 0.85 ×	(45)m -	+ (46)m +	(57)m	 + (59)m + (61)m	
(62)m=	460.08	411.25	445.4	1	418.02	423.21	3	15.33	315.39	328.79	322.79	432.54	433.81	455.33	3	(62)
Solar DI	-IW input	calculated	using A	ppe	endix G or	Appendix	κH	(negativ	ve quantity)' if no sola	r contrib	ution to wate	er heating	g)	
(add a	ddition	al lines if	FGHF	RS a	and/or V	WHRS	s ap	oplies,	, see Ap	pendix	G)		-	-	_	
(63)m=	0	0	0		0	0		0	0	0	0	0	0	0		(63)
Output	t from v	vater hea	ter										-		_	
(64)m=	460.08	411.25	445.4	1	418.02	423.21	3	15.33	315.39	328.79	322.79	432.54	433.81	455.33	3	-
										Out	put from w	ater heat	er (annual)	12	4761.93	(64)
Heat g	ains fro	om water	heatir	ng,	kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61)r	n] + 0.8 x	x [(46)n	n + (57)m	+ (59)ı	m]	
(65)m=	152.73	136.52	147.8	5	138.75	140.47	6	6.13	64.85	69.31	68.6	143.57	144	151.15	5	(65)
inclu	ıde (57)m in calo	culatio	n o	of (65)m	only if c	yliı	nder is	s in the c	dwelling	or hot w	ater is	from com	munity	heating	
5. Int	ternal g	jains (see	e Table	e 5	and 5a):										
Metab	<u>olic gai</u>	<u>ns (Table</u>	e 5), W	/att	s									-	_	
	Jan	Feb	Ma	r	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec	:	
(66)m=	122.18	122.18	122.1	8	122.18	122.18	1	22.18	122.18	122.18	122.18	122.18	3 122.18	122.18	3	(66)
Ligh <mark>tin</mark>	g gains	s (calcula	ted in	Ap	pendix	L, equat	ion	L9 or	r L9a), a	lso see	Table 5					
(67)m=	38.31	34.03	27.68	8	20.95	15.66	1	3.22	14.29	18.57	24.93	3 <mark>1.65</mark>	36.94	39.38		(67)
App <mark>lia</mark>	nces ga	ains (ca <mark>lc</mark>	ulated	l in	Append	dix L, eq	uat	tion L'	13 o <mark>r L1</mark> :	3a), also	o see Ta	ble <mark>5</mark>				
(68)m=	217.34	219.59	213.9)1	201.81	186.54	1	72.18	162.59	160.34	166.02	17 <mark>8.12</mark>	193.39	207.75		(68)
Coo <mark>kir</mark>	ng gain	s (calcula	ated in	Ap	pendix	L, equa	tior	L15 ו	or L15a)	, also s	e <mark>e Tab</mark> le	e 5				
(69)m=	35.22	35.22	35.22	2	35. <mark>22</mark>	35.22	3	35.22	35.22	35.22	35.22	35.22	35.22	35.22		(69)
Pumps	s and fa	ans gains	(Tabl	e 5	a)											
(70)m=	10	10	10		10	10		10	10	10	10	10	10	10		(70)
Losses	s e.g. e	vaporatic	on (ne	gati	ive valu	es) (Tab	ole	5)			-				_	
(71)m=	-97.74	-97.74	-97.7	4	-97.74	-97.74	-9	97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74		(71)
Water	heating	g gains (T	able	5)							-			-		
(72)m=	205.28	203.15	198.7	'3	192.71	188.81	9	91.84	87.17	93.16	95.28	192.98	3 200.01	203.16	;	(72)
Total i	nterna	l gains =	:					(66)	m + (67)m	ı + (68)m	+ (69)m +	(70)m +	(71)m + (72))m		
(73)m=	530.59	526.43	509.9	7	485.13	460.66	3	846.9	333.7	341.72	355.89	472.4	499.99	519.94	ł	(73)
6. So	lar gair	ns:														
Solar g	gains are	calculated	using s	olar	flux from	Table 6a	and	associ	ated equa	tions to c	onvert to th	ne applica	able orientat	tion.		
Orienta	ation:	Access F Table 6d	actor		Area m²			Flu Tab	x ole 6a	٦	g_ able 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77		x	3.6	6	x	1	0.63	x	0.85	×	0.7	=	16.05	(74)
North	0.9x	0.77		x	3.6	6	x	2	0.32	x	0.85	×	0.7	=	30.67	(74)
North	0.9x	0.77		x	3.6	6	x	3	4.53	x	0.85		0.7	=	52.11	(74)
North	0.9x	0.77		x	3.6	6	x	5	5.46	x	0.85	×	0.7	- -	83.7	(74)
North	0.9x	0.77		x	3.6	6	x	7	4.72	x	0.85	×	0.7	=	112.76	(74)

North	0.9x	0.77		x	3.6	6	×	7	79.99	x	0.85	x	Γ	0.7		= [120.71	(74)
North	0.9x	0.77		x	3.6	6	×	7	74.68	x	0.85	x	Ē	0.7		=	112.7	(74)
North	0.9x	0.77		x	3.6	6	×	5	59.25	x	0.85	x	Ē	0.7		=	89.41	(74)
North	0.9x	0.77		x	3.6	6	×	4	11.52	x	0.85	x	Ē	0.7		= [62.65	(74)
North	0.9x	0.77		x	3.6	6	×	2	24.19	x	0.85	x	Ē	0.7		= [36.51	(74)
North	0.9x	0.77		x	3.6	6	×	1	13.12	x	0.85	x	Ē	0.7		=	19.8	(74)
North	0.9x	0.77		x	3.6	6	×		8.86	x	0.85	x	Ē	0.7		= [13.38	(74)
South	0.9x	0.77		x	3.1	2	x	4	46.75	x	0.85	x	Γ	0.7		=	60.15	(78)
South	0.9x	0.77		x	3.1	2	x	7	76.57	x	0.85	x	Ē	0.7		= [98.5	(78)
South	0.9x	0.77		x	3.1	2	x	9	97.53	x	0.85	x	Γ	0.7		= [125.48	(78)
South	0.9x	0.77		x	3.1	2	x	1	10.23	x	0.85	x	Ē	0.7		=	141.81	(78)
South	0.9x	0.77		x	3.1	2	x	1	14.87	x	0.85	x	Ē	0.7		= [147.78	(78)
South	0.9x	0.77		x	3.1	2	×	1	10.55	x	0.85	x	Ē	0.7		= [142.22	(78)
South	0.9x	0.77		x	3.1	2	×	1	08.01	x	0.85	x	Ē	0.7		= [138.96	(78)
South	0.9x	0.77		x	3.1	2	×	1	04.89	x	0.85	x	Ē	0.7		=	134.95	(78)
South	0.9x	0.77		x	3.1	2	×	1	01.89	x	0.85	x	Ē	0.7		= [131.07	(78)
South	0.9x	0.77		x	3.1	2	×	6	32.59	x	0.85	x	Ē	0.7		= [106.25	(78)
South	0.9x	0.77		x	3.1	2	×	5	55.42	х	0.85	x		0.7		=	71.29	(78)
South	0.9x	0.77		x	3.1	2	x		40.4	x	0.85	x		0.7		= [51.97	(78)
Sola <mark>r (</mark>	<mark>gain</mark> s in	watts, <mark>ca</mark>	alculat	ed	for each	n mon	th			(83)m	n = Sum(74)r	m(82)ı	m					
(83)m=	76.19	129.17	177.5	9	225.52	260.54	4 2	262.93	251.65	224	.36 193.7	3 142.	75	91.09	65.3	85		(83)
Total g	gains – i	nternal a	nd so	lar	(84)m =	: (73)n	1 + (83)m	, watts	1					r			<i>(</i>)
(84)m=	606.78	655.6	687.5	5	710.65	721.2	6	09.83	585.36	566	.08 549.6	615.	.15	591.08	585.	29		(84)
7. Me	ean inter	nal temp	eratu	e (heating	seaso	on)											
Temp	perature	during h	eating	g pe	eriods ir	the li	ving	area	from Tal	ble 9	, Th1 (°C)					[21	(85)
Utilis	ation fac	tor for g	ains fo	or li	ving are	a, h1,	m (s	see Ta	able 9a)									
	Jan	Feb	Ма	r	Apr	Ma	y	Jun	Jul	A	ug Sep	p O	ct	Nov	De	ec		
(86)m=	1	1	1		0.99	0.99		0.98	0.96	0.9	0.99	0.9	9	1	1			(86)
Mear	n interna	l tempera	ature i	in li	iving are	ea T1	(follo	ow ste	ps 3 to 7	7 in T	able 9c)							
(87)m=	17.89	18.04	18.39)	18.93	19.5	2	20.04	20.42	20.	38 19.91	1 19.2	23	18.5	17.8	39		(87)
Temp	perature	during h	eating	1 pe	eriods ir	rest o	of dv	velling	from Ta	able 9	9, Th2 (°C	;)						
(88)m=	18.43	18.44	18.45	5	18.5	18.51	•	18.57	18.57	18.	58 18.55	5 18.5	51	18.49	18.4	17		(88)
Utilis	ation fac	tor for a	ains fo	or re	est of d	vellinc	1 h2	m (se	e Table	9a)		!		•				
(89)m=	1	1	0.99		0.99	0.98	,, <u>,, ,, ,</u>	0.95	0.82	0.8	35 0.97	0.9	9	1	1			(89)
Moor		l tompor	oturo	L in t	ho root	of dwo		. TO /f			to 7 in To		\	1				
(90)m=	15.84		16.36		16.93	17.51		18.08	18 43	2ps 3	4 17.94) 24	16.5	15.8	38		(90)
(00)11-			10.00	·								fLA = l	_ivir	I ig area ÷ (4	1 4) =	~	0.28	(91)
	• •	1	- 1	<i></i>	. 4						(1.4.) -	50		- ``		l	0.20	
Mear			ature	(tor	the wh		/ellin	ng) = f	$LA \times T1$	+ (1	- tLA) × T	12	70	17.05	40.4			(02)
(92)m=	10.4	10.07	16.92	-	17.48	18.06		10.02	18.98	18.	94 18.48	2 ¹ /.	19	17.05	16.4	ю		(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.85	17.02	17.37	17.93	18.51	19.07	19.43	19.39	18.93	18.24	17.5	16.88		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	i to the r ilisation	mean int factor fo	ernal tei or gains	mperatui using Ta	re obtain able 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	1	1	0.99	0.99	0.98	0.96	0.9	0.92	0.97	0.99	1	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	604.76	652.72	683.13	702.93	705.27	585.66	529.22	520.7	535.24	608.09	588.2	583.59		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	5102.49	4903.4	4381.16	3562.34	2673.24	1718.03	1085.42	1145.11	1871.57	2998.9	4118.89	5067		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	3346.31	2856.45	2751.33	2058.77	1464.17	0	0	0	0	1778.77	2542.1	3335.66		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	20133.56	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								254.86	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	HP)					
Spac	e heatir	ng:										r		٦
Fracti	on of sp	ace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal hea <mark>ti</mark>	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Effi <mark>cie</mark>	ency of r	main s <mark>pa</mark>	ace heat	ing syste	em 1							Ī	65.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						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))								
	3346.31	2856.45	2751.33	2058.77	1464.17	0	0	0	0	1778.77	2542.1	3335.66		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)									(211)
	5077.86	4334.53	4175.01	3124.09	2221.8	0	0	0	0	2699.19	3857.51	5061.7		
								Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}		30551.68	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							-		_
= {[(98)m x (20	01)] } x 1	00 ÷ (20	8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating	J												
Output	from w	ater hea	ter (calc	ulated a	bove)									
	460.08	411.25	445.41	418.02	423.21	315.33	315.39	328.79	322.79	432.54	433.81	455.33		٦
Efficier	ncy of w	ater hea	iter	1									55.8	(216)
(217)m=	64.49	64.43	64.28	63.95	63.33	55.8	55.8	55.8	55.8	63.65	64.21	64.5		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(∠19)m (219)m=	1 = (04) 713.42	638.26	0 + (∠17) 692.93	653.7	668.27	565.11	565.21	589.22	578.47	679.6	675.66	705.96		
()								Tota	LI = Sum(2 ⁻	19a), ,, =			7725.81	(219)
Annua	l totale								,	· 112	Wh/vear	. l	kWh/vear	()
Space	heating	fuel use	ed, main	system	1					r. I		[30551.68	1
			,									l		

Water heating fuel used			7725.81
Electricity for pumps, fans and electric keep-hot			
central heating pump:		150	6 (230c
boiler with a fan-assisted flue		45	; (230e
Total electricity for the above, kWh/year	sum of (230a)(230g) =	201 (231)
Electricity for lighting			676.65 (232)
12a. CO2 emissions – Individual heating systems	including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	6599.16 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	1668.77 (264)
Space and water heating	(261) + (262) + (263) + (264) =	8267.94 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	104.32 (267)
Electricity for lighting	(232) x	0.519 =	351.18 (268)
Total CO2, kg/year		sum of (265)(271) =	8723.44 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	110.42 (273)
El rating (section 14)			25 (274)

			User D	etails:											
Assessor Name: Software Name:	Stroma FSAP 2	2012	roperty	Stroma Softwa	a Num are Ver Unit 11	ber: sion:		Versio	n: 1.0.3.4						
Address :	. london	, i	roporty /	luuress.	Onit 11										
1. Overall dwelling dimer	isions:														
Basement			Area	a(m²) 51	(1a) x	Av. He	ight(m) 1.9	(2a) =	Volume(m³ 96.9	ⁱ) (3a)					
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+	(1e)+(1r	ı)	51	(4)										
Dwelling volume			L		(3a)+(3b))+(3c)+(3d	d)+(3e)+	.(3n) =	96.9	(5)					
2. Ventilation rate:															
Number of chimneys Number of open flues	main heating 0 +	secondar heating	y] + [_] + [_	0 0] = [total 0 0	x 4	40 = 20 =	0 0	r (6a) (6b)					
Number of intermittent fan	S					2	x	10 =	20	(7a)					
Number of passive vents						0	x .	10 =	0	(7b)					
Number of flueless gas fire	es					0	X 4	40 =	0	(7c)					
	ber of open flues 0 + 0 + 0 = 0 × 20 = ber of intermittent fans ber of passive vents ber of flueless gas fires 0 × 10 = 0 × 40 = Air ch ation due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 20 ÷ $(5) =pressurisation test has been carried out or is intended, proceed to (17) otherwise continue from (9) to (16)$														
Infiltration due to chimney If a pressurisation test has be Number of storeys in the	mber of passive vents 0 $x \ 10 =$ mber of flueless gas fires 0 $x \ 40 =$ Itration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 \div (5) = if a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) $(9)-1] \times 0.1 =$														
Additional infiltration	,						[(9)	-1]x0.1 =	0	(10)					
Structural infiltration: 0.2	25 for steel or timb	er frame or	0.35 for	masonr	y constr	uction			0	(11)					
if both types of wall are pre deducting areas of opening	esent, use the value co gs); if equal user 0.35	rresponding to	the great	er wall are	a (after					_					
If suspended wooden flo	bor, enter 0.2 (uns	ealed) or 0.	1 (seale	d), else	enter 0				0	(12)					
If no draught lobby, ente	er 0.05, else enter	U							0						
Window infiltration	and doors draugh	it stripped		0.25 - [0.2	x (14) ÷ 1	001 =			0	-(14)					
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	-(10)					
Air permeability value, c	50, expressed in	cubic metre	s per ho	our per so	guare m	etre of e	envelope	area	20	(17)					
If based on air permeabilit	y value, then (18)	= [(17) ÷ 20]+(8	3), otherwi	se (18) = (16)				1.21	(18)					
Air permeability value applies	if a pressurisation tes	t has been don	e or a deg	gree air pei	meability	is being u	sed								
Number of sides sheltered	I			(00) 4	0.075 (4	0)]			1	(19)					
Shelter factor				(20) = 1 - [0.075 X (1	9)] =			0.92	(20)					
Inflitration rate incorporation	ng sneiter factor	l		(21) = (10)	x (20) =				1.12	(21)					
	r montniy wind sp		ll	A.1.0	Son	Oct	Nov	Dee							
	ad from Table 7	ay jun	Jul	Aug	Sep	Oct		Dec							
$(22)_{m-}$		20	2.8	37	Λ	13	15	47							
	4.4 4.3	, 3.0	5.0	3.1	4	4.0	4.5	4.1							
Wind Factor (22a)m = (22)m ÷ 4	8 0.05	0.05	0.02	1	1 00	1 1 2	1 10							
	.20 1.1 1.0	0.90	0.90	0.92	I	1.00	1.12	1.10							

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m		-				
	1.42	1.39	1.37	1.23	1.2	1.06	1.06	1.03	1.12	1.2	1.26	1.31			
Calcul If m	ate ette	<i>ctive air</i> al ventila	change : ation:	rate for t	he appli	cable ca	ISE								(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	23b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)					(23h)
If bal	anced with	h heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =	, (,					(230)
a) If	balance	ed mech	, anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	, a)m = (22	2b)m + (23b) x [1 – (23c)	÷ 1001		
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24a)
b) If	balance	ed mech	ı anical ve	ntilation	ı without	heat rec	L Coverv (N	I //V) (24b	m = (22)	1 2b)m + ()	1 23b)				
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	r positiv	/e input v	ventilatio	n from c	outside	!		!			
,	if (22b)r	n < 0.5 >	‹ (23b), t	then (24	c) = (23b); otherv	wise (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	natural	ventilati	on or wh	ole hous	se positiv	ve input	ventilatio	on from I	oft						
(0.4.1)	if (22b)r	n = 1, th	en (24d)	m = (221)	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]	4.00				(0.1d)
(24a)m=	1.42	1.39	1.37	1.23	1.2	1.06	1.06	1.03	1.12	1.2	1.26	1.31			(24u)
Effe	ctive air		rate - er	nter (24a	1) or (24)	5) or (240	c) or (24		(25)	1.2	1.26	1 21	l		(25)
(25)11=	1.42	1.39	1.37	1.25	1.2	1.00	1.00	1.05	1.12	1.2	1.20	1.51			(23)
3. He	at losse	s and he	eat loss	paramet	er:										
ELEN		Gros area	ss (m²)	Openin m	lgs 1 ²	Net Ar A ,r	rea m²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²·l	↔ ≺	A X kJ/l	í k K
Doo <mark>rs</mark>						1.9	x	1.4	=	2.66					(26)
Windo	ws Type	e 1				1.67	x1.	/[1/(4.8)+	0.04] =	6.72					(27)
Windo	ws Type	e 2				0.84	x1.	/[1/(4.8)+	0.04] =	3.38					(27)
Walls [®]	Type1	45.	3	2.51		42.79) X	2.1	=	89.86					(29)
Walls	Type2	15.3	39	1.9		13.49) x	2.1	=	28.33					(29)
Roof		31.	9	0		31.9	x	2.3	=	73.37			ΠĒ		(30)
Total a	area of e	elements	, m²			92.59	9								(31)
* for win ** incluc	ndows and le 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	lated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	n paragraph	1 3.2		
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				204	.33	(33)
Heat c	apacity	Cm = S	(A x k)						((28)	.(30) + (32	2) + (32a)	(32e) =	C		(34)
Therm	al mass	parame	eter (TMF	- = Cm -	÷ TFA) ir	ר kJ/m²K	,		Indica	tive Value	: High		45	0	(35)
For des can be t	ign asses: used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f			
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	K						1	4	(36)
if details	s of therma	al bridging	are not kn	10wn (36) =	= 0.15 x (3	1)									-
Total f	abric he	at loss							(33) +	(36) =			218	.33	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y 	<u> </u>	<u> </u>		(38)m	= 0.33 × (25)m x (5)	I		
(00) -	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			(20)
(38)m=	45.5	44.6	43.71	39.25	38.36	33.9	33.9	33.01	35.68	38.36	40.14	41.93			(30)
Heat t	ransfer o	coefficie	nt, W/K			1			(39)m	= (37) + (3	38)m	1	l		
(39)m=	263.82	262.93	262.04	257.58	256.69	252.22	252.22	251.33	254.01	256.69	258.47	260.25		25	
									,	+verage =	Sum(39)	112 / TZ=	257	.35	(39)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	5.17	5.16	5.14	5.05	5.03	4.95	4.95	4.93	4.98	5.03	5.07	5.1		
									/	Average =	Sum(40)1.	12 /12=	5.05	(40)
eamuri]	r or day	/s in mor	nın (Tab Mər		May	lun		Δυσ	Son	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31 Aug	30	31	30	31		(41)
(,=	01				01		01	0.		01				()
4. Wat	ter heat	ting ener	gy requi	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	upancy, I 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (1	TFA -13	.9) .9)	72		(42)
Annual Reduce t not more	averag the annua that 125	le hot wa al average litres per p	ater usag hot water person per	ge in litre usage by s day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.04		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					I	
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54		
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600) kWh/mon	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	900.48	(44)
(45)m=	122.41	107.06	110.48	96. <mark>3</mark> 2	92.42	79.75	73.9	84.8	85.81	10 <mark>0.01</mark>	109.17	118.55		_
lf instanta	aneous w	ater heatin	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1180.67	(45)
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78		(46)
Water s	storage	loss:												
Storage	e volum	e (litres)	includir	ng any so	olar or M	/WHRS	storage	within sa	ame ves	sel		160		(47)
If comm	nunity h ise if no	eating a	nd no ta	ink in dw ar (this in	velling, e ocludes i	nter 110 nstantar	litres in	(47) mbi boil	ers) ente	er 'O' in <i>(</i>	(47)			
Water s	storage	loss:	not wate			notantai					(11)			
a) If ma	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		16	60		(50)
b) If ma	anufact	urer's de	eclared of factor fr	cylinder l	oss fact	or is not	known:							
If comm	nunity h	age loss leating s	ee secti	on 4.3	ez(kvv	n/iitre/ua	iy)				0.	05		(51)
Volume	e factor	from Tal	ble 2a	011 1.0							0.	91		(52)
Tempe	rature f	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	5.	85		(54)
Enter ((50) or ((54) in (5	55)								5.	85		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	m				
(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(56)
If cylinde	r contains	s dedicated	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24		(57)
Primary	/ circuit	loss (an	inual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m 					
(mod	itied by	tactor fr	rom Tab	IE H5 if t	nere is s	solar wat	ter heati	ng and a	cylinder	r thermo	ostat)	400	l	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for eac	h n	nonth (61)m =	(60)) ÷ 36	65 × (41)	m						
(61)m=	0	0	0		0	0		0	0	0	0	0	0	0		(61)
Total h	eat rec	uired for	water	hea	ating ca	lculated	l for	eacl	n month	(62)m =	= 0.85 ×	(45)m +	· (46)m +	(57)m +	(59)m + (61)m	
(62)m=	432.03	386.71	420.09) :	395.94	402.03	29	7.06	298.45	309.35	303.12	409.62	408.79	428.16]	(62)
Solar DI	HW input	calculated	using Ap	pper	ndix G or	Appendix	: H (r	negati	ve quantity	v) (enter '()' if no sola	r contribu	ition to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	Sa	nd/or V	VWHRS	ар	plies	, see Ap	pendix	G)		_			
(63)m=	0	0	0		0	0		0	0	0	0	0	0	0		(63)
Output	from v	ater hea	ter				_					-		-	_	
(64)m=	432.03	386.71	420.09) :	395.94	402.03	29	7.06	298.45	309.35	303.12	409.62	408.79	428.16		-
										Out	put from w	ater heat	er (annual)₁	12	4491.37	(64)
Heat g	ains fro	om water	heating	g, k	wh/mo	onth 0.2	5´[0.85	× (45)m	+ (61)r	n] + 0.8 x	x [(46)n	n + (57)m	+ (59)m]	
(65)m=	143.4	128.36	139.44	ŀ	131.41	133.43	60	0.05	59.22	62.85	62.07	135.95	135.69	142.12		(65)
inclu	ide (57)	m in calo	culatior	n of	(65)m	only if c	ylin	der is	s in the c	dwelling	or hot w	ater is	from com	munity ł	neating	
5. Int	ernal g	ains (see	Table	5 a	and 5a)	:										
Metab	olic gai	ns (Table	e 5), Wa	atts	5											
	Jan	Feb	Mar		Apr	Мау		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	85.98	85.98	85.98		85.98	85.98	85	5.98	85.98	85.98	85.98	85.98	85.98	85.98		(66)
Ligh <mark>tin</mark>	g gains	(calcula	ted in A	٩p	oendix l	_, equat	ion	L9 oi	r L9a), <mark>a</mark>	lso see	Table 5					
(67)m=	2 <mark>9.11</mark>	25.86	21.03	Γ	15.92	11.9	10).05	10.8 <mark>6</mark>	14.11	18.94	24.05	28.07	29.92		(67)
Applia	nces ga	ains (ca <mark>lc</mark>	ulated	in /	Append	lix L, eq	uati	on L	13 o <mark>r L1</mark> :	3a), als	o see Ta	ble 5	·			
(68)m=	149.83	151.39	147.47	·	<mark>139</mark> .13	128.6	11	8.7	112.09	110.54	114.45	122.8	133.32	143.22		(68)
Cookir	ng gains	s (calcula	ited in <i>i</i>	App	oendix	L, equat	ion	L15	or L15a)	, also s	ee Table	5				
(69)m=	31.6	31.6	31.6	T	31.6	31.6	3	1.6	31.6	31.6	31.6	31.6	31.6	31.6		(69)
Pumps	and fa	Ins gains	(Table	5a	a)											
(70)m=	10	10	10	Τ	10	10		10	10	10	10	10	10	10		(70)
Losses	s e.g. e	vaporatio	n (neg	ativ	/e valu	es) (Tab	le 5	5)			•	•	•			
(71)m=	-68.78	-68.78	-68.78		-68.78	-68.78	-6	8.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78		(71)
Water	heating	, gains (T	able 5)									•		1	
(72)m=	192.75	191.01	187.41		182.52	179.34	8	3.4	79.6	84.47	86.2	182.73	188.45	191.02]	(72)
Total i	nterna	l gains =		-				(66)	m + (67)m	+ (68)m	+ (69)m +	(70)m + (71)m + (72)	m	1	
(73)m=	430.48	427.05	414.7		396.36	378.63	27	0.94	261.34	267.91	278.39	388.37	408.64	422.96]	(73)
6. So	lar gain	s:					1					L				
Solar g	ains are	calculated	using so	lar f	lux from	Table 6a	and	associ	ated equa	tions to c	onvert to th	ne applica	ble orientat	ion.		
Orienta	ation:	Access F	actor		Area			Flu	X		g		FF		Gains	
		Table 6d			m²			Tal	ole 6a	-	Table 6b	_	Fable 6c		(W)	
East	0.9x	1		× [1.6	7	x	1	9.64	x	0.85	×	0.7	=	13.52	(76)
East	0.9x	1		×	1.6	7	×	3	8.42	x	0.85	×	0.7	=	26.46	(76)
East	0.9x	1		× [1.6	7	×	6	3.27	x	0.85	×	0.7	=	43.57	(76)
East	0.9x	1		×	1.6	7	x [9	2.28	x	0.85	×	0.7	=	63.54	(76)
East	0.9x	1		×「	1.6	7	x	1	13.09	x	0.85	x	0.7	=	77.88	(76)

East	0.9x	1		x	1.6	7	x	1	15.77	x	0.85		x	0.7		= [79.72	(76)
East	0.9x	1		x	1.6	7	x	1	10.22	x	0.85		x	0.7		= [75.9	(76)
East	0.9x	1		x	1.6	7	x	g	94.68	x	0.85		x	0.7		= [65.19	(76)
East	0.9x	1		x	1.6	7	x	7	'3.59	x	0.85		x	0.7		= [50.67	(76)
East	0.9x	1		x	1.6	7	x	4	5.59	x	0.85		x	0.7		= [31.39	(76)
East	0.9x	1		x	1.6	7	x	2	24.49	x	0.85		x	0.7		= [16.86	(76)
East	0.9x	1		x	1.6	7	x	1	6.15	x	0.85		x	0.7		= [11.12	(76)
West	0.9x	0.77		x	0.8	4	x	1	9.64	x	0.85		x	0.7		= [6.8	(80)
West	0.9x	0.77		x	0.8	4	x	3	88.42	×	0.85		x	0.7		= [13.31	(80)
West	0.9x	0.77		x	0.8	4	x	6	3.27	x	0.85		x	0.7		= [21.92	(80)
West	0.9x	0.77		x	0.8	4	x	g	92.28	x	0.85		x	0.7		= [31.96	(80)
West	0.9x	0.77		x	0.8	4	x	1	13.09	x	0.85		x	0.7		= [39.17	(80)
West	0.9x	0.77		x	0.8	4	x	1	15.77	x	0.85		x	0.7		= [40.1	(80)
West	0.9x	0.77		x	0.8	4	x	1	10.22	x	0.85		x	0.7		= [38.18	(80)
West	0.9x	0.77		x	0.8	4	x	g	94.68	x	0.85		x	0.7		= [32.79	(80)
West	0.9x	0.77		x	0.8	4	x	7	3.59	x	0.85		x	0.7		= [25.49	(80)
West	0.9x	0.77		x	0.8	4	x	4	5.59	x	0.85		x	0.7		= [15.79	(80)
West	0.9x	0.77		x	0.8	4	×	2	24.49	х	0.85		x	0.7		- [8.48	(80)
West	0.9x	0.77		x	0.8	4	x	1	6.15	x	0.85		x	0.7		- [5.59	(80)
Solar (gains in	watts, <mark>ca</mark>	alcula	ted	for eacl	n mon	th			(83)m	n = Sum(74))m(<mark>8</mark> 2)m					
(83)m=	20.33	39.76	65.4	9	95.51	117.0	5 1	19.82	114.07	97.	99 76.1	6	47.18	25.35	16.7	2		(83)
l otal g	jains – i	nternal a	nd so	blar	(84)m =	: (73)n	1 + (83)m	, watts	I								(2.1)
(84)m=	450.81	466.81	480.	19	491.87	495.6	3 3	90.76	375.41	365	5.9 354.	55 4	135.55	433.98	439.6	57		(84)
7. Me	ean inter	nal temp	eratu	ıre (heating	seaso	on)											
Temp	perature	during h	eatin	g pe	eriods ir	the li	ving	area	from Tab	ole 9	, Th1 (°C)					21	(85)
Utilis	ation fac	tor for g	ains f	or li	ving are	a, h1,	m (s	ee Ta	ble 9a)									
	Jan	Feb	Ma	ar	Apr	Ma	y 📃	Jun	Jul	A	ug Se	эр	Oct	Nov	De	С		
(86)m=	1	1	1		0.99	0.99		0.98	0.96	0.9	97 0.99	9	0.99	1	1			(86)
Mear	n interna	l tempera	ature	in li	iving are	ea T1	(follo	w ste	ps 3 to 7	7 in T	able 9c)							
(87)m=	17.92	18.06	18.4	1	18.93	19.51	2	20.03	20.41	20.	36 19.8	39	19.24	18.52	17.9	2		(87)
Temp	perature	during h	eatin	g pe	eriods ir	rest o	of dw	/elling	from Ta	able 9	9, Th2 (°C	C)						
(88)m=	18.41	18.42	18.4	3	18.47	18.48	1	18.53	18.53	18.	54 18.5	51	18.48	18.47	18.4	5		(88)
Utilis	ation fac	tor for a	ains f	or re	est of d	velling	ı. h2	.m (se	e Table	9a)	•			•				
(89)m=	1	1	0.9	9	0.99	0.97		0.95	0.81	0.8	35 0.97	7	0.99	0.99	1			(89)
Moor			oturo	in t	ho roct	of dwo		T2 (f			to 7 in T		00)	1				
(90)m=	15.86	16.01	16.3	6 I	16.92	17 49		12 (1	18.38	18	36 179		90) 17 23	16.5	15.8	9		(90)
(00)11-			. 0.0	-						L		- fLA	= Liv	ing area ÷ (4	1 4) =	-	0.56	(91)
								\	· •		() ()	To		- (L	0.00	
Mear			ature	(tor	the wh		ellin	g) = f	$LA \times T1$	+ (1	- tLA) ×	12	10.00	47.04	47.0			(00)
(92)m=	17.03	17.17	17.5	2	18.06	18.63		19.16	19.53	19.	49 19.0	⁷²	18.36	17.64	17.04	4		(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.48	17.62	17.97	18.51	19.08	19.61	19.98	19.94	19.47	18.81	18.09	17.49		(93)
8. Spa	ace hea	iting requ	uiremen	t										
Set Ti the ut	i to the ilisation	mean int factor fo	ternal te or gains	mperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(7	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	n:										
(94)m=	1	1	0.99	0.99	0.98	0.97	0.93	0.94	0.98	0.99	0.99	1		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	448.91	464.49	476.89	486.4	485.2	379.05	350.94	345.41	347.35	430.3	431.42	437.99		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	3475.87	3344.55	3004.86	2474.53	1894.36	1263.47	851.67	889.76	1364.79	2108.49	2840.56	3457.8		(97)
Space	e heatin	g require	ement fo	or each m	nonth, k\	/Vh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	2252.06	1935.4	1880.81	1431.45	1048.42	0	0	0	0	1248.58	1734.58	2246.74		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	13778.03	(98)
Space	e heatin	g requir	ement in	ı kWh/m²	/year								270.16	(99)
9a. Ene	ergy rea	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space	e heatii	ng:												-
Fracti	on of sp	bace hea	at from s	econdary	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal hea <mark>ti</mark>	<mark>ng f</mark> rom	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main s <mark>p</mark> a	ace heat	ing syste	em 1								65.9	(206)
Effi <mark>cie</mark>	ency of a	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g requir	ement (o	calculate	d above)									
	2252.06	1935.4	1880.81	1431.45	1048.42	0	0	0	0	1248.58	1734.58	2246.74		
(211)m	n = {[(98	s)m x (20	04)] } x 1	100 ÷ (20)6)									(211)
	3417.39	2936.88	2854.04	2172.16	1590.92	0	0	0	0	1894.65	2632.14	3409.32		
-								Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	=	20907.49	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98))m x (20	01)]}x 1	00 ÷ (20)8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}		0	(215)
Water	heating	9												-
Output	from w	ater hea	ter (calc	ulated al	bove)									
	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		-
Efficier	ncy of w	ater hea	ater										55.8	(216)
(217)m=	64.03	63.97	63.79	63.41	62.75	55.8	55.8	55.8	55.8	63.08	63.7	64.04		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m (219)m=	1 = (64) 674.68	604.51	$J \div (217)$ 658.54	624.39	640.67	532.36	534.86	554.4	543.23	649.38	641.74	668.54		
(= / 0)///-	0. 1.00			021.00	0.001	002.00	001.00	Tota	I = Sum(2)	19a), " =	• · · · · · ·	000.07	7327 28	(210)
Annua	l totale								、-	۰۱۱۲ ۲۰۱	Nh/vear	,	kWh/vear	
Space	heating	fuel use	ed, main	system	1					N.	and year		20907.49	1
1	3		,									l		J

Water heating fuel used			7327.28
Electricity for pumps, fans and electric keep-hot			
central heating pump:		156	(2300
boiler with a fan-assisted flue		45	(2306
Total electricity for the above, kWh/year	sum of (2	230a)(230g) =	201 (231)
Electricity for lighting			514.14 (232)
12a. CO2 emissions – Individual heating systems	including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	4516.02 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	1582.69 (264)
Space and water heating	(261) + (262) + (263) + (264)	=	6098.71 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	104.32 (267)
Electricity for lighting	(232) x	0.519 =	266.84 (268)
Total CO2, kg/year		sum of (265)(271) =	6469.87 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	126.86 (273)
El rating (section 14)			26 (274)



Appendix B - SAP outputs for the 'Be Lean' stage

The DER outputs from the FSAP modelling of the proposed development with the upgraded fabric and building services systems were used to calculate the 'Be Lean' stage CO_2 emissions of the development.



				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	2	roportu	Strom Softwa	a Num are Ver	ber: sion:		Versio	on: 1.0.3.4	
Address :	london NV	V3 4PB	F	roperty /	Audress	. Unit T					
1. Overall dwelling dime	nsions:										
Ŭ				Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	
Basement					33	(1a) x	2.	.25	(2a) =	74.25	(3a)
Ground floor					19	(1b) x	1.	.65	(2b) =	31.35	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+	(1d)+(1e)	+(1r	n)	52	(4)					-
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	105.6	(5)
2 Ventilation rate:											1
	main	se	condar	у	other		total			m ³ per hour	
Number of chimneys] + [] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0] + [0] = [0	x 2	20 =	0](6b)
Number of intermittent fa	ns						2	× ′	10 =	20	(7a)
Number of passive vents						Ē	0	× ′	10 =	0	(7b)
Number of flueless gas fi	res						0	× 4	40 =	0	(7c)
									Air ch	anges per hou	ır
Infiltration due to chimne	s, flues and f	ans = (6a)+(6b)+(7	a)+ (7b)+(7c) =		20	· [÷ (5) =	0.19	(8)
If a pressurisation test has b	een ca <mark>rried out</mark> ol	is intended	d, procee	d to (17), d	otherwise o	continue fr	om (9) to ((16)			٦
Additional infiltration	ie dw <mark>eiling</mark> (na	5)						[(9)-	-11x0 1 =	0	(9)
Structural infiltration: 0	.25 for steel or	timber fr	ame or	0.35 fo	r masoni	rv constr	uction	[(0)	1,0.1 -	0	(10) (11)
if both types of wall are p	resent, use the va	lue corresp	onding to	the great	er wall are	a (after				.], ,
deducting areas of openir	ngs); if equal user	0.35 (unseale	ad) or 0	1 (seale	ad) alsa	enter ()				0	7(12)
If no draught lobby, en	ter 0.05. else e	enter 0			<i>a</i>), cioc					0	(12)
Percentage of windows	s and doors dr	aught stri	ipped							0	(14)
Window infiltration		-			0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	d in cubi	c metre	s per ho	our per s	quare m	etre of e	nvelope	area	10	(17)
If based on air permeabil	ity value, then	(18) = [(17) ÷ 20]+(8	3), otherwi	ise (18) = ((16)				0.69	(18)
Air permeability value applie	s if a pressurisation	on test has	been dor	e or a deg	gree air pe	rmeability	is being us	sed	ĺ		
Shelter factor	u				(20) = 1 -	[0.075 x (1	9)] =			0.92	(19)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18) x (20) =				0.64](21)
Infiltration rate modified for	or monthly wir	id speed									J ' '
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tabl	e 7									
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	2a)m =	(22)m ÷	4									_		
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18			
Adjuste	ed infiltra	ation rat	e (allowi	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m						
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75			
Calcula	ate effec	ctive air	change	rate for t	he appli	cable ca	se		-		-	-	- 	_	
II IIIe			ucing App	ondix N (2	(25) = (22)) x Emy (c	ocuption (N		nuico (22h	(220)				0	(23a)
If bold					(200) = (200)	a) X FIIIV (e	equation (i)	i) = (23a)				0	(23b)
									() = (0)	0h)ma (/	00h) [/	(00.0)	. 4001	0	(23c)
a) If			anical ve					HR) (248	a m = (2)	20)m + (. 1	23D) × [*	1 - (23C)	÷ 100] I		(24a)
(24a)III=					U		()					0			(24a)
D) IT	balance	a mech	anical ve	entilation	without	neat rec	covery (N	VIV) (240 1	m = (22)	2b)m + (2 1	23b)	0	1		(24b)
(24b)m=		0	0	0	0	0	0	0	0	0	0	0			(240)
c) If	whole h	ouse ex	tract ver	tilation (or positiv	/e input v	ventilatio	on from c a) = (22k)	outside	5 v (22h					
(24c)m-		0.5			(231) = (231)			C = (ZZL)	$\frac{1}{1}$.5 × (230		0	1		(24c)
(240)III-		un tilati								0	0	0			(210)
a) n	if (22b)m	r = 1, th	en (24d)	m = (22)	b)m othe	e input erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]					
(24d) <mark>m=</mark>	0.83	0.82	0.81	0.75	0.73	0.68	0.68	0.67	0.7	0 <mark>.73</mark>	0.76	0.78			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	d) in boy	(25)						
(25)m=	0.83	0.82	0.81	0.75	0.73	0.68	0.68	0.67	0.7	0.73	0.76	0.78			(25)
0.116															
				naramen											
			5at 1055	Oponin		Not Ar	200					k volu	、 、		k
ELEN		Gros	ss (m²)	Openin m	gs 1 ²	Net Ar A ,r	ea n²	U-valu W/m2	ue 2K	A X U (W/ł	K)	k-value kJ/m²·l	e K	A X I kJ/K	k
ELEN Doors	IENT Type 1	Gros area	ss (m²)	Openin m	gs J ²	Net Ar A ,r 7.3	rea m² x	U-valu W/m2	ue 2K =	A X U (W/I 10.22	<)	k-value kJ/m²₊l	e K	A X I kJ/K	k (26)
ELEN Doors	IENT Type 1 Type 2	Gros	ss (m²)	Openin r	gs J ²	Net Ar A ,r 7.3	ea n ² x	U-valu W/m2 1.4	ue 2K =	A X U (W/ł 10.22 6.02	<)	k-value kJ/m²·I	e K	A X I kJ/K	k (26) (26)
Doors Window	IENT Type 1 Type 2 ws Type	Gros area	35 (m ²)	Openin m	gs _{j²}	Net Ar A ,r 7.3 4.3	ea n ² x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+	ue 2K = =	A X U (W/ł 10.22 6.02 3.1	<)	k-value kJ/m²·I	e K	A X I kJ/K	k (26) (26) (27)
Doors Doors Windov	IENT Type 1 Type 2 ws Type ws Type	Gros area	ss (m ²)	Openin m	gs ₂ 2	Net Ar A ,r 7.3 4.3 1.6	ea n ² x x x ¹ x ¹	U-valu W/m2 1.4 (1/(2.1)+ /[1/(2.1)+	ue 2K □ = ○ 0.04] = ○ 0.04] =	A X U (W/I 10.22 6.02 3.1 3.82	<)	k-value kJ/m²-I	e K	A X I kJ/K	k (26) (26) (27) (27)
ELEN Doors Doors Windov Floor	IENT Type 1 Type 2 ws Type ws Type	Gros area	(m ²)	Openin m	gs ₁₂	Net Ar A ,r 7.3 4.3 1.6 1.97	ea n ² x x x x ¹ x ¹	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+	ue 2K = = 0.04] = ○ 0.04] =	A X U (W/I 10.22 6.02 3.1 3.82 7.546		k-value kJ/m²+l	× K	A X I kJ/K	k (26) (26) (27) (27) (28)
Doors Doors Doors Windov Floor Walls	IENT Type 1 Type 2 ws Type ws Type	Gros area	4	Openin m	gs ,2	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3	ea n ² x x x ¹ x ¹ x ¹ x	U-valu W/m2 1.4 (1/(2.1)+ /[1/(2.1)+ /[1/(2.1)+	ue 2K = = = ○ 0.04] = = ○ 0.04] = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546		k-value kJ/m²·I		A X I kJ/K	(26) (26) (27) (27) (28) (29)
Doors Doors Windov Windov Floor Walls	IENT Type 1 Type 2 ws Type ws Type Type1	Grosarea	4 1	Openin m	gs ₁ 2 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23	ea n ² x x x x ¹ x ¹ x ¹ x ²	U-valu W/m2 1.4 [1/(2.1)+ /[1/(2.1)+ [0.22 0.28	ue 2K = = = 0.04] = = 0.04] = = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98		k-value kJ/m²+l		A X I kJ/K	k (26) (27) (27) (27) (28) (29)
Doors Doors Windov Windov Floor Walls ⁻ Roof	A Providence of the second sec	Gros area 2 29. 44.	4 1	Openin m 15.1 0	gs ,2	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1	ea n ² x x x x ¹ x ¹ x ¹ x ² x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28	ue 2K = = 0.04] = ○ 0.04] = = = = =	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98 12.35		k-value kJ/m²+l		A X I kJ/K	k (26) (27) (27) (28) (29) (29) (29)
Doors Doors Windov Windov Floor Walls ⁻ Roof	IENT Type 1 Type 2 ws Type ws Type Type1 Type2	Gros area 1 29. 29. 44.	4 1 m ²	Openin m 15.1' 0 0 0	gs ,2 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19	ea n ² x x x ¹ x ¹ x ¹ x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.16	ue 2K = = = 0.04] = = 0.04] = = = = = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04		k-value kJ/m²·I		A X I kJ/K	k (26) (27) (27) (28) (29) (29) (29) (30)
Doors Doors Windov Windov Floor Walls ⁻ Roof Total a	A Providence of e	Grosarea area 1 29. 44. 19. Iements	4 1 , m ²	Openin m 15.1 0 0	gs ² 7	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8	ea n ² x x x x ¹ x ¹ x ¹ x ² x x x x x x x x x	U-valu W/m2 1.4 [1/(2.1)+ /[1/(2.1)+ [0.22 0.28 0.28 0.28	ue 2K = = = 0.04] = = 0.04] = = = = = = =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04		k-value kJ/m²+l			k (26) (27) (27) (28) (29) (29) (30) (31)
S. ree ELEN Doors Doors Windov Floor Walls ⁻ Roof Total a Party v	IENT Type 1 Type 2 ws Type ws Type Type1 Type2 area of e wall	Grosarea area 1 29. 44. 19. Iements	4 1 , m ²	Openin m 15.1 0 0	gs ,2 7	Net Ar A,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9	ea n ² x x x ¹ x ¹ x ¹ x ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 (1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.16	ue 2K = = 0.04] = = 0.04] = = = = = = = = =	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04		k-value kJ/m²·l			 (26) (27) (27) (27) (28) (29) (30) (31) (32)
S. ree ELEN Doors Doors Windov Windov Floor Walls ⁻ Roof Total a Party v * for win ** includ	A Providence of endows and le the area	Gros area 4 29. 44. 19 19 19 19 19 19 19 19 19 19 19 19 19	4 1 , m ² ows, use e sides of in	Openin m 15.1 0 0 effective with ternal wal	gs ⁷ ndow U-va ¹ / ₂ ¹ / ₂	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calcul titions	ea n ² x x x ¹ x ¹ x ¹ x ² x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.16	ue : = : 0.04] : = : = : = : = : = : = : = : = : = : = : = : = : = : = : = : = : = : =	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 ue)+0.04] a	<)	k-value kJ/m²+l			k (26) (27) (27) (28) (29) (29) (30) (31) (32)
S. ree ELEN Doors Doors Windov Floor Walls ⁻ Roof Total a Party v * for win ** includ Fabric	A Providence of environmental of the area of environmental of the area of environmental of the area of environmental of the area of the ar	Gros area 4 2 2 29. 44. 19 19 19 19 19 19 19 19 19 19 19 19 19	4 1 , m ² ows, use e sides of ir = S (A x	Openin m 15.1 0 0 effective wi internal wal U)	gs ⁷ mdow U-va ls and par	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 14.9 alue calculations	ea n ² x x x ¹ x ¹ x ¹ x ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 [1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.16 0.16	$\begin{array}{c} ue \\ 2K \\ = \\ 0.04] = \\ 0.04] = \\ = \\ = \\ = \\ = \\ = \\ \\ = \\ \\ \\ \\ \\ $	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 12.35 3.04	<)	k-value kJ/m²+l	× K	A X I kJ/K	k (26) (27) (27) (28) (29) (29) (30) (31) (32) (33)
S. ree ELEN Doors Doors Windou Windou Floor Walls ⁻ Roof Total a Party v * for win ** includ Fabric Heat c	A Providence of environmental losses of environmental losses of environmental losses of environmental loss and le the area heat loss apacity (Gros area Grosarea129. $44.19191919191919191919191919$	4 1 , m ² ows, use e sides of ir = S (A x (A x k)	Openin m 15.1 0 0 effective winternal wal	gs j2 7 Indow U-va Is and par	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calculations	ea n ² x x x ¹ x ¹ x ¹ x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ /[1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.28 0.16	$\begin{array}{c} ue \\ 2K \\ = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ = \\ = \\ 0 = \\$	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 12.35 3.04	K) Image: system in Image: system in	k-value kJ/m²-I		A X I kJ/K	k (26) (27) (27) (28) (29) (30) (31) (32) (33) (33) (34)
S. ree ELEN Doors Doors Windou Floor Walls ⁻ Walls ⁻ Roof Total a Party v * for win ** includ Fabric Heat c Therm	ALENT Type 1 Type 2 ws Type ws Type ws Type Type1 Type2 area of e wall dows and le the area heat los apacity (al mass	Gros area Grosarea129. $44.19lementsroof windas on bothas on bothas, W/K =Cm = Scparame$	$\frac{4}{1}$ $\frac{4}{2}$ $\frac{1}{2}$ $\frac{1}$	Openin m $ \begin{array}{c} 15.1\\ \hline 0\\ \hline 0\\ \hline 0\\ \hline 0\\ \hline 0\\ \hline 0\\ \hline 0\\ \hline $	gs ⁷ ⁷ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ² ² ² ² ³ ⁴ ⁴ ⁴ ⁴ ⁵ ⁶ ⁶ ⁶ ⁶ ⁷ ⁷ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calculations	ea n ² x x x ¹ x ¹ x ¹ x ² x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 /[1/(2.1)+ /[1/(2.1)+ (1/(2.1)+ 0.22 0.28 0.28 0.28 0.28 0.28 0.28 0.16	$\begin{bmatrix} ue\\2K \\ = \\ 0.04] = \\ 0.04] = \\ = \\ = \\ = \\ = \\ (1) = \\ (1/U-value) \\ (1/U-value) \\ (28). \\ Indices$	A X U (W// 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 0 ue)+0.04] a (30) + (32 (30) + (32	<pre>K)</pre>	k-value kJ/m²-l		A X I kJ/K	k (26) (27) (27) (28) (29) (29) (30) (31) (32) (33) (33) (34) (35)
S. ree ELEN Doors Doors Windou Windou Floor Walls ⁻ Roof Total a Party v * for win ** includ Fabric Heat c Therm. For desi can be	ALENT Type 1 Type 2 ws Type ws Type ws Type Type1 Type2 area of e wall dows and le the area heat los apacity (al mass ign assess used instea	Gros area Grosarea129. $(44.)(19)lementsroof windas on bothas, W/K =Cm = S(parameand of a de$	$\frac{4}{1}$ $\frac{4}{1}$ $\frac{1}{2}$ $\frac{4}{3}$ $\frac{1}{3}$ $\frac{1}$	Openin m $ \begin{array}{c} 15.1\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\ 0\\$	gs 2 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Net Ar A ,r 7.3 4.3 1.6 1.97 34.3 14.23 44.1 19 126.8 14.9 alue calcul titions	ea n ² x x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.4 1.4 [1/(2.1)+ /[1/(2.1)+ [1/(2.1)+ [0.22 0.28 0.28 0.28 0.28 0.28 0.16 (26)(30)	$\begin{array}{c} ue \\ 2K \\ = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ = \\ = \\ = \\ 0 \\ = \\ 0 \\ 0.04] = \\ = \\ 0.04] = \\$	A X U (W/I 10.22 6.02 3.1 3.82 7.546 3.98 12.35 3.04 12.35 3.04 0 ue)+0.04] a (30) + (32 (30) + (32 c) values of	<pre>K)</pre>	k-value kJ/m²-l		A X I kJ/K	k (26) (27) (27) (28) (29) (30) (31) (32) (33) (33) (34) (35)

if detail	s of therm	al bridging	are not kr	own (36) =	= 0.15 x (3	1)			(22)	(2.2)				-
Iotal	tabric he	eat loss							(33) +	(36) =			70.07	(37)
Ventil	ation hea	at loss ca	alculated	monthl	y I				(38)m	= 0.33 × (25)m x (5)	_	l	
(00)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)m=	28.94	28.49	28.06	26	25.61	23.82	23.82	23.49	24.51	25.61	26.39	27.21		(30)
Heat t	ransfer	coefficie	nt, W/K	. <u> </u>	. <u> </u>	·	i		(39)m	= (37) + (3	38)m	i	I	
(39)m=	99.02	98.57	98.13	96.07	95.69	93.89	93.89	93.56	94.58	95.69	96.47	97.28		
Heat I	oss para	ameter (H	HLP), W	/m²K					(40)m	Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	96.07	(39)
(40)m=	1.9	1.9	1.89	1.85	1.84	1.81	1.81	1.8	1.82	1.84	1.86	1.87		_
Numb	er of da	ys in moi	nth (Tab	le 1a)						Average =	Sum(40)1	12 /12=	1.85	(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. W	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Accur	nod occi		NI									75	l	(40)
if TI	FA > 13.	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0)013 x (TFA -13.	.9)	/5		(42)
if TI	FA £ 13.	9, N = 1												
Annua	al averag	ge hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	se target o	75	.74		(43)
not moi	re that 125	ilitres per	person pe	r day (all w	ater use, l	hot and co	ld)	lo acilieve	a water us	se largel o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wa	ter usage i	in litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	8 3.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31		
			<u> </u>					1	-	Total = Su	m(44) ₁₁₂ =	=	908.89	(44)
Energy	content o	f hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65		
If inotor	topoquo i	votor booti	na ot poin	of upp (pr	hot wata	r otorogo)	ontor 0 in	havaa (16	-	Total = Su	m(45) ₁₁₂ =	=	1191.69	(45)
ii iiistai			ng at point			siorage),				1	1	1	I	(10)
(46)m= Water	18.53 storage	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95		(46)
Storag	ge volum	ne (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		160		(47)
If com	, Imunity ł	neating a	and no ta	ink in dw	vellina, e	nter 110) litres in	(47)						. ,
Other	wise if n	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If r	nanufac	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temp	erature f	actor fro	m Table	2b								0		(49)
Energ	y lost fro	om water	storage	, kWh/ye	ear			(48) x (49)	=		1	60		(50)
b) If r	nanutac ater stor	turer's de	eclared (cylinder l com Tabl	loss fact e 2 (k\\/	or is not h/litre/da	known:					00	l	(51)
If com	imunity h	neating s	ee secti	on 4.3		1/1110/00	xy)				0.	03		(31)
Volum	ne factor	from Ta	ble 2a								0.	.91		(52)
Temp	erature f	actor fro	m Table	2b							0.	78		(53)
Energ	y lost fro	om water	[.] storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	2.	84		(54)
Enter	⁻ (50) or	(54) in (5	55)								2.	84		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(56)
If cylind	er contain	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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Prima	ry circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Prima	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	339.97	303.53	327.92	306.65	309.69	207.61	205.94	216.94	213.73	317.35	319.62	336.07		(62)
Solar D	HW input	calculated	using App	endix G o	r 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)	-	-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter											
(64)m=	339.97	303.53	327.92	306.65	309.69	207.61	205.94	216.94	213.73	317.35	319.62	336.07		_
								Outp	out from wa	ater heate	r (annual)₁	12	3405.02	(64)
Hea <mark>t g</mark>	jains fro	m water	heating,	kWh/m	onth 0.2	<mark>5 ´</mark> [0.85	× (45)m	+ (61)n	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m	1	
(65)m=	143.78	128.69	139.78	131.71	133.7 <mark>2</mark>	<mark>6</mark> 0.3	59.45	63.11	62.33	136.26	136.03	142.49		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	<mark>mu</mark> nity h	eating	
5. In	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45		(66)
Lightir	ig gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	16.66	14.8	12.03	9.11	6.81	5.75	6.21	8.08	10.84	13.76	16.06	17.12		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-			
(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5	-	-		
(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75		(69)
Pumps	s and fa	ns gains	(Table s	5a)				-	-	-				
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losse	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96		(71)
Water	heating	gains (1	able 5)											
Water (72)m=	heating 193.26	gains (1 191.51	able 5) 187.87	182.93	179.73	83.75	79.91	84.83	86.57	183.15	188.92	191.51		(72)
Water (72)m= Total	heating 193.26 internal	gains (1 191.51 gains =	able 5) 187.87	182.93	179.73	83.75 (66)	79.91)m + (67)m	84.83 n + (68)m -	86.57 ⊦ (69)m + (183.15 (70)m + (7	188.92 1)m + (72)	191.51 m		(72)
Water (72)m= Total i (73)m=	heating 193.26 internal 421.58	gains (1 191.51 gains = 419.55	able 5) 187.87 409.17	182.93 392.82	179.73 376.6	83.75 (66) 269.49	79.91)m + (67)m 259.39	84.83 n + (68)m - 264.59	86.57 + (69)m + (273.08	183.15 (70)m + (7 381.07	188.92 1)m + (72) 399.86	191.51 m 413.58		(72) (73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access F Table 6d	actor	•	Area m²			Flu Tal	x ble 6a		Та	g_ able 6b		Ta	FF able 6c			Gains (W)	
North	0.9x	0.77		x	1.9	7	x	1	0.63	×		0.76	x	Γ	0.7		=	7.72	(74)
North	0.9x	0.77		x	1.9	7	x	2	0.32	x		0.76	x	Γ	0.7		=	14.76	(74)
North	0.9x	0.77		x	1.9	7	x	3	4.53	x		0.76	×	Γ	0.7		=	25.08	(74)
North	0.9x	0.77		x	1.9	7	x	5	5.46	x		0.76	×	Γ	0.7		=	40.28	(74)
North	0.9x	0.77		x	1.9	7	x	7	4.72	x		0.76	x	Γ	0.7		=	54.27	(74)
North	0.9x	0.77		x	1.9	7	x	7	9.99	x		0.76	×	Γ	0.7		=	58.09	(74)
North	0.9x	0.77		x	1.9	7	x	7	4.68	x		0.76	x	Γ	0.7		=	54.24	(74)
North	0.9x	0.77		x	1.9	7	x	5	9.25	x		0.76	x	Γ	0.7		=	43.03	(74)
North	0.9x	0.77		x	1.9	7	x	4	1.52	x		0.76	x		0.7		=	30.15	(74)
North	0.9x	0.77		x	1.9	7	x	2	4.19	x		0.76	x	Γ	0.7		=	17.57	(74)
North	0.9x	0.77		x	1.9	7	x	1	3.12	x		0.76	x	Γ	0.7		=	9.53	(74)
North	0.9x	0.77		x	1.9	7	x		3.86	x		0.76	x		0.7		=	6.44	(74)
South	0.9x	0.77		x	1.0	6	x	4	6.75	x		0.76	x	Γ	0.7		=	27.58	(78)
South	0.9x	0.77		x	1.0	6	x	7	6.57	x		0.76	x	Γ	0.7		=	45.17	(78)
South	0.9x	0.77		x	1.0	6	x	9	7.53	x		0.76	x		0.7		=	57.53	(78)
South	0.9x	0.77		x	1.0	6	x	1	10.23	x		0.76	Х	Γ	0.7		=	65.03	(78)
South	0.9x	0.77		x	1.0	3	х	1.	14.87	x		0.76	x		0.7		-	67.76	(78)
South	0.9x	0.77		x	1.0	3	х	1	10.55	İ 🗴		0.76	x		0.7		=	65.21	(78)
South	0.9x	0.77		x	1.0	6	х	10	08.01	x		0.76	x	Γ	0.7		=	63.71	(78)
South	0.9x	0.77		x	1.0	6	x	1(04.89	x		0.76	x		0.7		=	61.88	(78)
South	0.9x	0.77		x	1.0	3	x	10	01.89	×		0.76	x		0.7		=	60.1	(78)
South	0.9x	0.77		x	1.0	6	x	8	2.59	x		0.76	x		0.7		=	48.72	(78)
South	0.9x	0.77		x	1.0	6	x	5	5.42	x		0.76	x		0.7		=	32.69	(78)
South	0.9x	0.77		x	1.0	3	x	4	40.4	x		0.76	x		0.7		=	23.83	(78)
Solar g	ains ir	n watts, ca	alcula	ted	for eac	1 mont	h I	122.2	117.05	(83)n	n = Su	um(74)m .	(82)r	n 	12 22	20	27		(83)
Total o	ains –	internal a	and so	olar	(84)m =	= (73)m	<u>' </u>) + (83)m	watts	104		30.23	00.2	.0	42.22	50.	21		(00)
(84)m=	456.88	3 479.47	491.	78	498.13	498.63	3 3	92.79	377.34	369	.49	363.34	447.:	36	442.07	443	.84		(84)
	on inte		oroti	uro ((booting		2			I	l								
Temp	an inte	e during h	perall	a n	nealing ariods ir	seaso the liv	n) vina	area f	rom Tak	م اد	Th							21	(85)
Litilies	etion fs	e during r	icauii aine f	y p or li		1 110 11 22 b1 1	'''''y m (c		1011 Tai	516 9	,	r (C)						21	_(03)
Otilise	Jan	Feb	Ma	ar I	Apr	Ma\	/	Jun	Jul	A	ua	Sep	00	t I	Nov	D	ec		
(86)m=	1	1	1		0.99	0.98	╈	0.97	0.88	0.9	91	0.98	0.9	э	1	1			(86)
Mean	intern	al temper	I ature	in I	iving ar	a T1 (folle	w ste	ns 3 to 7	1 7 in 7		9c)							
(87)m=	19.78	19.87	20.0	5	20.32	20.59		20.77	20.92	20	.9	20.7	20.4	3	20.08	19.	78		(87)
Temp	eratur	e durina h	ı neatin		eriods ir	rest o	 f dv	velling	from Ta	u able (<u>,</u> а тн)2 (°C)							
(88)m=	19.4	19.4	19.4	<u>9 P</u>	19.44	19.44		19.47	19.47	19.	.47	19.46	19.4	4	19.43	19.4	42		(88)
l Itilies	ation fo	actor for a	i ains f	or r	est of d	velling		m (se	e Tahle	9a)									
(89)m=	1	1	1		0.99	0.96		0.91	0.68	0.1	73	0.95	0.9	э	1	1			(89)
										I						L			

Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	le 9c)				
(90)m=	17.85	17.98	18.25	18.66	19.05	19.31	19.45	19.44	19.21	18.83	18.31	17.87		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.66	(91)
Maan	intorno	Itompor	oturo (fo	r tha wh		lling) f	A T4	. (1 fl	A) TO					
	10 12	10.23		19 75	20.06	1111(y) = 11	20.42	+(1-1)	A) X 12	19.89	19.47	10.13	l	(92)
	adjucto		ho moor		tompor	oturo fro		20.4			13.47	19.15		(02)
Appiy	10 12	10.23	19.43	19 75	20.06	20.28	20.42	20 4	20 10	10.80	19.47	10.13	l	(93)
8 Sn:		ting regi	uirement	18.78	20.00	20.20	20.42	20.4	20.10	10.00	10.47	10.10		(,
Sot Ti	i to the i	mean int	ornal to	mperatu	ro obtain	od at st	on 11 of	Table 0	h so tha	t Ti m_(76)m an	d re-calc	sulato	
the ut	ilisation	factor fo	or gains	using Ta	able 9a		ерттог		0, 50 ina	u 11,111–(<i>r 0)</i> 111 an	u ie-caic	Julate	
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	i ains, hm	1 <u>'</u> 1:	, , , , , , , , , , , , , , , , , , ,									
(94)m=	1	1	1	0.99	0.97	0.95	0.83	0.86	0.97	0.99	1	1		(94)
Usefu	l gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	456.29	478.54	490	493.65	484.23	371.31	311.74	315.93	352.58	442.31	440.88	443.36		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
He <mark>at I</mark>	loss rate	e for mea	an interr	al tempe	erature,	Lm, W =	- =[(39)m	r x [(93)m	– (96)m]			.	
(97)m=	14 <mark>67.48</mark>	1412.1	1269.24	1042.43	800.35	53 2.86	358.41	374.66	576.12	888.84	1193.74	1452.27		(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=	752.33	627.35	579.76	395.13	235.19	0	0	0	0	332.22	542.06	750.63		
						r		Tota	l per year	(kWh/yea) = Sum(9	8)15,912 =	4214.65	(98)
Space	- heatin	a require	ement in	$kM/h/m^2$	2/vear								81.05	 (99)
Opuot	5 noutin	grequit			/year								01.00	
9a. En	ergy red	luiremer	nts – Ind	ividual h	eating s	ystems į	ncluding	micro-C	(HP)					
Space	e heatir	ig:	at from s	econdar	v/supple	montary	evetom						0	7(201)
Fracti	011 01 3µ					mentary	System	(202) = 1	(201) -					
Fracti	on of sp	ace nea	at from m	nain syst	em(s)			(202) = 1	- (201) =	/			1	(202)
Fracti	on 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								88.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec	kWh/ve	_ ar
Space	e heatin	g require	ement (c	alculate	d above))			1		_			
•	752.33	627.35	579.76	395.13	235.19	0	0	0	0	332.22	542.06	750.63		
ا (211)m	n – ∫[(Q8)m x (20	1 14)1 \ v 1	I 00 ∸ (20	1)6)	1	1	1	1	1	1			(211)
(211)11	846.26	705.68	652.14	444.46	264.55	0	0	0	0	373.7	609.74	844.35		(211)
	010.20	100.00	002.111		201.00	Ŭ	Ů	Tota	l (kWh/vea	ar) = Sum(2)	211)	=	4740.89	7(211)
Creat	. h tin	a fuel (a									- 715,1012		4740.09	_(211)
	e neatin)m x (20	g iuei (s)1)1 \ v 1	econdar	y), KVVN/ 181	month									
- ([(30)			00 ÷ (20		0	0	0	0	0	0	0	0	l	
(210)11-	0	0	Ů	0	0	0	0	Tota	l (kWh/vea	ar) = Sum(2)	215)		0	7(215)
\N/~+	h • • • • • •	_								, C arrie	· · / 15,1012	:	U	_(210)
outout	from w) ator boo	tor (colo	ulated o	hove)									
Juipul	339.97	303.53	327.92	306.65	309.69	207.61	205.94	216.94	213.73	317.35	319.62	336.07		
Efficier	ncv of w	ater hea	iter							L			78.8	(216)
														- L' - (



			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	on: 1.0.3.4	
	London	Pr	operty A	Address:	Unit 2					
Address :	, London									
Basement	1510115.		Area	a (m²) 55	(1a) x	Av. He	ight(m) .17	(2a) =	Volume(m³ 119.35) (3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e	e)+(1n)	55	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3c	d)+(3e)+	.(3n) =	119.35	(5)
2. Ventilation rate:				_						
Number of chimneys Number of open flues	$ \begin{array}{ccc} main & so \\ heating & h \\ \hline 0 & + \\ \hline 0 & + \\ \end{array} $	econdary neating 0 0	y + [] + []	0 0] = [total 0 0	x 2	40 = 20 =	m³ per hou 0 0	r (6a) (6b)
Number of intermittent fan	S				Γ	2	x ´	10 =	20	(7a)
Number of passive vents					Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fire	es				Ē	0	X 4	40 = Air ch	0 nanges per ho	(7c)
Infiltration due to chimneys If a pressurisation test has be Number of storeys in the	s, flues and fans = (6 en carried out or is intende e dwelling (ns)	a)+(6b)+(7a	a)+(7b)+(7 I to (17), c	7c) = otherwise c	ontinue fre	20 om (9) to ((16)	÷ (5) =	0.17	(8) (9)
Structural infiltration of both types of wall are pre deducting areas of opening	25 for steel or timber sent, use the value corres gs); if equal user 0.35	frame or	0.35 for the greate	masonr er wall area	y constr a (after enter 0	uction	[(9)-	-1JXU.1 =	0	(10) (11)
If no draught lobby enter	er 0.05, else enter 0		1 (00010	u), 0100					0	(12)
Percentage of windows	and doors draught st	ripped							0	(14)
Window infiltration	5			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, q	50, expressed in cub	oic metres	s per ho	ur per so	quare m	etre of e	envelope	area	10	(17)
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8), otherwis	se (18) = (16)				0.67	(18)
Air permeability value applies	if a pressurisation test has	s been don	e or a deg	ıree air pei	meability	is being u	sed			_
Number of sides sheltered	1			(20) = 1 - [0 075 x (1	9)] =			2	(19)
Infiltration rate incorporatir	na shelter factor			(20) = (18)	x(20) =	0)] –			0.85	(20)
Infiltration rate modified to	r monthly wind speed	4		() ()					0.57	(21)
Jan Feb M	Mar Apr Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7	II					1			
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Eactor $(22a)m = (22)^{2}$)m ÷ 4	<u> </u>					1	1	I	
(22a)m= 1.27 1.25 1.	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
<i>.</i>	0.72	0.71	0.7	0.62	0.61	0.54	0.54	0.52	0.57	0.61	0.64	0.67		
Calcula	ate effe	<i>ctive air</i> al ventila	change	rate for t	he appli	cable ca	se						0	(220)
lf exh	aust air h	eat pump	usina App	endix N. (2	3b) = (23a	i) × Fmv (e	equation (1	N5)) . othe	rwise (23b	o) = (23a)			0	(23b)
lf bala	anced wit	h heat reco	overy: effic	ciency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,			0	(23c)
a) If	balance	ed mech	anical v	entilation	with hea	at recove	erv (MVI	HR) (24a	a)m = (2)	2b)m + ((23b) × [l – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0		0]	(24a)
b) If	balance	ed mech	anical v	entilation	without	heat rec	covery (N	и ЛV) (24t	m = (22)	1 2b)m + (23b)			
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	nouse ex	tract ve	ntilation of	or positiv	re input v	ventilatio	n from o	outside		I			
í	if (22b)r	n < 0.5 >	‹ (23b),	then (24d	c) = (23b); other\	wise (24	c) = (22t	o) m + 0	.5 × (23b	c)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	nole hous	e positiv	e input	ventilatio	on from	oft					
i	if (22b)r	n = 1, th	en (24d)m = (22t	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72		(240)
Effe	ctive air		rate - e	nter (24a) or (24b	o) or (24)	c) or (24	d) in box	x (25)	0.00	0.7	0.70		(25)
(25)m=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN		Gros area	ss (m²)	Openin m	gs 2	Net Ar	rea m²	U-val W/m2	ue K	A X U	K)	k-value) <	A X k kJ/K
Doors			()			1.9	x	1.4		2.66				(26)
Windov		e 1				9.03		/[1/(1.6)+	0.04] =	13.58	F			(27)
Windo	ws Type	e 2				1.82		/[1/(4.8)+	0.04] =	7 33	Ħ			(27)
Windo	ws Type	- 3				0.87		. (/[1/(4.8)+	0.041 -	3.5	5			(27)
Floor						55		0.02		51 15				(28)
Walls ⁻	Tvne1	20	•	10.9		19.05		0.33	$\exists]$	27.0			\dashv	(20)
Walls ⁻	Tvne2	20.	4	10.8	<u></u>	F 04		2.1		10.59			\dashv	(20)
Total a	rea of e		- m ²	2.11		01.74		2.1		10.56				(21)
Dorty			,			91.71								(31)
	vall					27.9		0		0			\dashv	(32)
* for win	vali dowe one	l roof wind	0.000	offoctivo wi	ndowlly	1.13	X		=			naragraph		(32)
** includ	le the are	as on both	sides of i	nternal wal	ls and part	titions	aleu using	nonnula i	/[(1/0-vait	<i>le)</i> +0.04j č	as given in	i paragraph	5.2	
Fabric	heat lo	ss, W/K	= S (A x	: U)				(26)(30)) + (32) =				126.7	1 (33)
Heat c	apacity	Cm = S	(A x k)						((28).	(30) + (3	2) + (32a)	(32e) =	0	(34)
Therm	al mass	parame	eter (TM	P = Cm ÷	- TFA) in	n kJ/m²K			Indica	ative Value	: High		450	(35)
For desi can be u	gn asses Ised inste	sments wh ad of a de	ere the de tailed cald	etails of the culation.	constructi	ion are noi	t known pr	ecisely the	e indicative	e values of	f TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) ca	Iculated u	using Ap	pendix I	<						14.4	(36)
if details	of therm	al bridging	are not ki	nown (36) =	= 0.15 x (3	1)								i``´
Total fa	abric he	at loss							(33) +	- (36) =			141.1	1 (37)
Ventila	tion he	at loss ca	alculate	d monthly	/				(38)m	= 0.33 × ((25)m x (5)	I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(38)m=	30	29.6	29.21	27.37	27.02	25.42	25.42	25.12	26.03	27.02	27.72	28.45		(38)
Heat tra	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	171.11	170.71	170.32	168.48	168.13	166.53	166.53	166.23	167.14	168.13	168.83	169.56		
Heat los	e nara	motor (F		/m2k					(40)m	Average =	Sum(39)1.	12 /12=	168.47	(39)
(40)m=	3.11	3.1	3.1	3.06	3.06	3.03	3.03	3.02	3.04	- (33)iii ÷	3.07	3.08		
										Average =	Sum(40)1		3.06	(40)
Number	r of day	rs in mor	nth (Tab	le 1a)								·		
Ļ	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. Wat	er heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
Assume	ed occu	ipancy, I	N	_							1.	.84		(42)
if TFA if TFA	\ > 13.9 \ £ 13.9	9, N = 1 9. N = 1	+ 1.76 x	[1 - exp	(-0.0003	49 x (TF	-A -13.9)2)] + 0.(0013 x (TFA -13.	9)			
Annual	averag	e hot wa	ater usag	ge in litre	es per da	iy Vd,av	erage =	(25 x N)	+ 36		77	' .84		(43)
Reduce the not more	he annua that 125	al average litres per l	hot water person per	usage by : r dav (all w	5% if the a rater use. I	welling is not and co	designed t ld)	to achieve	a water us	se target o	f			
Г	lan	Feb	Mar	Apr	May	lun		Αυσ	Sen	Oct	Nov	Dec		
L Hot water	^r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	Geb	Out	1100	Dec		
(44)m=	<mark>8</mark> 5.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	<mark>8</mark> 5.62		
										Total = Su	m(44) ₁₁₂ =	-	9 <mark>34.05</mark>	(44)
Energy co	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	126.97	111.05	114.6	99.91	95.8 <mark>6</mark>	82.72	76.65	87.96	89.01	103.74	113.24	122.97		
lf instanta	neous w	ater heatii	ng at point	t of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)	l otal = Su	m(45) ₁₁₂ =	=	1224.68	(45)
(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45		(46)
Water s	torage	loss:	1	1				1		1		<u> </u>		
Storage	volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		160		(47)
If comm	unity h	eating a	ind no ta	nk in dw r (this in	velling, e scludes i	nter 110 nstantar	litres in	(47) mbi boil	ore) ont	ər '()' in (47)			
Water s	torage	loss:	not wate			istantai								
a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temper	ature fa	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		1	60		(50)
b) If ma Hot wat	anufact er stora	urer's de age loss	eclared of factor fr	cylinder I com Tabl	oss fact e 2 (kW	or is not h/litre/da	known: v)				0	03		(51)
If comm	nunity h	eating s	ee secti	on 4.3	(. ,				0.			()
Volume	factor	from Ta	ble 2a								0.	.91		(52)
Temper	ature fa	actor fro	m Table	2b							0.	.78		(53)
Energy	lost fro	m water	storage	e, kWh/y€	ear			(47) x (51)	x (52) x (53) =	2.	.84		(54)
Water e	torace	04) III (5 1099 cel	o) culated f	for each	month			((56)m - (55) × (41)	m	2.	.84		(55)
(56)m_ [88 04	70 52	88.04	85.2	88.04	85.2	88 04	88.04	85.2	88.04	85.2	88.04		(56)
If cylinder	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	(00)
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)

Primar	y circuit	loss (ar	nual) fro	om Table	93							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)	-		
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss cal	culated	for each	month (61)m =	(60) ÷ 36	65 × (41))m	_					
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	343.39	306.52	331.01	309.34	312.28	209.83	208	219.31	216.13	320.15	322.67	339.38		(62)
Solar Dł	-IW input o	alculated	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 V	VWHRS	applies	, see Ap	pendix (3)	-	-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from wa	ater hea	ter											
(64)m=	343.39	306.52	331.01	309.34	312.28	209.83	208	219.31	216.13	320.15	322.67	339.38		_
				-		_	-	Outp	out from wa	ater heate	r (annual)₁	12	3438.01	(64)
Heat g	ains froi	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	144.92	129.69	140.8	132.61	134.58	61.04	60.14	63.9	63.13	137.19	137.04	143.59		(65)
in <mark>clu</mark>	ıde (57)ı	n in calc	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternai ga	ains (see	Table 5	and 5a):									
Metab	olic gain	s (Table	e 5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	9 <mark>1.87</mark>	91.87	91.87	91. <mark>87</mark>	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equati	ion L9 o	r L9a), a	lso see [.]	Table 5			-		
(67)m=	14.29	12.69	10.32	7.81	5.84	4.93	5.33	6.93	9.29	11.8	13.77	14.68		(67)
Applia	nces gai	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19		(69)
Pumps	and far	ns gains	(Table 5											
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49		(71)
Water	heating	gains (T	able 5)											
(72)m=	194.79	192.99	189.25	184.18	180.88	84.78	80.83	85.88	87.68	184.4	190.33	193		(72)
Total i	nternal	gains =	:			(66)	• m + (67)m	• n + (68)m +	• + (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	429.82	428.09	417.79	401.29	384.77	277.17	266.56	271.55	279.9	388.04	407.21	421.36		(73)
6. So	lar gains	s:												
Solar g	ains are c	alculated	using sola	r flux from	Table 6a a	and assoc	iated equa	itions to co	onvert to th	e applicat	le orientat	ion.		

Orienta	tion:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.82	x	10.63	×	0.85	x	0.7	=	7.98	(74)
North	0.9x	0.77	x	0.87	x	10.63	×	0.85	x	0.7	=	3.81	(74)

North	0.9x	0.77		x	1.8	2	x	2	20.32	x	0.85	x	0.7	=		15.25	(74)
North	0.9x	0.77		x	0.8	57	x		20.32] x [0.85	×	0.7	=	Γ	7.29	(74)
North	0.9x	0.77		x	1.8	2	x		34.53	x	0.85	x	0.7	= =	Γ	25.91	(74)
North	0.9x	0.77		x	0.8	57	x	3	34.53	x	0.85	x	0.7	=		12.39	(74)
North	0.9x	0.77		x	1.8	2	x	5	55.46	×	0.85	x	0.7	=	Γ	41.62	(74)
North	0.9x	0.77		x	0.8	57	x	5	55.46	x	0.85	x	0.7	=	Γ	19.9	(74)
North	0.9x	0.77		x	1.8	2	x	7	74.72	x	0.85	x	0.7	=		56.07	(74)
North	0.9x	0.77		x	0.8	57	x	7	74.72	x	0.85	x	0.7	=		26.8	(74)
North	0.9x	0.77		x	1.8	2	x	7	79.99	x	0.85	x	0.7	=		60.02	(74)
North	0.9x	0.77		x	0.8	57	x	7	79.99	x	0.85	x	0.7	=		28.69	(74)
North	0.9x	0.77		x	1.8	2	x	7	74.68	x	0.85	x	0.7	=		56.04	(74)
North	0.9x	0.77		x	0.8	57	x	7	74.68	x	0.85	x	0.7	=		26.79	(74)
North	0.9x	0.77		x	1.8	2	x	5	59.25	x	0.85	x	0.7	=		44.46	(74)
North	0.9x	0.77		x	0.8	57	x	5	59.25	x	0.85	x	0.7	=		21.25	(74)
North	0.9x	0.77		x	1.8	2	x	2	11.52	x	0.85	x	0.7	=		31.16	(74)
North	0.9x	0.77		x	0.8	57	x	2	11.52	x	0.85	x	0.7	=		14.89	(74)
North	0.9x	0.77		x	1.8	2	x	2	24.19	x	0.85	x	0.7	=		18.15	(74)
North	0.9x	0.77		x	0.8	57	X	2	24.19	x	0.85	x	0.7	=		8.68	(74)
North	0.9x	0.77		x	1.8	2	х		13.12	x	0.85	x	0.7	=		9.84	(74)
North	0.9x	0.77		x	0.8	57	х		13.12] ×	0.85	x	0.7	=		4.71	(74)
North	0.9x	0.77		x	1.8	2	x		8.86] ×	0.85	x	0.7	=		6.65	(74)
North	0.9x	0.77		x	0.8	7	x		8.86	x	0.85	x	0.7	=		3.18	(74)
South	0.9x	0.77		x	9.0	13	x	4	46.75	x	0.76	x	0.7	=		155.64	(78)
South	0.9x	0.77		x	9.0	13	x	7	6.57	x	0.76	x	0.7	=		2 <mark>54.91</mark>	(78)
South	0.9x	0.77		x	9.0	3	x	9	97.53	x	0.76	x	0.7	=		324.7	(78)
South	0.9x	0.77		x	9.0	3	x	1	10.23	x	0.76	x	0.7	=		366.99	(78)
South	0.9x	0.77		x	9.0	3	x	1	14.87	x	0.76	x	0.7	=		382.42	(78)
South	0.9x	0.77		x	9.0	13	x	1	10.55	x	0.76	x	0.7	=		368.03	(78)
South	0.9x	0.77		x	9.0	13	x	1	08.01	x	0.76	x	0.7	=		359.59	(78)
South	0.9x	0.77		x	9.0	13	x	1	04.89	x	0.76	x	0.7	=		349.21	(78)
South	0.9x	0.77		x	9.0	13	x	1	01.89	x	0.76	x	0.7	=		339.19	(78)
South	0.9x	0.77		x	9.0	13	x	8	32.59	x	0.76	x	0.7	=		274.94	(78)
South	0.9x	0.77		x	9.0	13	x	5	55.42	x	0.76	x	0.7	=		184.49	(78)
South	0.9x	0.77		x	9.0	13	x		40.4	×	0.76	x	0.7	=		134.49	(78)
Solar	noine in	watte ea	laula	tod	for oad	n mont	'n			(92)m	- Sum(74)m	(82)m					
(83)m=	167.44	277.44	363		428.51	465.3		456.75	442.42	414	.92 385.24	301.7	7 199.04	144.32	2		(83)
Total g	gains – i	nternal a	nd so	olar	(84)m =	- = (73)m	<u>ו</u>	(83)m	, watts	I		1					
(84)m=	597.26	705.53	780.	.8	829.8	850.06	3 7	733.92	708.97	686	.47 665.14	689.8	606.25	565.68	;		(84)
7. Me	an inter	rnal temp	eratu	ıre (heating	seaso	on)										
Temp	perature	during h	eatin	g pe	eriods ir	n the liv	ving	area	from Tab	ble 9,	, Th1 (°C)				Γ	21	(85)
Utilis	ation fac	ctor for ga	ains f	or li	ving are	ea, h1,	<u>m (</u> s	see Ta	able 9a)						-		_

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

(86)m=	1	1	0.99	0.98	0.95	0.91	0.8	0.83	0.94	0.98	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	19.06	19.24	19.54	19.94	20.35	20.65	20.86	20.83	, 20.54	20.08	19.5	19.03		(87)
Temp	erature	durina h	eating p	eriods ir	n rest of	dwellina	from Ta	able 9. Ti	h2 (°C)					
(88)m=	18.7	18.7	18.7	18.72	18.72	18.74	18.74	18.74	18.73	18.72	18.72	18.71		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.96	0.9	0.76	0.48	0.54	0.84	0.96	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.35	16.62	17.05	17.64	18.19	18.57	18.72	18.71	18.46	17.83	17	16.32		(90)
l									f	iLA = Livin	g area ÷ (4	4) =	0.55	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) – fl	Ι Δ 🗙 Τ1	+ (1 – fl	Δ) v T2			L		
(92)m=	17.84	18.06	18.42	18.9	19.38	19.72	19.89	19.88	19.61	19.06	18.37	17.81		(92)
Apply	adjustn	nent to t	L he mear	internal	l I temper	i ature fro	n Table	4e, whe	ere appro	priate				
(93)m=	17.84	18.06	18.42	18.9	19.38	19.72	19.89	19.88	19.61	19.06	18.37	17.81		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	i to the r	mean int	ernal te	mperatu	re obtain	ned 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				0		D		
Litilion	Jan	Feb	aine hr	Apr	May	Jun	Jui	Aug	Sep	Oct	NOV	Dec		
(94)m=	0.99	0.99	0.98	0.96	0.92	0.84	0.68	0.72	0.9	0.96	0.99	1		(94)
Usefu	l gains.	hmGm .	. W = (9	4)m x (84	4)m									
(95)m=	594.22	698.72	766.51	798.51	778.94	619.49	481.21	492.22	595.48	66 <mark>5.08</mark>	600.32	563.34		(95)
Month	nly avera	age exte	rnal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	2316.15	2246.25	2030.12	1685.22	1290.55	851.97	548.45	577.76	920.23	1423.1	1902.92	2307.72		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/moni	th = 0.02	24 x [(97])m – (95)m] x (4 ⁻	1)m			
(98)m=	1281.12	1039.94	940.12	638.43	380.63	0	0	0	0	563.97	937.87	1297.82		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	7079.9	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								128.73	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:		_								r		_
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	– (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								88.9	(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/y	ear
Space	e heatin	g require	ement (c	alculate	d above))								
	1281.12	1039.94	940.12	638.43	380.63	0	0	0	0	563.97	937.87	1297.82		
(211)m	ı = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)									(211)
	1441.07	1169.79	1057.51	718.14	428.16	0	0	0	0	634.39	1054.97	1459.87		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	7963.89	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (20	01)]}x1	00 ÷ (20	8)					-	-		_	_	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ıl (kWh/yea	ar) =Sum(2	2 15) _{15,101}	2=	0	(215)
Water	heating	l 												
Output	343.39	ater nea 306.52	ter (caic 331.01	309.34	312.28	209.83	208	219.31	216.13	320.15	322.67	339.38]	
Efficier	ncy of w	ater hea	ıter										78.8	(216)
(217)m=	86.55	86.38	86.03	85.33	84.05	78.8	78.8	78.8	78.8	84.96	86.08	86.6		(217)
Fuel fo (219)m	r water) = (64)	heating, m x 100	kWh/mo) ÷ (217)	onth m								•		
(219)m=	396.73	354.85	384.77	362.52	371.56	266.29	263.96	278.31	274.27	376.84	374.86	391.9]	
								Tota	I = Sum(2)	19a) ₁₁₂ =			4096.86	(219)
Annua	I totals									k	Wh/yea	r	kWh/yea	r
Space	heating	fuel use	ed, main	system	1								7963.89	
Water	heating	fuel use	d										4096.86	
Electric	city for p	oumps, fa	ans and	electric l	keep-ho	t								
centra	al heatin	g pump:	:									120]	(230c)
boi <mark>ler</mark>	with a f	an-assis	ted flue									45		(230e)
Tota <mark>l e</mark>	lectricity	for the	above, l	<mark>kWh/</mark> yea	r			sum	of (230a).	<mark>(2</mark> 30g) =			165	(231)
Electric	city for li	ghting											252.32	(232)
12a. (CO <mark>2 em</mark>	issions -	– Individ	ual h <mark>eat</mark> i	ng syste	ems inclu	uding mi	cro-CHP			_			
						Fn	erav			Fmiss	ion fac	tor	Emission	5
						kW	/h/year			kg CO	2/kWh		kg <mark>CO2/</mark> ye	ar
Space	heating	(main s	ystem 1)		(211	I) x			0.2	16	=	1720.2	(261)
Space	heating	(second	dary)			(218	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	884.92	(264)
Space	and wat	ter heati	ng			(261	I) + (262)	+ (263) + ((264) =				2605.12	(265)
Electric	city for p	oumps, fa	ans and	electric l	keep-ho	t (231	l) x			0.5	19	=	85.64	(267)
Electric	city for li	ghting				(232	2) x			0.5	19	=	130.95	(268)
Total C	02, kg/	year							sum o	f (265)(2	271) =		2821.71	(272)
Dwelli	ng CO2	Emissi	on Rate	•					(272) -	÷ (4) =			51.3	(273)
EI ratir	ig (secti	on 14)											62	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	on: 1.0.3.4	
Addross	london	PI	openy <i>r</i>	Address.	Unit 3					
1 Overall dwelling dimen	, ionuon									
Basement	510113.		Area	a(m²) 51	(1a) x	Av. He	ight(m) .17	(2a) =	Volume(m³ 110.67) (3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e)+(1n)	51	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3c	l)+(3e)+	.(3n) =	110.67	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	$ \begin{array}{ccc} main & se \\ heating & h \\ \hline 0 & + \\ \hline 0 & + \\ \end{array} $	econdary eating 0 0	y +] +	0 0] = [total 0 0	x 4	40 = 20 =	m³ per hou 0 0	r (6a) (6b)
Number of intermittent fan	S					2	Х ′	10 =	20	(7a)
Number of passive vents					Γ	0	x ′	10 =	0	(7b)
Number of flueless gas fire	0 hanges per ho	(7c)								
Infiltration due to chimneys If a pressurisation test has be Number of storeys in the Additional infiltration Structural infiltration: 0.2	0.18 0 0 0 0 0 0	(8) (9) (10) (11)								
if both types of wall are pre deducting areas of opening If suspended wooden flo If no draught lobby, ente Percentage of windows	sent, use the value corres, as); if equal user 0.35 por, enter 0.2 (unseal er 0.05, else enter 0 and doors draught st	ponding to ed) or 0. ripped	the greate	er wall area	a (after enter 0				0 0 0	(12) (13) (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, q	50, expressed in cub	ic metres	s per ho	our per so	quare m	etre of e	envelope	area	10	(17)
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8), otherwis	se (18) = (16)				0.68	(18)
Air permeability value applies	if a pressurisation test has	s been don	e or a deg	ree air pei	meability	is being u	sed			-
Number of sides sheltered Shelter factor				(20) = 1 - [0.075 x (1	9)] =			3	(19)
Infiltration rate incorporatir	ng shelter factor			(21) = (18)	x (20) =	-74			0.70	(20)
Infiltration rate modified fo	r monthly wind speed	l		((- /				0.55	(21)
Jan Feb M	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7				·		1			
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4	I					1		I	
(22a)m= 1.27 1.25 1.	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
~ ' '	0.67	0.66	0.65	0.58	0.57	0.5	0.5	0.49	0.53	0.57	0.59	0.62		
Calcul If me	ate ette	<i>ctive air (</i> al ventila	change	rate for t	he appli	cable ca	se						0	(23a)
lf exh	aust air h	eat pump (using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)), othei	rwise (23b) = (23a)				(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,				(23c)
a) If	balance	ed mecha	, anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	u)m = (22	2b)m + (23b) x [⁻	1 – (23c)	– 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	ed mecha	ı anical ve	entilation	without	heat rec	coverv (N	MV) (24b)m = (22	1 2b)m + (;	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from c	outside		!		1	
í	if (22b)r	n < 0.5 ×	(23b), t	hen (24a	c) = (23b); otherv	wise (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	natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilatio	on from I	oft					
(if (22b)r	n = 1, the	en (24d)	m = (22t	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			1	(0.41)
(24d)m=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69		(240)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in boy	(25)	0.00	0.00	0.00	1	(25)
(25)m=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69		(25)
3. He	at l <mark>osse</mark>	s and he	at loss	oaramete	er:									
ELEN		Gros area	ss (m²)	Openin m	gs 2	Net Ar	ea n²	U-valı W/m2	le K	A X U	K)	k-value	e K	A X k
Doors			()			1.9		1.4	=	2.66				(26)
Windo		e 1				9.03		/[1/(1.6)+	0.04] =	13.58	Ħ			(27)
Windo	ws Type	2				2.89		/[1/(4.8)+	0.041 =	11 64	Ħ			(27)
Floor						51				50.49	E, r			(28)
Walls ⁻	Tvne1	16.1	4	0.02		7 11		2.1		14.02	╡╏		\dashv	(20)
Walls ⁻	Type2	16.1	1	4.70		11 21		2.1		22.75	╡╏		\dashv	(20)
Total a	area of e		 m²	4.79		02.24		2.1	[23.75	L			(20)
Party	wall	Jonionio	,			03.24	'			0				
* for win	idows and	l roof wind	ows use e	offective wi	ndow H-va	33.3 alue calcul	×	u formula 1	= [/[(1/L-valu	0 (e)+0 041 a	L	naragraph		(32)
** inclua	le the area	as on both	sides of ir	nternal wal	ls and par	titions		g torritaide in		o)10.04j d	io givoir in	paragrapi	0.2	
Fabric	heat los	ss, W/K =	= S (A x	U)				(26)(30)	+ (32) =				117.0	05 (33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	⁻ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: High		450) (35)
For desi can be i	ign asses: Jsed inste	sments wh ad of a dei	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						12.8	3 (36)
if details	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			129.8	35 (37)
Ventila	ation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	26.52	26.2	25.89	24.41	24.13	22.85	22.85	22.61	23.34	24.13	24.69	25.28		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	156.37	156.05	155.74	154.26	153.98	152.7	152.7	152.46	153.19	153.98	154.54	155.13		
										Average =	Sum(39)1	12 /12=	154.2	26 (39)

Heat lo	ss para	imeter (H	HLP), W/	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	3.07	3.06	3.05	3.02	3.02	2.99	2.99	2.99	3	3.02	3.03	3.04		
L	r of dov		I						/	Average =	Sum(40) ₁ .	.12 /12=	3.02	(40)
	.lan	Feb	Mar	Apr	May	Jun	Jul	Αυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
Ϋ́ L														
4. Wat	ter heat	ting enei	rgy requi	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	ıpancy, I 9, N = 1 9, N = 1	N + 1.76 x	:[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.(0013 x (1	ΓFA -13.	1. .9)	72		(42)
Annual Reduce t not more	averag he annua that 125	le hot wa al average litres per l	ater usag hot water person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.04		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	r day for ea I	ach month I	Vd,m = fa	ctor from T	Fable 1c x	(43)					I	
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	000.40	
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	total = Su	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	900.48	(44)
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55		-
lf instanta	aneous w	vater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)) to (61)	Fotal = Su	m(45) ₁₁₂ =	:	1180.67	(45)
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78		(46)
Water s	storage	loss:	vincludir		olar or M		storade	within sa	ame ves	ما		100		(47)
lf comm	nunity h	eating a	nd no ta	ink in dw	velling e	nter 110	litres in	(47)		501		160		(47)
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	eous co	ombi boil	ers) ente	er '0' in (47)			
Water s	storage	loss:											L	
a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	e, kWh/ye	ear	or in not	known:	(48) x (49)	=		16	60		(50)
Hot wat	ter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	known. iy)				0.	03		(51)
If comm	nunity h	leating s	ee secti	on 4.3										
Volume	factor	from Tal	ble 2a								0.	91		(52)
I empei	rature f	actor fro	m Table	26							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	2.	84		(54)
Water s		loss cal	culated f	for each	month			((56)m = (55) x (41)r	m	2.	84		(55)
(56)m-	00 04	70.52		05 2	00 04	05.0	00 04	00.04	05.0	00 04	05.0	99.04		(56)
If cylinder	r contains	s dedicate	d solar sto	o5.2 rage, (57)	m = (56)m	x [(50) – (68.04 H11)] ÷ (5	00.04 0), else (5	7)m = (56)	m where (65.2 H11) is fro	m Append	lix H	(30)
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primarv	/ circuit	loss (an	nual) fro	om Table	e 3)		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	ified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)		1	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for each	n month	(61)m =	(60) ÷ 3	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		(62)
Solar DH	- IW input	calculated	using App	pendix G o	r Appendix	H (negat	ive quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	applies	, see Ap	pendix (G)			-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		_
								Out	out from w	ater heate	r (annual)₁	12	3393.99	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	5 × (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder	is in the o	dwelling	or hot w	ater is fi	rom com	munity h	leating	
5. Int	ernal g	ains (see	a Table :	5 and 5a):									
Metab	olic daii	ns (Table	e 5). Wa	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	8 <mark>5.98</mark>	85.98	85.98		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equati	ion L9 o	or L9a), a	lso see	Table 5					
(67)m=	13.36	11.86	9.65	7.3	5.46	4.61	4.98	6.47	8.69	11.03	12.88	13.73		(67)
Applia	nces ga	ains (calc	ulated in	n Appene	dix L, eq	uation L	.13 or L1	3a), also	see Ta	ble 5				
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22		(68)
Cookir	a dains	s (calcula	ted in A		L. equat	ion L15	or L15a), also se	ee Table	5				
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6		(69)
Pumps	and fa	ns gains	(Table	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	se.a. e	vaporatio	n (nega	utive valu	es) (Tab	le 5)	1							
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78		(71)
Water	heating	u dains (T	able 5)											
(72)m=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02		(72)
Total i	nterna	l aains =	L			(66)m + (67)m	L 1 + (68)m ·	L + (69)m + (L (70)m + (7	I 1)m + (72)			
(73)m=	414.73	413.06	403.32	387.74	372.19	265.51	255.47	260.28	268.14	375.36	393.45	406.76		(73)
6. So	ar gain	s:												· ,
Solar g	ains are	calculated	using sola	ar flux from	Table 6a a	and assoc	ciated equa	tions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area		Flu	х		g_		FF		Gains	
		Table 6d		m²		Та	ble 6a	Т	able 6b	Т	able 6c		(W)	
North	0.9x	0.77	x	2.8	39	x	10.63	x	0.85	x	0.7	=	12.67	(74)
North	0.9x	0.77	×	2.8	39	x :	20.32	×	0.85		0.7	=	24.22	(74)
North	0.9x	0.77	×	2.8	39	x :	34.53	×	0.85		0.7	=	41.15	(74)
North	0.9x	0.77	×	2.8	39	x	55.46	×	0.85	╡ <u> </u>	0.7		66.09	(74)
North	0.9x	0.77	×	2.8	39	×	74.72	×	0.85		0.7	=	89.03	(74)

North	0.9x	0.77	>	(2.89	x	7	79.99	×	0.85	x	0.7	=	95.31	(74)
North	0.9x	0.77	>	¢	2.89	x	7	74.68	x	0.85	x	0.7	=	88.99	(74)
North	0.9x	0.77	>	(2.89	×	5	59.25	x	0.85	x	0.7	=	70.6	(74)
North	0.9x	0.77	>	(2.89	×	2	1.52	x	0.85	x	0.7	=	49.47	(74)
North	0.9x	0.77	>	(2.89	x	2	24.19	x	0.85	x	0.7	=	28.83	(74)
North	0.9x	0.77)	(2.89	×	1	3.12	x	0.85	x	0.7	=	15.63	(74)
North	0.9x	0.77)	(2.89	×		8.86	x	0.85	x	0.7	=	10.56	(74)
South	0.9x	0.77	>	(9.03	×	4	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77)	(9.03	×	7	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77)	(9.03	×	9	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	>	(9.03	×	1	10.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77)	(9.03	×	1	14.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77)	(9.03] ×	1	10.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	>		9.03	×	1	08.01	×	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77)		9.03	×	1	04.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77)	(9.03	×	1	01.89	×	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	>		9.03	×	6	32.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77)		9.03	×	5	55.42	x	0.76	x	0.7	=	184.49	(78)
Sout <mark>h</mark>	0.9x	0.77	>	¢ I	9.03	x		40.4	x	0.76	x	0.7	=	134.49	(78)
						J									
Solar (<mark>gain</mark> s in	watts, <mark>cal</mark>	<mark>cu</mark> late	d [.]	for each mor	th			(83)m	n = Sum(74)m	(82)m		_	_	
(83)m=	168.32	279.12	36 <mark>5.85</mark>		433.08 471.4	6	463.34	448.58	419	.81 388.67	303.7	6 200.12	145.05		(83)
Total g	gains – i	nternal an	id sola	ar ((84)m = (73)r	n +	(83)m	, watts	-			_		-	
(84)m=	583.04	692.18	769.17		820.82 843.6	5	728.85	704.04	680	.09 656.81	679.1	2 593.57	551.82		(84)
7. Me	ean inter	nal tempe	erature	e (I	heating seas	on)									
Temp	perature	during he	eating	pe	eriods in the I	iving	area	from Tal	ble 9	, Th1 (°C)				21	(85)
Utilis	ation fac	tor for gai	ins for	liv	ving area, h1	,m (:	see Ta	ble 9a)	·				,	-	
	Jan	Feb	Mar		Apr Ma	y	Jun	Jul	A	ug Sep	Oc	t Nov	Dec		
(86)m=	1	0.99	0.99		0.97 0.94		0.89	0.77	0.	8 0.93	0.98	0.99	1		(86)
Mear	interna	l tempera	ture in	ı li	ving area T1	(foll	ow ste	ps 3 to 7	7 in T	able 9c)	_				
(87)m=	19.11	19.3	19.61		20 20.4		20.69	20.88	20.	85 20.58	20.12	2 19.55	19.09		(87)
Temp	perature	during he	ating	ре	eriods in rest	of d	velling	from Ta	able 9	9, Th2 (°C)					
(88)m=	18.72	18.72	18.72	T	18.74 18.74	4	18.75	18.75	18.	76 18.75	18.74	4 18.73	18.73]	(88)
Utilis	ation fac	tor for gai	ins for	re	est of dwelling	n h2	n (se	e Table	.9a)	•	<u>.</u>	•		-	
(89)m=	1	0.99	0.98	Ť	0.95 0.88	<u></u>	0.73	0.45	0.	5 0.82	0.95	0.99	1	1	(89)
Moor			turo in		ne rest of dw	 allin/	n T2 (f	l ollow ste		to 7 in Tab			ļ	_	
(90)m=	16.44	16.72	17.16	Т	17.73 18.2	7	18.62	18.74	18.	73 18.51	17.9	1 17.08	16.4	1	(90)
· · · / · ·	L										fLA = Li	ving area ÷ (4) =	0.55) (91)
N 4	int	1.40.0000	h		the substruction of				. /4	41 A) T O		`			
Mear		i tempera		or T			1g) = f	$LA \times 11$	+ (1	- TLA) × 12		1 10 15	17.00	7	(02)
(92)11=	11.92	1 10.10	10.02	1	10.99 19.4	ا ر	13.11	1 19.93	1 19.	91 19.00	1 19.14	t 10.40	1 11.09	1	(34)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.92	18.15	18.52	18.99	19.45	19.77	19.93	19.91	19.66	19.14	18.45	17.89		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti the ut	i to the r ilisation	mean int factor fo	ernal ter or gains	mperatur using Ta	e obtain ble 9a	ied at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.98	0.96	0.9	0.82	0.65	0.69	0.88	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	579.61	684.31	752.47	784	760.68	598.48	455.94	467.79	577.55	650.51	586.78	549.17		(95)
Month	nly avera	age exte	ernal tem	perature	e from Ta	able 8							l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m : r	x [(93)m·	– (96)m]			I	
(97)m=	2130.19	2067.97	1871.23	1556.9	1193.8	789.1	508.03	535.23	851.9	1314.84	1754	2123.98		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m	i	I	
(98)m=	1153.63	929.82	832.36	556.49	322.24	0	0	0	0	494.26	840.39	1171.66		1
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	6300.86	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								123.55	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Sp <mark>ac</mark>	e heatir	ng:												
Fracti	on of sp	ace hea	at from s	econdary	y/supple	mentary	system						0	(201)
Fracti	<mark>on</mark> of sp	ace hea	at from n	<mark>nain s</mark> yst	em(s)			(202) = 1 -	(201) =				1	(202)
Fracti	on of to	tal hea <mark>ti</mark>	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main s <mark>pa</mark>	ace heat	ing syste	em 1								88.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	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 (c	alculate	d above))	i			i	i			
	1153.63	929.82	832.36	556.49	322.24	0	0	0	0	494.26	840.39	1171.66		
(211)m	n = {[(98)m x (20	94)] } x 1	00 ÷ (20)6)									(211)
	1297.67	1045.92	936.29	625.97	362.48	0	0	0	0	555.98	945.33	1317.95		_
								Tota	I (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	F	7087.58	(211)
Space = {[(98]	e heatin)m x (20	g fuel (s)1)] } x 1	econdar 00 ÷ (20	y), kWh/ 8)	month									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
I								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating	J												3
Output	from w	ater hea	ter (calc	ulated a	oove)									
	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		_
Efficier	ncy of w	ater hea	iter										78.8	(216)
(217)m=	86.39	86.19	85.8	85.04	83.65	78.8	78.8	78.8	78.8	84.66	85.87	86.44		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100) ÷ (217) 381	m 359 56	369 18	262 52	260 47	274 3	270 21	373 74	371 01	387 52		
()					000.10			Tota	I = Sum(2	19a), ,, =	0.1.01		4052 72	(219)
Annua	l totale								,	۰۱۱۲ ایر	Wh/vear		kWh/vear](=)
Space	heating	fuel use	ed, main	system	1						, y our		7087.58	1
	5													1

Water heating fuel used				4052.72]					
Electricity for pumps, fans and electric keep-hot					1					
central heating pump:			120		(230c)					
boiler with a fan-assisted flue			45		(230e)					
Total electricity for the above, kWh/year	S	um of (230a)…(230g) =		165	(231)					
Electricity for lighting				235.9	(232)					
12a. CO2 emissions – Individual heating systems	including micro-Cl	HP								
	Energy kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	r					
Space heating (main system 1)	(211) x	0.216	=	1530.92	(261)					
Space heating (secondary)	(215) x	0.519	=	0	(263)					
Water heating	(219) x	0.216	=	875.39	(264)					
Space and water heating	(261) + (262) + (263)	+ (264) =		2406.31	(265)					
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.64	(267)					
Electricity for lighting	(232) x	0.519	=	122.43	(268)					
Total CO2, kg/year		sum of (265)(271) =		2614.37	(272)					
Dwelling CO2 Emission Rate		(272) ÷ (4) =		51.26	(273)					
El rating (section 14)				64	(274)					
			User D	etails:						
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Assessor Name: Software Name:	Stroma FSAP 201	2 Pro	operty A	Stroma Softwa	a Num are Ver Unit 4	ber: sion:		Versio	n: 1.0.3.4	
Address :	. london		opony /	laarooo.	Orne T					
1. Overall dwelling dimen	isions:									
Basement			Area	1(m²) 51	(1a) x	Av. He	ight(m) .18	(2a) =	Volume(m ³) 111.18) (3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e	e)+(1n)		51	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	111.18	(5)
2. Ventilation rate:	- -									
Number of chimneys Number of open flues	$\begin{array}{c c} main & se \\ heating & h \\ \hline 0 & + \\ \hline 0 & + \\ \hline 0 & + \\ \hline \end{array}$	econdary eating 0 0) + [_] + [_	0 0 0] = [total 0 0	x 4	40 = 20 =	m ³ per hou](6a)](6b)
Number of intermittent fan	s				」 「	2	x ′	0 =	20](7a)
Number of passive vents							x ^	0 =		 (7b)
Number of flueless ges fire						0		10 -	0	
						0		Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans = (6)	a)+(6b)+(7a	l)+(7b)+(7	7c) =		20	(10)	÷ (5) =	0.18	(8)
Number of storeys in the Additional infiltration Structural infiltration: 0.2	en carried out or is interior e dwelling (ns) 25 for steel or timber t	frame or (0.35 for	masonr	y constr	uction	(9) [(9)-	1]x0.1 =	0 0 0	(9) (10) (11)
deducting areas of opening	sent, use the value corres js); if equal user 0.35	ponaing to t	ne greate	er wall area	a (aner					
If suspended wooden flo	oor, enter 0.2 (unseal	ed) or 0.1	(seale	d), else	enter 0				0	(12)
If no draught lobby, ente	r 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught st	ripped		0.05 10.0	~ (1.4) • 1	001			0	(14)
Window infiltration				0.25 - [0.2 (8) ± (10) -	X (14) ÷ 1 ⊾ (11) ⊥ (1	(00] =	+ (15) -		0	(15)
	50 expressed in cut	ic motros	nor ho			2) + (13)		araa	0	$-\frac{(16)}{(17)}$
If based on air permeabilit	$_{150}$, expressed in cub v value, then $(18) = [(1)$	$7) \div 20]+(8)$, otherwis	ui pei su se (18) = (16)		invelope	alea	10	$ - \frac{(17)}{(18)} $
Air permeability value applies	if a pressurisation test has	s been done	or a deg	ree air per	meability	is being u	sed	l	0.00	
Number of sides sheltered	ł							[2	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporatir	ng shelter factor			(21) = (18)	x (20) =				0.58	(21)
Infiltration rate modified fo	r monthly wind speed	1					i		1	
Jan Feb M	/lar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7	,					i	·	l	
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4						1			
(22a)m= 1.27 1.25 1.	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m		-	-	_	
	0.74	0.72	0.71	0.64	0.62	0.55	0.55	0.53	0.58	0.62	0.65	0.68		
If m	ate effe	<i>ctive air</i> al ventila	change	rate for t	he appli	cable ca	se						0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)), othei	rwise (23b) = (23a)				(23b)
If bala	anced with	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,				(23c)
a) If	balance	ed mech	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (22	2b)m + (23b) x [′	1 – (23c)	÷ 100]	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mecha	ı anical ve	entilation	without	heat rec	overv (ľ	MV) (24b	m = (22)	1 2b)m + (;	23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from c	outside	!			1	
,	if (22b)r	n < 0.5 ×	(23b) , t	then (24o	c) = (23b); otherv	wise (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	natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilati	on from I	oft	_				
(2.1.1)	if (22b)r	n = 1, th	en (24d)	m = (22k	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	J	(240)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24)	c) or (24	d) in boy	(25)	0.00	0.74	0.70	1	(25)
(25)m=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN		Gros area	ss (m²)	Openin m	gs 2	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²·l) K	A X k kJ/K
Doo <mark>rs</mark>						1.9	x	1.4	=	2.66				(26)
Windo	<mark>ws</mark> Type	e 1				9.03	x1	/[1/(1.6)+	0.04] =	13.58				(27)
Win <mark>do</mark>	ws Type	e 2				0.39	x1	/[1/(4.8)+	0.04] =	1.57				(27)
Floor						51	×	0.97	=	49.47				(28)
Walls ⁻	Type1	39.	2	0.39		38.81	x	2.1		81.5				(29)
Walls ⁻	Type2	10.9	9	10.93	3	0.06	×	2.1		0.13			$\exists \square$	(29)
Total a	area of e	elements	, m²			101.1	9							(31)
Party v	wall					16.1	×	0	=	0				(32)
* for win ** includ	idows and le the area	l roof wind as on both	ows, use e sides of ii	effective wi	ndow U-va Is and par	alue calcul titions	ated using	g formula 1,	/[(1/U-valı	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				148.91	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TM	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: High		450	(35)
For desi can be ι	ign asses: used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pi	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 ł	<						15.2	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			164.11	(37)
Ventila	ation hea	at loss ca	alculateo	d monthly	/			I 1	(38)m	= 0.33 × (25)m x (5))	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	4	
(38)m=	28.3	27.92	27.54	25.76	25.42	23.87	23.87	23.59	24.47	25.42	26.1	26.8	l	(38)
Heat ti	ransfer o	coefficie	nt, W/K	1 1		r	r	r	(39)m	= (37) + (3	38)m		1	
(39)m=	192.41	192.02	191.64	189.86	189.53	187.98	187.98	187.69	188.58	189.53	190.21	190.91		
										average =	Sum(39)1	12 /12=	189.86	o (39)

Heat lo	ss para	imeter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	3.77	3.77	3.76	3.72	3.72	3.69	3.69	3.68	3.7	3.72	3.73	3.74		
Numbe	r of day	rs in mor	nth (Tab	le 1a)					/	Average =	Sum(40)1	.12 /12=	3.72	(40)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
Ľ														
4. Wat	ter heat	ting enei	rgy requi	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	ıpancy, I 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.(0013 x (1	ΓFA -13.	1. 9)	72		(42)
Annual Reduce t not more	averag the annua that 125	je hot wa al average litres per j	ater usag hot water person per	ge in litre usage by s day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.04		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					I	
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54		
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mon	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 10	c, 1d)	900.48	(44)
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55		
lf instanta	aneous w	vater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Fotal = Su	m(45) ₁₁₂ =		1180.67	(45)
(46)m=	18.36	16.06	16.57	14. <mark>45</mark>	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78		(46)
Water s	storage	loss:	vincludir	na any so	alar or M		storado	within sa	ame ves	ما		100		(47)
lf com	e volum		nd no ta	ing any so		nter 110	litres in	(17)		501		160		(47)
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water s	storage	loss:												
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear	or io pot	known:	(48) x (49)	=		16	60		(50)
Hot wat	ter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	iy)				0.	03		(51)
If comm	nunity h	leating s	ee secti	on 4.3										
Volume	e factor	from Tal	ble 2a	0							0.	91		(52)
Iempe	rature f	actor fro	m I able	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	2.	84		(54)
Water e			culated f	for each	month			((56)m - (55) × (41)r	m	2.	84		(55)
		70 50				05.0	00.04		00) x (41)	00.04	05.0	00.04	l	(56)
(56)m= If cylinde	88.04 r contains	79.52 s dedicate	d solar sto	85.2 rage, (57)ı	88.04 m = (56)m	85.2 x [(50) – (88.04 H11)] ÷ (5	88.04 0), else (5	85.2 7)m = (56)	88.04 m where (85.2 H11) is fro	88.04 m Append	lix H	(00)
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primar	/ circuit	loss (an	nual) fro	om Table	93	•	•)		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		•		•	
(mod	lified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)		L	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for each	n month	(61)m =	(60) ÷ 3	65 × (41)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	ch month	(62)m =	• 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96]	(62)
Solar DH	HW input	calculated	using App	pendix G o	r Appendix	H (negat	tive quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	applies	s, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	vater hea	ter					-	-		-	_	_	
(64)m=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		_
								Out	out from w	ater heate	r (annual)₁	12	3393.99	(64)
Heat g	ains fro	om water	heating	, kWh/m	onth 0.2	5 ´ [0.85	5 × (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12		(65)
inclu	ide (57))m in calo	culation	of (65)m	only if c	ylinder	is in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating	
5. Int	ternal g	ains (see	Table	5 and 5a):									
Metab	olic gaiı	ns (Table	e 5), Wa	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	8 <mark>5.98</mark>	85.98	85.98		(66)
Ligh <mark>tin</mark>	g gains	(calcula	ted in A	ppendix	L, equat	ion L9 c	or L9a), a	lso see	Table 5					
(67)m=	13.58	12.06	<mark>9</mark> .81	7.43	5.55	4.69	5.06	6.58	8.83	11.22	13.09	13.96		(67)
Applia	nces ga	ains (ca <mark>lc</mark>	ulat <mark>ed i</mark>	n Appen	dix L, eq	uation L	.13 or L1	3a), also	o see Ta	ble <mark>5</mark>				
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22		(68)
Cookir	ng gains	s (calcula	ited in A	ppendix	L, equat	ion L15	or L15a), also se	ee Table	5				
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6		(69)
Pumps	and fa	Ins gains	(Table	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. e	vaporatic	n (nega	tive valu	es) (Tab	le 5)	-			•	•			
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78		(71)
Water	heating	, gains (T	able 5)	•			-				•			
(72)m=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02		(72)
Total i	nterna	I gains =		•		(66	67)m + (67)m	• • + (68)m ·	+ (69)m +	(70)m + (7	'1)m + (72)	m		
(73)m=	414.95	413.25	403.48	387.87	372.28	265.58	255.55	260.38	268.28	375.54	393.66	406.99		(73)
6. So	lar gain	IS:			<u> </u>				<u>.</u>					
Solar g	ains are	calculated	using sola	ar flux from	Table 6a	and asso	ciated equa	tions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area		Flu	ux	_	g	_	FF		Gains	
		Table 6d		m²		Ta	ible 6a	Т	able 6b	Т	able 6c		(VV)	
North	0.9x	0.77	x	0.3	39	x	10.63	x	0.85	x	0.7	=	1.71	(74)
North	0.9x	0.77	x	0.3	39	x	20.32	x	0.85	x	0.7	=	3.27	(74)
North	0.9x	0.77	×	0.3	39	x	34.53	x	0.85	x	0.7	=	5.55	(74)
North	0.9x	0.77	x	0.3	39	x	55.46	x	0.85	x	0.7	=	8.92	(74)
North	0.9x	0.77	x	0.3	39	x	74.72	x	0.85	×	0.7	=	12.02	(74)

North	0.9x	0.77	x	0.3	39	x	7	9.99	x	0.85		x	0.7		=	12.86	(74)
North	0.9x	0.77	x	0.3	39	x	7	4.68	X	0.85		x	0.7		= [12.01	(74)
North	0.9x	0.77	x	0.3	39	x	5	9.25	x	0.85		x	0.7		= [9.53	(74)
North	0.9x	0.77	x	0.3	39	x	4	1.52	x	0.85		x	0.7		= [6.68	(74)
North	0.9x	0.77	x	0.3	39	x	2	4.19	x	0.85		x	0.7		= [3.89	(74)
North	0.9x	0.77	x	0.3	39	x	1	3.12	x	0.85		x	0.7		= [2.11	(74)
North	0.9x	0.77	x	0.3	39	x	6	8.86	x	0.85		x	0.7		= [1.43	(74)
South	0.9x	0.77	x	9.0)3	x	4	6.75	x	0.76		x	0.7		= [155.64	(78)
South	0.9x	0.77	x	9.0)3	x	7	6.57	x	0.76		x	0.7		= [254.91	(78)
South	0.9x	0.77	x	9.0)3	x	g	7.53	x	0.76		x	0.7		= [324.7	(78)
South	0.9x	0.77	x	9.0)3	x	1	10.23	x	0.76		x	0.7		= [366.99	(78)
South	0.9x	0.77	x	9.0)3	x	1	14.87	x	0.76		x	0.7		= [382.42	(78)
South	0.9x	0.77	x	9.0)3	x	1	10.55	x	0.76		x	0.7		= [368.03	(78)
South	0.9x	0.77	x	9.0)3	x	1	08.01	x	0.76		x	0.7		= [359.59	(78)
South	0.9x	0.77	x	9.0)3	x	1	04.89	x	0.76		x	0.7		= [349.21	(78)
South	0.9x	0.77	x	9.0)3	x	1	01.89	x	0.76		x	0.7		= [339.19	(78)
South	0.9x	0.77	x	9.0)3	x	8	2.59	x	0.76		x	0.7		= [274.94	(78)
South	0.9x	0.77	x	9.0)3	X	5	5.42	х	0.76		х	0.7		=[184.49	(78)
South	0.9x	0.77	×	9.0)3	x		40.4	x	0.76		x	0.7		= [134.49	(78)
															_		
Sola <mark>r</mark> (<mark>gain</mark> s in	watts, <mark>calo</mark>	culated	for eac	h mont	:h			(83)m	n = Sum(74))m(82	!)m		-			
(83)m=	157.35	258.17	330.26	375.91	394.44	1 3	80.89	371.6	358	.74 345.8	37 278	8.83	3 186.6	135.	.92		(83)
Total g	gains – i	nternal and	d solar	(84)m =	= (73)n r	1 + (83)m	, watts	1				_				
(84)m=	572.3	671.43	733.74	763.77	766.72	2 6	46.48	627.14	619	.12 614.1	15 654	4.37	580.26	542.	.91		(84)
7. Me	ean inter	nal tempe	rature	(heating	seasc	on)											
Temp	perature	during hea	ating p	eriods ir	n the liv	ving	area	from Tal	ble 9	, Th1 (°C))					21	(85)
Utilis	ation fac	tor for gain	ns for l	iving are	ea, h1,	m (s	ee Ta	ble 9a)						-			
	Jan	Feb	Mar	Apr	May	/	Jun	Jul	A	ug Se	p C	Oct	Nov	D	ес		
(86)m=	1	0.99	0.99	0.98	0.96		0.93	0.86	0.8	37 0.95	5 0.	98	0.99	1			(86)
Mear	n interna	l temperat	ure in	living ar	ea T1 (follo	w ste	ps 3 to 7	7 in T	able 9c)							
(87)m=	18.69	18.88	19.21	19.64	20.1	2	20.47	20.75	20.	72 20.3	7 19	.83	19.19	18.6	67		(87)
Temp	perature	during hea	ating p	eriods ir	n rest c	of dw	elling	from Ta	able 9	9, Th2 (°C	C)						
(88)m=	18.41	18.42	18.42	18.43	18.43	1	18.45	18.45	18.	45 18.4	4 18	.43	18.43	18.4	42		(88)
Utilis	ation fac	tor for gai	ns for i	est of d	welling	h2	m (se	e Table	9a)	•							
(89)m=	0.99	0.99	0.98	0.96	0.91	<u> </u>	0.81	0.51	0.5	56 0.86	6 O.	96	0.99	1			(89)
Moor		L temperat		the rest	of dwo	lling	T2 (f	l ollow ste		to 7 in T	able Q	-)					
(90)m=	15.67	15.95	16.42	17.05	17.69		12 (1	18.41	18	.4 18.0	7 17	ر 33'	16.4	15.6	64		(90)
·/···-									<u> </u>		fLA =	Liv	ring area ÷ (4	1 4) =		0.47) (91)
N 4	int			u 4 ha - '	ماد ا		~) ('		. /4	£1. A.) -	то				Ĺ		` ´
		i temperat	ure (fo	18 29			(g) = f	LA X 11	+ (1	$- TLA) \times$	1Z	50	17 70	17/			(02)
(32)11=	1 17.1		11.14	10.20	I 10.03		J.21	1 19.02	1 19		0 I 10		1 11.12	I ''''	01		(32)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.1	17.33	17.74	18.28	18.83	19.27	19.52	19.5	19.16	18.52	17.72	17.07		(93)
8. Sp	ace hea	ting requ	uirement	i										
Set T the ut	i to the i tilisation	mean int factor fo	ernal ter or gains	mperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.98	0.96	0.92	0.87	0.71	0.74	0.9	0.96	0.99	0.99		(94)
Usefu	ıl gains,	hmGm	, W = (9-	4)m x (84	4)m								1	
(95)m=	568.23	663.2	718.43	734.83	708.7	560.11	446.22	458.58	552.42	628.57	572.91	539.66		(95)
Mont	nly aver	age exte	ernal tem	perature	e from Ta	able 8								(0.0)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m : L = 40.00	x [(93)m	– (96)m	4500.00	0040 70	0.450.00	l	(07)
(97)m=	2462.63	2387.73	2153.26	1780.42	1351.65	877.31	548.23	581.12	953.55	1500.23	2019.78	2456.86		(97)
Space		g require			101111, K	/vn/moni	n = 0.02	4 X [(97])m – (95)MJ X (4	1)m 1041 75	1426.4		
(90)11=	1409.44	1100.00	1007.51	752.05	470.00	0	0	U Toto		040.02	1041.75	1420.4	7082.67	
-								Tota	i per year	(күүп/уеаг) = Sum(9	0)15,912 =	7963.07	(90) T
Space	e heatin	g require	ement in	kWh/m ²	/year								156.54	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	HP)					
Spac	e heatii	ng:												
Fract	ion of sp	bace hea	at from s	econdary	y/supple	mentary	system						0	(201)
Fracti	ion of sp	bace 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 I	main s <mark>pa</mark>	ace heat	ing syste	em 1								88.9	(206)
Effi <mark>ci</mark> e	enc <mark>y of</mark> s	seconda	<mark>ry/</mark> suppl	ementar:	y heating	g system	ח, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Spac	e heatin	g require	ement (c	alculate	d above))								
	1409.44	1158.88	1067.51	752.83	478.35	0	0	0	0	648.52	1041.75	1426.4		
(211)m	n = {[(98)m x (20	(4)] } x 1	00 ÷ (20	6)		-							(211)
	1585.42	1303.58	1200.8	846.82	538.08	0	0	0	0	729.49	1171.82	1604.5		-
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	8980.5	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									
= {[(98)m x (20	01)]}x1	00 ÷ (20)8) 										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	т (кууп/уеа	ar) =Sum(2	215) _{15,1012}	-	0	(215)
Water	heating]	(
Output	338.82	ater nea	ter (caic	ulated al	308.83	206.86	205 25	216 15	212 93	316 42	318.6	334.96		
Efficie	ncv of w	ater hea	ter	000.70	000.00	200.00	200.20	210.10	212.00	010.42	010.0	004.00	78.8	1 (216)
(217)m-	86 75	86.6	86 31	85 73	84 64	78.8	78.8	78.8	78.8	85 31	86 31	86 78	70.0	(217)
Eucl fo		heating	k\//h/m/	nth	04.04	, 0.0	10.0	10.0	, 0.0	00.01	00.01	00.70		、—···)
(219)m	n = (64)	<u>m_x</u> 100	<u>) ÷ (217)</u>	m										
(219)m=	390.6	349.33	378.75	356.66	364.86	262.52	260.47	274.3	270.21	370.89	369.14	385.97		
								Tota	I = Sum(2	19a) ₁₁₂ =			4033.69	(219)
Annua	al totals									k\	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								8980.5	

Water heating fuel used			4033.69)
Electricity for pumps, fans and electric keep-hot				
central heating pump:		Г	120	(230c)
boiler with a fan-assisted flue		Γ	45	(230e)
Total electricity for the above, kWh/year	SL	um of (230a)(230g) =	165	(231)
Electricity for lighting			239.8	(232)
12a. CO2 emissions – Individual heating systems	including micro-CH	IP		
	Energy kWh/year	Emission facto kg CO2/kWh	or Emission kg CO2	o ns ⁄year
Space heating (main system 1)	(211) x	0.216	= 1939.79	(261)
Space heating (secondary)	(215) x	0.519	= 0	(263)
Water heating	(219) x	0.216	= 871.28	(264)
Space and water heating	(261) + (262) + (263)	+ (264) =	2811.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 85.64	(267)
Electricity for lighting	(232) x	0.519	= 124.46	(268)
Total CO2, kg/year		sum of (265)(271) =	3021.16	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	59.24	(273)
El rating (section 14)			58	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP	2012	roperty	Stroma Softwa	a Num are Ver Unit 5	ber: sion:		Versio	on: 1.0.3.4	
Address :	london	L. L. L. L. L. L. L. L. L. L. L. L. L. L	iopeny /	-001655.	Offit 5					
1. Overall dwelling dimer	sions:									
Basement			Area	a(m²) 128	(1a) x	Av. He	ight(m) .08	(2a) =	Volume(m³ 522.24) (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d))+(1e)+(1n	n)	128	(4)			-		_
Dwelling volume			L		(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	522.24	(5)
2. Ventilation rate:	_								<u>, , ,</u>	
Number of chimneys Number of open flues	main heating	+ 0 + 0	y] + [_] + [_	0 0] = [] = [total 0 0		40 = 20 =	0 0	r (6a) (6b)
Number of intermittent fan	s				- -	3	x ²	10 =	30	(7a)
Number of passive vents						0	x ^	10 =	0	 (7b)
Number of flueless gas fire	es					0	X 4	40 =	0	(7c)
								Air ch	anges per ho	our
Infiltration due to chimney	s, flues and fans en ca <mark>rried out or is i</mark>	a = (6a)+(6b)+(7)	(a)+(7b)+(7 d to (17), c	7c) = otherwise c	ontinue fr	30 om (9) to ((16)	÷ (5) =	0.06	(8)
Number of storeys in the Additional infiltration	e dw <mark>elling</mark> (ns)		0.05 ([(9)	-1]x0.1 =	0	(9) (10)
if both types of wall are pre deducting areas of opening	25 for steel of tin esent, use the value (gs); if equal user 0.3	nder frame or corresponding to 5	0.35 for	er wall area	y constr a (after	uction			0	(11)
If suspended wooden flo	oor, enter 0.2 (ur	nsealed) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else ente	er O							0	(13)
Percentage of windows	and doors draug	ght stripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	[00] =	. (45)		0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) ·	+ (15) =		0	
Air permeability value, c	150, expressed in	$(1 \text{ CUDIC Metre}) = [(17) \div 20] + (8)$	s per no 3) otherwi	our per so se (18) = (Juare m 16)	etre of e	envelope	area	10	(17)
Air permeability value applies	if a pressurisation te	est has been don	e or a dec	aree air pei	meability	is beina u	sed		0.56	
Number of sides sheltered	, 1		0	, i	,	0			2	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)	x (20) =				0.47	(21)
Infiltration rate modified fo	r monthly wind s	peed					-			
Jan Feb I	Mar Apr I	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
(22)m= 5.1 5 4	4.4 4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
(22a)m= 1.27 1.25 1	.23 1.1 1	.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	d infiltra	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.6	0.59	0.58	0.52	0.51	0.45	0.45	0.44	0.47	0.51	0.53	0.56		
Calculā	ite effec	tive air	change	rate for t	he appli	cable ca	se	-		-		-	- 	
li me				andix NL (2	26) (00	а) Г ран (с	austica (muiaa (22h	·) (22a)			0	(23a)
				$\frac{1}{2}$	(23a) = (23a)	a) × FIIIV (e	equation (i	n Toblo 4b)) = (23a)			0	(23b)
			· ·			,) =		001.) [4 (00)	0	(23c)
a) if t			anical ve			at recove		HR) (24a T	a)m = (22)	2b)m + (T	23b) × [*	1 - (23c)) ÷ 100]]	(245)
(24a)m=					0		0					0	J	(24a)
			anical ve		without	neat rec	covery (i	VIV) (240 T	m = (22)	2b)m + (i T	230)		1	(24b)
(240)m=		0			0					0	0	0	J	(240)
C) If V if	vhole ho (22b)m	ouse ex	tract ver	tilation o	or positiv	/e input \	ventilatio	c) = (22)	outside $n + 0$	5 v (23h	N)			
(24c)m=	0	0.0			(200) = (200)		0	$\frac{0}{0} = \frac{221}{0}$) iii + 0.			0	1	(24c)
		vontilativ					vontilati	on from l	oft	L ů	Ů	L ů	J	
u) if	ⁱ (22b)m	n = 1, the	en (24d)	m = (22k)	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m ² x	0.5]				
(24d)m=	0.68	0.68	0.67	0.64	0.63	0.6	0.6	0.6	0.61	0.63	0.64	0.65]	(24d)
Effec	tive air	change	rate - er	nter (24a) or (24) or (24	c) or (24	d) in bo	k (25)		<u>.</u>			
(25)m=	0.68	0.68	0.67	0.64	0.63	0.6	0.6	0.6	0.61	0.63	0.64	0.65		(25)
2 1 1 2 2									1				,	
3. Hea					ər.	Not Ar	~~					kyolu		
ELEIVI	ENI	area	(m^2)	Openin	gs	Net Ar	ea	U-van	ue	AXU		K-value	-	АЛК
		aica		III	14	A,r	n²	W/m2	2K	(VV/I	K)	kJ/m²-	K	KJ/K
Doo <mark>rs</mark> 7	Гуре 1	arca	(111-)			A ,r	n²	W/m2	2K	(VV/I 3.92	K)	kJ/m²•	ĸ	KJ/K (26)
Doors T Doors T	Гуре 1 Гуре 2	area	(111-)		12	A ,r 2.8	n² X	W/m2	2K = = =	(VV/ 3.92 2.1	K)	kJ/m²-	ĸ	KJ/K (26) (26)
Doors 1 Doors 1 Window	Гуре 1 Гуре 2 vs Type	1	(11-)		14	A ,r 2.8 1.5	m ² x	W/m2 1.4 1.4 /[1/(4.8)+	2K = = 0.04] =	(W/I 3.92 2.1 69.87	K)	kJ/m²-	ĸ	KJ/K (26) (26) (27)
Doors 1 Doors 1 Window Windov	Гуре 1 Гуре 2 vs Type vs Type	1	(111-)			A ,r 2.8 1.5 17.35	m ² x x x x x1	W/m2 1.4 /[1/(4.8)+ /[1/(1.6)+	2K = [- 0.04] = [- 0.04] = [(W// 3.92 2.1 69.87	K)	kJ/m²-	ĸ	kJ/K (26) (26) (27)
Doors 1 Doors 1 Window Window Window	Гуре 1 Гуре 2 vs Type vs Type vs Type	1			14	A ,r 2.8 1.5 17.35 2.48	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(4.8)+ /[1/(1.6)+ /[1/(4.8)+	:: :: <td::< td=""> :: :: <td:< td=""><td>(W/I 3.92 2.1 69.87 3.73</td><td>K)</td><td>kJ/m²•</td><td>K</td><td>kJ/K (26) (26) (27) (27)</td></td:<></td::<>	(W/I 3.92 2.1 69.87 3.73	K)	kJ/m²•	K	kJ/K (26) (26) (27) (27)
Doors 1 Doors 1 Window Window Window	Гуре 1 Гуре 2 vs Type vs Type vs Type	1 2 3			12	A ,r 2.8 1.5 17.35 2.48 1.5	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	!! = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04	K)	kJ/m²+		kJ/K (26) (26) (27) (27) (27)
Doors 1 Doors 1 Window Window Window Floor	Type 1 Type 2 vs Type vs Type vs Type	1 2 3				A ,r 2.8 1.5 17.35 2.48 1.5 128	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79	!! =	(W// 3.92 2.1 69.87 3.73 6.04 101.12		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28)
Doors 1 Doors 1 Window Window Floor Walls T	Type 1 Type 2 vs Type vs Type vs Type Type1	1 2 3 74.2	26	18.85	5	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1	!! = 0.04] = 0.04] = 0.04] = 0.04] = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29)
Doors 1 Doors 1 Window Window Window Floor Walls T Walls T	Type 1 Type 2 vs Type vs Type vs Type Type1 Type2	1 2 3 74.2 46.	26	18.8	5	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28	:K = :0.04]	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29)
Doors 1 Doors 1 Window Window Floor Walls T Walls T Walls T	Type 1 Type 2 vs Type vs Type vs Type ype1 ype2 ype3	1 2 3 74.2 46. 71.1	26 4 6	18.84 5.28 1.5	5	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1	!! = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29)
Doors T Doors T Window Window Floor Walls T Walls T Walls T Walls T	Type 1 Type 2 vs Type vs Type vs Type ype1 type2 type3 type4	1 2 3 74.2 46. 71.1 5.3	26 4 6 4	18.8 5.28 1.5 0	5	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3	!K = 0.04] 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6		kJ/m².		kJ/K (26) (27) (27) (27) (28) (29) (29) (29) (29)
Doors T Doors T Window Window Floor Walls T Walls T Walls T Walls T Roof	Type 1 Type 2 vs Type vs Type vs Type ype1 type2 type3 type4	1 2 3 74.2 46. 71.1 5.3 17	26 4 6 4	18.84 5.28 1.5 0 0	5	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3 2.3	!K = 0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 39.1		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (29) (30)
Doors 1 Doors 1 Window Window Floor Walls T Walls T Walls T Roof Total ar	Type 1 Type 2 vs Type vs Type vs Type ype1 Type2 Type3 Type4 rea of el	1 2 3 74.2 46. 71.1 5.3 17 lements	26 4 6 4	18.84 5.28 1.5 0 0	5	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.10	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3 2.3	!! =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 39.1		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31)
Doors T Doors T Window Window Floor Walls T Walls T Walls T Walls T Roof Total an Party w	Type 1 Type 2 vs Type vs Type vs Type type1 type2 type3 type3 type4 rea of el	1 2 3 74.2 46. 71.1 5.3 17 lements	26 4 6 4 , m ²	18.8 5.28 1.5 0	5	A, r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.11 22.1	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3 2.3	!K = 0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 39.1		kJ/m².		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32)
Doors 1 Doors 1 Window Window Floor Walls T Walls T Walls T Walls T Roof Total ar Party w	Type 1 Type 2 vs Type vs Type vs Type vs Type ype1 ype3 ype3 ype4 rea of el vall dows and e the area	$\begin{bmatrix} 1 \\ 2 \\ 3 \\ \hline 74.2 \\ \hline 46. \\ \hline 71.1 \\ \hline 5.3 \\ \hline 17 \\ ements \\ roof wind as on both \\ \end{bmatrix}$	26 4 6 4 , m ² ows, use e sides of ir	18.84 5.28 1.5 0 0 0 0 0 0 0 0 0 0 0	5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.11 22.1 alue calculations	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.28 2.1 0.3 2.3 0 0 formula 1	$\begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 39.1 0 <i>u</i> e)+0.04] <i>e</i>	K)	paragraph		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32)
Doors T Doors T Window Window Floor Walls T Walls T Walls T Walls T Roof Total an Party w * for wind ** include Fabric I	Type 1 Type 2 vs Type vs Type vs Type type1 type2 type3 type3 type4 rea of el vall dows and the area neat los	$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} 74.2 \\ 46. \\ 71.1 \\ 5.3 \\ 17 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10 \\ 10$	26 4 6 4 , m ² ows, use e sides of ir = S (A x	18.83 5.28 1.5 0 0 effective with thermal walk U)	5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.11 22.1 alue calculations	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 (1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.28 2.1 0.3 2.3 0 0 formula 1 (26)(30)	$\begin{array}{c} 2 \\ 2 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 39.1 0 <i>ue)+0.04] e</i>	K)	paragraph	K	 kJ/K (26) (27) (27) (27) (27) (29) (29) (29) (29) (29) (30) (31) (32)
Doors T Doors T Window Window Floor Walls T Walls T Walls T Walls T Walls T Roof Total an Party w * for wind ** include Fabric F Heat ca	Type 1 Type 2 vs Type vs Type vs Type vs Type ype1 ype2 ype3 ype3 ype4 rea of el all dows and e the area neat los apacity (roof winds, W/K = Cm = S($\frac{26}{4}$ $\frac{6}{4}$ $\frac{4}{5}$ $\frac{6}{5}$ $\frac{4}{5}$ $\frac{6}{5}$ $\frac{4}{5}$ $\frac{6}{5}$ $\frac{1}{5}$	18.84 5.28 1.5 0 0 effective winternal walk	5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 2.8 1.5 17.35 2.48 1.5 128 55.41 41.12 69.66 5.34 17 342.11 22.1 alue calculations	m ² x x x x x x x x x x x x x x x x x x x	W/m2 1.4 1.4 (1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 0.79 2.1 0.28 2.1 0.3 2.3 0 0 formula 1 (26)(30)	$\begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	(W// 3.92 2.1 69.87 3.73 6.04 101.12 116.36 11.51 146.29 1.6 39.1 0 <i>u</i> e)+0.04] <i>e</i>	K)	paragraph (32e) =	K	 kJ/K (26) (27) (27) (27) (27) (29) (29) (29) (29) (29) (30) (31) (32)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

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if detail	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)			(22)	(26)				
Veetil			- - 4	l					(33) +	(30) =	05)		553.64	(37)
ventila					y May	lun		Aug	(38)m	= 0.33 x (25)m x (5)	Dec	1	
(38)m=	117.62	116.4	115.2	109.58	108.53	103.63	103.63	102.72	105.52	108.53	110.65	112.88		(38)
Heat t	ransfer (L	L nt_W/K						(39)m	= (37) + (3	1 38)m]	
(39)m=	671.26	670.04	668.84	663.22	662.16	657.27	657.27	656.36	659.15	662.16	664.29	666.52]	
			I				I		,	L Average =	Sum(39)1	12 /12=	663.21	(39)
Heat I	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	5.24	5.23	5.23	5.18	5.17	5.13	5.13	5.13	5.15	5.17	5.19	5.21		_
Numb	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1	12 /12=	5.18	(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. W	ater hea	ting ene	rgy requ	irement:								kWh/y	ear:	
A			NI										1	(10)
if TF	FA > 13.9	9, N = 1	ы + 1.76 x	[1 - exp	(-0.0003	849 x (TF	- A -13.9)2)] + 0.0)013 x (⁻	TFA -13.	2. .9)	.89		(42)
if TF	FA £ 13.9	9, N = 1				,			,		,		_	
Annua	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36	se target o	10	2.83		(43)
not mor	re that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ld)		a water us	se largel o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wa	ter usage i	n litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from	Table 1c x	(43)					J	
(44)m=	113.11	109	104.88	100.77	96.66	92.55	92.55	96.66	100.77	10 <mark>4.88</mark>	109	113.11		
			<u> </u>					1		Total = Su	m(44) ₁₁₂ =	=	1233.94	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x C	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	167.74	146.71	151.39	131.98	126.64	109.28	101.27	116.2	117.59	137.04	149.59	162.45		_
lf inotor	topoquo y	ator hooti	na ot poin	fund (no	hot wata	r otorogo)	ontor 0 in	havaa (16) to (61)	Total = Su	m(45) ₁₁₂ =	=	1617.89	(45)
ii iiistai						siorage),							1	(10)
(46)m= Water	25.16 storage	22.01	22.71	19.8	19	16.39	15.19	17.43	17.64	20.56	22.44	24.37		(46)
Storag	ge volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		160	1	(47)
If com	, Imunity h	eating a	and no ta	ink in dw	velling, e	nter 110) litres in	(47)					1	
Other	wise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:											_	
a) If n	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temp	erature f	actor fro	m Table	2b								0		(49)
Energ	y lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		1	60		(50)
D) IT N Hot w	nanutaci ater stor	urer's di ane loss	eclared (cylinder i com Tabl	ioss tact le 2 (kW	or is not h/litre/da	KNOWN:				0	02	1	(51)
If com	munity h	eating s	see secti	on 4.3		,	~)/				L0.	00]	
Volum	ne factor	from Ta	ble 2a								0.	.91]	(52)
Temp	erature f	actor fro	m Table	2b							0.	78]	(53)
Energ	y lost fro	m water	r storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	2.	.84]	(54)
Enter	(50) or	(54) in (5	55)								2.	.84]	(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	1	(56)
If cylind	er contain	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	lix H	
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primar	ry circuit	loss (ar	nual) fro	om Table	e 3							0]	(58)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				•	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	ostat)		•	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m		_			_	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)n	n
(62)m=	384.15	342.18	367.8	341.42	343.06	236.39	232.62	247.55	244.7	353.46	359.02	378.86		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	KH (negati	ve quantity	/) (enter '0	' if no sola	r contribut	tion to wate	er heating)	,	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)			-	•	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter				-	-	-				-	
(64)m=	384.15	342.18	367.8	341.42	343.06	236.39	232.62	247.55	244.7	353.46	359.02	378.86		_
								Outp	out from w	ater heate	r (annual)₁	12	3831.21	(64)
Hea <mark>t g</mark>	jains fro	m water	heating	, kWh/m	onth 0.2	<mark>5 ´</mark> [0.85	× (45)m	+ (61)n	n] + 0.8 x	x [(46)m	<mark>+ (57)</mark> m	+ (59)m]	
(65)m=	158.48	141.54	153.04	143.27	144.81	6 <mark>9.87</mark>	68.32	73.29	72.63	148.27	149.13	156.72		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	vate <mark>r is f</mark> i	rom com	<mark>mu</mark> nity h	neating	
5. In	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	s (Table	5), Wat	ts				i		_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				-	
(67)m=	26.77	23.78	19.34	14.64	10.94	9.24	9.98	12.98	17.42	22.12	25.81	27.52		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5		-	_	
(68)m=	295.29	298.36	290.64	274.2	253.45	233.94	220.91	217.85	225.57	242.01	262.76	282.26		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5			_	
(69)m=	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45		(69)
Pumps	s and fai	ns gains	(Table &	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58		(71)
Water	heating	gains (T	able 5)								-		•	
(72)m=	213	210.63	205.7	198.99	194.64	97.04	91.83	98.51	100.88	199.29	207.12	210.64		(72)
Total i	internal	gains =				(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	m	-	
(73)m=	611.42	609.11	592.02	564.17	535.37	416.57	399.07	405.68	420.21	539.76	572.04	596.77		(73)
	•	•	•	•		•							1	

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ition:	Access Factor Table 6d	-	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.48	×	10.63) ×	0.76	×	0.7] =	9.72	(74)
North	0.9x	0.77	x	2.48	×	20.32	x	0.76	×	0.7	=	18.58	(74)
North	0.9×	0.77	x	2.48	×	34.53	x	0.76	×	0.7] =	31.57	(74)
North	0.9x	0.77	x	2.48	×	55.46	x	0.76	×	0.7] =	50.71	(74)
North	0.9x	0.77	x	2.48	×	74.72	x	0.76	×	0.7	=	68.31	(74)
North	0.9x	0.77	x	2.48	×	79.99	x	0.76	×	0.7] =	73.13	(74)
North	0.9x	0.77	x	2.48	×	74.68	x	0.76	×	0.7] =	68.28	(74)
North	0.9x	0.77	x	2.48	x	59.25	x	0.76	x	0.7] =	54.17	(74)
North	0.9x	0.77	x	2.48	×	41.52	x	0.76	×	0.7	j =	37.96	(74)
North	0.9x	0.77	x	2.48	x	24.19	x	0.76	x	0.7	1 =	22.12	– (74)
North	0.9x	0.77	x	2.48	×	13.12	x	0.76	×	0.7	1 =	11.99	(74)
North	0.9x	0.77	x	2.48	×	8.86	x	0.76	×	0.7	1 =	8.1	(74)
South	0.9×	0.77	x	17.35	x	46.75	x	0.85	x	0.7	i =	334.46	(78)
South	0.9x	0.77	x	17.35	×	76.57	x	0.85	×	0.7	i =	547.77	(78)
South	0.9×	0.77	x	17.35	x	97.53	x	0.85	x	0.7	i =	697.76	(78)
South	0.9×	0.77	x	17.35	×	110.23	x	0.85	х	0.7	1	788.62	(78)
Sout <mark>h</mark>	0.9×	0.77	x	17.35	x	114.87	x	0.85	x	0.7	i -	821.79	(78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	110.55	i 🖌	0.85	x	0.7	i =	790.86	- (78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	108.01	x	0.85	x	0.7	1 =	772.72	(78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	104.89	x	0.85	x	0.7	=	750.42	– (78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	101.89	×	0.85	x	0.7	i =	728.89	 (78)
Sout <mark>h</mark>	0.9x	0.77	x	17.35	x	82.59	x	0.85	x	0.7	i =	590.82	(78)
South	0.9×	0.77	x	17.35	×	55.42	x	0.85	×	0.7	i =	396.45	(78)
South	0.9x	0.77	x	17.35	×	40.4	x	0.85	×	0.7	1 =	289.01	– (78)
West	0.9×	0.77	x	1.5	x	19.64	x	0.85	x	0.7	i =	12.15	(80)
West	0.9x	0.77	x	1.5	×	38.42	x	0.85	x	0.7	1 =	23.76	(80)
West	0.9x	0.77	x	1.5	×	63.27	x	0.85	×	0.7	1 =	39.13	(80)
West	0.9x	0.77	x	1.5	×	92.28	x	0.85	×	0.7	i =	57.08	(80)
West	0.9×	0.77	x	1.5	×	113.09	x	0.85	×	0.7	j =	69.95	(80)
West	0.9×	0.77	x	1.5	x	115.77	x	0.85	x	0.7	i =	71.6	(80)
West	0.9×	0.77	x	1.5	x	110.22	x	0.85	x	0.7	i =	68.17	(80)
West	0.9x	0.77	x	1.5	×	94.68	x	0.85	×	0.7	1 =	58.56	(80)
West	0.9x	0.77	x	1.5	×	73.59	x	0.85	×	0.7] =	45.52	(80)
West	0.9x	0.77	x	1.5	×	45.59	x	0.85	×	0.7	j =	28.2	(80)
West	0.9x	0.77	x	1.5	x	24.49	İ x	0.85	×	0.7	j =	15.15	(80)
West	0.9x	0.77	x	1.5	×	16.15	l x	0.85	×	0.7	i =	9.99	(80)

Solar g	ains in	watts, ca	alculated	for eac	n month			(83)m = S	um(74)m .	(82)m			
(83)m=	356.33	590.11	768.46	896.41	960.05	935.6	909.17	863.14	812.37	641.13	423.6	307.1	(83)
Total g	ains – ir	nternal a	nd solar	(84)m =	- (73)m -	+ (83)m	, watts						-
(84)m=	967.75	1199.22	1360.48	1460.58	1495.42	1352.16	1308.24	1268.82	1232.58	1180.89	995.64	903.87	(84)

7. Me	an inter	nal temp	oerature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	a, h1,m	(see Ta	ble 9a)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.99	0.98	0.96	0.93	0.94	0.98	0.99	1	1		(86)
Moon	intornal	ltompor	ratura in	living or			nc 2 to 7	in Tabl						
(87)m=	17 84	18.04	18 42	18.96	19.54	20.1	20.48	20.43	19.96	19.23	18 45	17 81		(87)
(01)	11.01	10.01	10.12	10.00	10.01	20.1	20.10	20.10	10.00	10.20	10.10	11.01		()
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	able 9, Tl	n2 (°C)					(22)
(88)m=	18.05	18.05	18.05	18.06	18.06	18.06	18.06	18.06	18.06	18.06	18.05	18.05		(88)
Utilisa	tion fac	tor for g	ains for	rest of d	welling, l	n2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.98	0.96	0.88	0.61	0.67	0.92	0.98	1	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	14.31	14.6	15.16	15.95	16.79	17.57	17.99	17.95	17.39	, 16.34	15.2	14.28		(90)
I									f	LA = Livin	g area ÷ (4	4) =	0.36	(91)
Maan	internel	Itomnor	oturo (fo	r tho wh	مام طيروا	ling) fl	Δ	. (1 fl	۸) T O			I		
	15 50	15.84				18/18	_A X I I	+ (1 – 1	A) X IZ	17 38	16 37	15 55		(92)
	adjucto	15.04	10.34	intornal	tompor	10.40	m Table	10.05			10.57	15.55		(02)
(93)m-	15 59	15.84	16 34	17 04	17 79	18.48	18.88	18.85	18 32	17 38	16 37	15 55		(93)
(33)m=	ace hear	ting regi	uirement	17.04	11.13	10.40	10.00	10.00	10.52	17.50	10.07	10.00		(00)
Set Ti	to the r	mean int	ernal ter	mperatur	e obtain	ed at ste	on 11 of	Table Of	so tha	t Ti m–()	76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a		5p 11 01		, 30 tha	c 11,111–(1	0)111 a11			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>	ation fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.99	0.98	0.95	0.9	0.77	0.8	0.93	0.98	0.99	1		(94)
Usefu	l gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	963.65	1190.02	1342.36	1425.02	1422.74	1218.44	1009.8	1018.96	1146.44	1154.06	988.4	900.7		(95)
Month	nly avera	age exte	ernal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	7576.03	7332.79	6581.33	5396.14	4030.42	2550.04	1501.85	1605.81	2779.57	4490.92	6160.19	7567.62		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Wh/mont	h = 0.02	24 x [(97))m – (95)m] x (41	I)m			
(98)m=	4919.61	4127.94	3897.8	2859.21	1940.11	0	0	0	0	2482.62	3723.69	4960.19		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	28911.17	(98)
Space	e heating	g require	ement in	kWh/m²	/year								225.87	(99)
9a. En	erav rea	luiremer	nts <u>– Ind</u> i	ividual h	eating sv	/stems i	ncludina	micro-C	:HP)					
Space	e heatir	ng:												
Fracti	on of sp	ace hea	at from s	econdary	//supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main svs	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain sna	ace heat	ina svete	em 1							l		(206)
			nulounnel	amonto-	u hootie		0/						00.9	
	HUY OF S	seconda	i y/suppl	ementar	y neatin(y system	1, 70						U	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (o	calculate	d above))	1		1	1			1	
	4919.61	4127.94	3897.8	2859.21	1940.11	0	0	0	0	2482.62	3723.69	4960.19		
(211)m	1 = {[(98)m x (20)4)] } x 1	$100 \div (20)$)6) 04 00 00					0700.0	4400.00	<i>5570 50</i>	1	(211)
	5533.87	4643.35	4384.47	3216.2	2182.36	0	0	U Tota	U I (kWh/vea	2792.6 ar) = Sum(2	4188.63	5579.52	20504	7(211)
Space	- heatin	a fuel (s	econdar	·v) k\//h/	month				(- 15,1012		52521	
= {[(98)m x (20)1)]}x1	00 ÷ (20)8)	monur									
(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)												
Output	384.15	ater hea 342.18	ter (calc	ulated a	bove) 343.06	236.39	232.62	247.55	244.7	353.46	359.02	378.86]	
Efficier	ncy of w	ater hea	ater		0.000						000.02	010.00	78.8	(216)
(217)m=	88.08	88.04	87.93	87.7	87.22	78.8	78.8	78.8	78.8	87.5	87.91	88.1		(217)
Fuel fo	r water	heating,	kWh/m	onth			1			1			1	
(219)m	1 = (64)	m x 100	$) \div (217)$)m	202.22	200.00	205.2	21/ 15	210 54	402.04	409.4	420.04	1	
(219)11=	430.13	300.00	410.5	309.3	393.32	299.99	295.2	Tota	I = Sum(2)	19a) =	400.4	430.04	4487.99	(219)
Annua	l totals									k'	Wh/year		kWh/year	
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								3 <mark>2521</mark>	
Wat <mark>er</mark>	heating	fuel use	ed										4487.99	Ī
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ng pump	:									120	1	(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	lectricit	y for the	above,	kWh/yea	r			sum	of (230a).	(230g) =			165	(231)
Electric	city for l	ighting		-									472.83	(232)
12a. (CO2 em	issions ·	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHP)					_]
						Γ	Ŭ			F usia a		4	Fuele eleme	
						En kV	/h/year			kg CO	2/kWh	tor	kg CO2/yea	ar
Space	heating	(main s	system 1)		(21	1) x			0.2	16	=	7024.54	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	969.41	(264)
Space	and wa	ter heati	ing			(26	1) + (262)	+ (263) + (264) =				7993.94	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	85.64	(267)
Electric	city for I	ighting				(23	2) x			0.5	19	=	245.4	(268)
Total C	CO2, kg/	/year							sum o	of (265)(2	271) =		8324.98	(272)
Dwelli	ng CO2	Emissi	ion Rate	•					(272)	÷ (4) =			65.04	(273)
EI ratir	ng (secti	on 14)											40	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2 Dr	oportu /	Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.3.4	
Addross	london	PI	openy <i>F</i>	Address.						
1 Overall dwelling dimen	, ionuon									
Basement			Area	a (m²) 82	(1a) x	Av. He	ight(m) .05	(2a) =	Volume(m ³ 250.1	') (3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e)+(1n)	82	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	250.1	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	main se heating h 0 + 0 +	econdary eating 0 0	/ · · · · · · · · · · · · · · · · · · ·	0 0] = [total 0 0	x 2	40 = 20 =	m³ per hou 0	(6a) (6b)
Number of intermittent fan	S				Γ	2	x ′	10 =	20	(7a)
Number of passive vents					Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fire	es				Ē	0	X 4	40 = Air ch	0 anges per ho	(7c)
Infiltration due to chimneys	s, flues and fans = (6) en carried out or is intende	a)+(6b)+(7a ed, proceed	a)+(7b)+(7 to (17), o	7c) = otherwise c	ontinue fre	20 om (9) to ((16)	÷ (5) =	0.08	(8)
Number of storeys in the Additional infiltration Structural infiltration: 0.2	e dwelling (ns) 25 for steel or timber f	rame or	0.35 for	masonr	y constr	uction	[(9)	-1]x0.1 =	0 0 0	(9) (10) (11)
if both types of wall are pre deducting areas of opening If suspended wooden flo	esent, use the value corres gs); if equal user 0.35 Dor, enter 0.2 (unseal	bonding to ed) or 0.	the greate 1 (seale	er wall area d), else	a (after 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			0	(15)
Infiltration rate		_		(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, q	(50, expressed in cub)	ic metres	s per ho	ur per so $(18) = ($	quare m	etre of e	nvelope	area	10	(17)
Air permeability value applies	y value, then (10) = [(1	r) - 20j+(0), otherwis	se (10) = (iree air nei	meability	is heina u	bad		0.58	(18)
Number of sides sheltered		been done	e or a deg	ilee all per	meability	s being us	360		2	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporatir	ng shelter factor			(21) = (18)	x (20) =				0.49	(21)
Infiltration rate modified fo	r monthly wind speed									
Jan Feb M	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
(22)m= 5.1 5 4	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4									
(22a)m= 1.27 1.25 1.	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted	d infiltrat	tion rate	e (allowir	ng for sh	nelter an	nd wind s	speed) =	= (21a) x	(22a)m					
	0.63	0.62	0.6	0.54	0.53	0.47	0.47	0.46	0.49	0.53	0.55	0.58]	
Calculat	e effect	ive air c	change r	ate for t	he appli	cable ca	ise							(220)
lf exhau	ist air hea	t pump u	lion. Ising Anne	ndix N (2	3b) = (23;	a) x Emv (e	equation (N5)) othe	erwise (23h	(23a) = (23a)			0	(234)
lf balan	ced with h	neat reco	verv: effici	encv in %	allowing f	for in-use f	factor (fro	m Table 4h	n) =) = (200)			0	(230)
a) If b		moobo			with ho	ot room			n)m - (2	2h)m i (226) v [1 (220)		(230)
(24a)m-									a = (2	$\frac{20}{1}$		$\frac{1 - (230)}{1 - 0}$] - 100j]	(24a)
(2-10) b) If b:		mocha		ntilation	without				$\int_{-\infty}^{\infty}$	2b)m (22h)	Ů]	()
(24b)m-					without			101 V) (241	$\frac{1}{1}$	$\frac{20}{1}$	230)	0	1	(24b)
				tilation			Vontilati	on from		Ů	Ů	<u> </u>]	(=)
c) n w	(22b)m	$< 0.5 \times$	(23b), th	nen (240	r = (23t)	b): other	wise (24	lc) = (22)	b) m + 0	.5 x (23h))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If n	atural ve	entilatio	n or who	ole hous	e positi	ve input	ı ventilati	on from	loft	<u>I</u>			1	
if	(22b)m	= 1, the	en (24d)r	n = (22k)	o)m othe	erwise (2	24d)m =	0.5 + [(2	22b)m² x	0.5]				
(24d)m=	0.7	0.69	0.68	0.65	0.64	0.61	0.61	0.6	0.62	0.64	0.65	0.67]	(24d)
Effecti	ive air c	hange	rate - en	ter (24a) or (24l	o) or (24	c) or (24	4d) in bo	x (25)					
(25)m=	0.7	0.69	0.68	0.65	0.64	0.61	0.61	0.6	0.62	0.64	0.65	0.67		(25)
3 Heat	05565	and he	at loss n	aramete	٥r.									_
ELEME	NT	Gros area	s (m²)	Openin m	gs 2	Net Ar A .r	rea m²	U-val W/m2	ue 2K	A X U (W/	K)	k-value kJ/m²·	ə K	A X k kJ/K
Doors T	ype 1		Ì			1.8	×	3	=	5.4	,			(26)
Doors T	vpe 2					16		14	=	2 24	Ħ			(26)
Window	s Type	1				5.56		1/[1/(4.8)+	• 0.04] =	22.39	Ħ			(27)
Windows	s Type 2	2				4		1/[1/(4.8)+	+ 0.04] =	16 11	H			(27)
Windows	s Type (3				1 21	×	1/[1/(4.8)+	+ 0.04] =	4 87	=			(27)
Floor	- 71 -	_				82		1 25		102.5	ı ۲			(28)
Walls Ty	ne1	70.9	5	12.5	7	67.20		2.1		1/1 20			ᅴ	(29)
Walls Ty	/ne2	20.2	2	12.0		19.63		2.1	\exists	20.42			ᅴ	(20)
Roof	,poz	20.2	3	1.0		10.03	<u> </u>			59.12	╡╏		╡ ┝	(20)
Total are	a of ele	ments	/ m²	0		201.9	<u>^</u> ^	0.20		5.54	L			(31)
Dorty wa		incino,				201.0					—		—	(31)
Party wa	211 211					16.8		0	=	0	╡╏		\dashv	(32)
* for windo	ows and ro	oof windo	ows, use el	fective wi	ndow U-va	alue calcul	lated usin	g formula	= 1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	∟ h 3.2	(32)
Fabric b	eat loss	\\//K -			s anu par	uuons		(26)(30)) + (32) =				220	46 (33)
Heat car	pacity C	m = S0	Axk)	-,					((28)	(30) + (3)	(32a)	(32e) =		(34)
Thermal	mass	arame	ter (TMP	' = Cm -	- TFA) ir	ר k.l/m²k	_		Indica	ative Value	-, . (020). : High	(020) -		(34)
For desiar	assessm	nents whe	ere the det	ails of the	construct	tion are not	t known n	reciselv th	e indicative	e values of	TMP in T	able 1f	450	J(33)
can be use	ed instead	l of a det	ailed calcu	lation.			P							
Thermal	bridges	s : S (L	x Y) calo	culated u	using Ap	opendix I	K						18.	4 (36)

if details of thermal bridging are not known $(36) = 0.15 \times (31)$

Total fa	abric hea	at loss							(33) +	(36) =			357.86	(37)
Ventila	tion hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.57	56.94	56.32	53.4	52.86	50.32	50.32	49.85	51.3	52.86	53.96	55.11		(38)
Heat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m	-		
(39)m=	415.43	414.79	414.17	411.26	410.71	408.17	408.17	407.7	409.15	410.71	411.81	412.97		_
Heat lo	oss para	meter (H	ILP), W/	′m²K					ر (40)m	Average = = (39)m ÷	Sum(39)₁. ∙ (4)	12 /12=	411.25	(39)
(40)m=	5.07	5.06	5.05	5.02	5.01	4.98	4.98	4.97	4.99	5.01	5.02	5.04		
Numbe			oth (Tob						,	Average =	Sum(40) ₁ .	12 /12=	5.02	(40)
NUMDE	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)
	I							11						
4. Wa	iter heat	ina ener	av reau	rement:								kWh/ve	ear:	
		<u> </u>											1	
Assum if TF	ed occu A > 13.9	pancy, I A N = 1	N + 1 76 x	[1 - exp	(-0 0003	49 x (TF	- A -13 9)2)] + 0 ()013 x (⁻	TFA -13	2	.5		(42)
if TF	A £ 13.9	0, N = 1		[i onp	(0.0000	10 / (11)_)] · 0.0			,			
Ann <mark>ua</mark>	l averag	e hot wa	ater usa	ge in litre	s per da	y Vd,av	erage =	(25 x N)	+ 36	a tarract a	93	.57		(43)
not more	e that 125	litres per p	person per	day (all w	ater use, h	not and col	ld)	o achieve	a waler us	se largel o				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
Hot wate	er usage ir	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	Cop	0.01		200		
(44)m=	102.93	99.18	<mark>9</mark> 5.44	91.7	87.95	84.21	84.21	87.95	91.7	95.44	99.18	102.93		
Enorm	contont of	hot water	upod ool	ouloted ma	nthly - 1	100 x \/d r		Tm / 2600	klA/b/mor	Total = Su	m(44) ₁₁₂ =	=	1122.82	(44)
(45)m-	152.62	122.5	127 76	120.1	115 24	00.44	02.15	105 74	107	124 7	126 12	147.92		
(45)III=	152.05	155.5	137.70	120.1	115.24	99.44	92.10	105.74	107		m(45)	147.02	1472.10	(45)
lf instant	aneous w	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)) to (61)	101ai – 00	III(4 0)112 -	-	1472.13	
(46)m=	22.9	20.02	20.66	18.01	17.29	14.92	13.82	15.86	16.05	18.71	20.42	22.17		(46)
Vvater :	storage	loss: o (litroc)	includin		alar or M		storago	within co		col		400		(47)
lf comr	e volum	e (illies) esting s	nd no ta	nk in dw		ntor 110	litros in	(17)		501		160		(47)
Otherw	ise if nc	stored	hot wate	er (this in	cludes i	nstantan	neous co	ombi boile	ers) ente	er '0' in (47)			
Water	storage	loss:		,					,	,	,			
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature fa	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=		1	60		(50)
b) If m Hot wa	anufact	urer's de age loss	eclared of factor fr	ylinder I om Tabl	oss facto e 2 (kWI	or is not h/litre/da	known:				0	02		(51)
If comr	nunity h	eating s	ee secti	on 4.3	0 2 (1011	1, nu o, aa	''				0.	03		(01)
Volume	e factor	from Tal	ble 2a								0.	91		(52)
Tempe	rature fa	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	2.	84		(54)
Enter	(50) or (54) in (5	5)								2.	84		(55)

Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(56)
If cylinde	er contain	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	lix H	
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)		1	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m					_	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water he	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)r	n
(62)m=	369.05	328.97	354.17	329.53	331.65	226.55	223.5	237.09	234.11	341.11	345.55	364.23		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negativ	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)				1	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	1	1								1	
(64)m=	369.05	328.97	354.17	329.53	331.65	226.55	223.5	237.09	234.11	341.11	345.55	364.23		-
								Outp	out from wa	ater heate	r (annual)₁	12	3685.52	(64)
Heat g	ains fro	m water	heating,	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	153.45	137.15	148.51	139.32	141.02	66.6	65.29	69.81	69.11	144.16	144.65	151.85		(65)
inclu	ude (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	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	is (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(22)
(66)m=	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99		(66)
Lightin	ig gains	(calcula	ted in Ap	opendix	L, equat	ion L9 oi	r L9a), a	lso see	Table 5				1	(07)
(67)m=	21.14	18.77	15.27	11.56	8.64	7.29	7.88	10.24	13.75	17.46	20.38	21.72		(67)
Applia	nces ga	ins (calc I	ulated in	n Appeno	dix L, eq	uation L ²	13 or L1	3a), also I	see Ta	ble 5	1		1	(00)
(68)m=	223.57	225.89	220.04	207.6	191.89	177.12	167.26	164.94	170.78	183 23	198.94	213.71		(68)
Cookir										100.20				
(69)m=	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5			1	
	ng gains 35.5	(calcula 35.5	ited in A 35.5	ppendix 35.5	L, equat 35.5	ion L15 35.5	or L15a) 35.5), also se 35.5	e Table 35.5	35.5	35.5	35.5]	(69)
Pumps	ng gains 35.5 s and fai	(calcula 35.5 ns gains	ted in A 35.5 (Table 5	ppendix 35.5 5a)	L, equat	ion L15 35.5	or L15a) 35.5), also se 35.5	e Table	35.5	35.5	35.5]	(69)
Pumps (70)m=	ng gains 35.5 s and fai 10	(calcula 35.5 ns gains 10	ted in A 35.5 (Table 5	ppendix 35.5 5a) 10	L, equat 35.5 10	ion L15 35.5 10	or L15a) 35.5 10), also se 35.5 10	2007 2007 2007 2007 2007 2007 2007 2007	100.25 5 35.5	35.5	35.5 10]	(69) (70)
Pumps (70)m= Losses	ng gains 35.5 s and fai 10 s e.g. ev	(calcula 35.5 ns gains 10 raporatic	tted in A 35.5 (Table 5 10 on (nega	ppendix 35.5 5a) 10 tive valu	L, equat 35.5 10 es) (Tab	ion L15 35.5 10 le 5)	or L15a) 35.5 10), also se 35.5 10	ee Table 35.5 10	5 35.5 10	35.5	35.5 10]	(69) (70)
Pumps (70)m= Losses (71)m=	ng gains 35.5 s and fai 10 s e.g. ev -99.99	(calcula 35.5 ns gains 10 raporatic -99.99	ited in A 35.5 (Table 5 10 on (nega -99.99	ppendix 35.5 5a) 10 tive valu -99.99	L, equat 35.5 10 es) (Tab -99.99	ion L15 35.5 10 le 5) -99.99	or L15a) 35.5 10 -99.99), also se 35.5 10 -99.99	2ee Table 35.5 10 -99.99	-99.99	35.5 10 -99.99	35.5 10 -99.99]]	(69) (70) (71)
Pumps (70)m= Losses (71)m= Water	ng gains 35.5 s and fai 10 s e.g. ev -99.99 heating	(calcula 35.5 ns gains 10 vaporatic -99.99 gains (T	ited in A 35.5 (Table 5 10 n (nega -99.99 able 5)	ppendix 35.5 5a) 10 tive valu -99.99	L, equat 35.5 10 es) (Tab	ion L15 35.5 10 le 5) -99.99	or L15a) 35.5 10 -99.99), also se 35.5 10 -99.99	2ee Table 35.5 10 -99.99	100.20 5 35.5 10 -99.99	35.5 10 -99.99	35.5 10 -99.99]]	(69) (70) (71)
Pumps (70)m= Losses (71)m= Water (72)m=	ng gains 35.5 s and fai 10 s e.g. ev -99.99 heating 206.25	(calcula 35.5 ns gains 10 raporatic -99.99 gains (T 204.09	ited in A 35.5 (Table 5 10 n (nega -99.99 -able 5) 199.6	ppendix 35.5 5a) 10 tive valu -99.99	L, equat 35.5 10 es) (Tab -99.99 189.54	ion L15 35.5 10 le 5) -99.99 92.5	or L15a) 35.5 10 -99.99 87.75), also se 35.5 10 -99.99 93.83	200 Table 35.5 10 -99.99 95.99	-99.99 193.77	35.5 10 -99.99 200.9	35.5 10 -99.99 204.1]]]	(69) (70) (71) (72)
Pumps (70)m= Losses (71)m= Water (72)m= Total i	ng gains 35.5 s and fai 10 s e.g. ev -99.99 heating 206.25	(calcula 35.5 ns gains 10 vaporatic -99.99 gains (T 204.09 gains =	ited in A 35.5 (Table 5 10 n (nega -99.99 able 5) 199.6	ppendix 35.5 5a) 10 tive valu -99.99 193.5	L, equat 35.5 10 es) (Tab -99.99 189.54	ion L15 35.5 10 le 5) -99.99 92.5 (66)	or L15a) 35.5 10 -99.99 87.75 m + (67)m), also se 35.5 10 -99.99 93.83 a + (68)m -	ee Table 35.5 10 -99.99 95.99 + (69)m + (100.20 5 35.5 10 -99.99 193.77 (70)m + (7	35.5 10 -99.99 200.9 1)m + (72)	35.5 10 -99.99 204.1 m]]]	(69) (70) (71) (72)
Pumps (70)m= Losses (71)m= Water (72)m= Total i (73)m=	ng gains 35.5 s and fai 10 s e.g. ev -99.99 heating 206.25 internal 521.46	(calcula 35.5 ns gains 10 vaporatic -99.99 gains (T 204.09 gains = 519.25	ited in A 35.5 (Table 5 10 on (nega -99.99 able 5) 199.6 505.41	ppendix 35.5 5a) 10 tive valu -99.99 193.5 483.15	L, equat 35.5 10 es) (Tab -99.99 189.54 460.56	ion L15 35.5 10 le 5) -99.99 92.5 (66) 347.41	or L15a) 35.5 10 -99.99 87.75 m + (67)m 333.39	93.83 93.99 93.83 93.83	ee Table 35.5 10 -99.99 95.99 + (69)m + (351.02	100.20 5 35.5 10 -99.99 193.77 (70)m + (7 464.95	35.5 10 -99.99 200.9 1)m + (72) 490.71	35.5 10 -99.99 204.1 m 510.03]]]	 (69) (70) (71) (72) (73)

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orienta	ation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4	x	10.63	×	0.85	×	0.7] =	17.54	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.85	x	0.7] =	33.52	(74)
North	0.9x	0.77	x	4	x	34.53	×	0.85	×	0.7] =	56.95	(74)
North	0.9x	0.77	x	4	x	55.46	×	0.85	×	0.7] =	91.48	(74)
North	0.9x	0.77	x	4	x	74.72	×	0.85	×	0.7] =	123.23	(74)
North	0.9x	0.77	x	4	x	79.99	×	0.85	×	0.7] =	131.92	(74)
North	0.9x	0.77	x	4	x	74.68	×	0.85	×	0.7] =	123.17	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.85	x	0.7] =	97.72	(74)
North	0.9x	0.77	x	4	x	41.52	×	0.85	×	0.7	j =	68.47	(74)
North	0.9x	0.77	x	4	x	24.19	×	0.85	×	0.7] =	39.9	– (74)
North	0.9x	0.77	x	4	x	13.12	×	0.85	×	0.7	1 =	21.64	(74)
North	0.9x	0.77	x	4	x	8.86	×	0.85	×	0.7	1 =	14.62	– (74)
East	0.9×	1	x	5.56	x	19.64	x	0.85	x	0.7	i =	45.03	(76)
East	0.9x	1	x	5.56	x	38.42	×	0.85	×	0.7	i =	88.08	(76)
East	0.9×	1	x	5.56	x	63.27	x	0.85	x	0.7	1 =	145.06	– (76)
East	0.9x		x	5.56	×	92.28	x	0.85	х	0.7	i =	211.56	(76)
East	0.9x	1	x	5.56	x	113.09	x	0.85	x	0.7	i -	259.27	– (76)
East	0.9×	1	x	5.56	x	115.77	×	0.85	x	0.7] =	265.41	– (76)
East	0.9×	1	x	5.56	x	110.22	x	0.85	x	0.7	1 =	252.68	– (76)
East	0.9×		x	5.56	x	94.68	x	0.85	x	0.7	1 =	217.05	– (76)
East	0.9×	1	x	5.56	x	73.59	×	0.85	x	0.7	j =	168.71	╡ (76)
East	0.9×	1	x	5.56	х	45.59	x	0.85	x	0.7	1 =	104.52	– (76)
East	0.9×	1	x	5.56	×	24.49	x	0.85	×	0.7	j =	56.14	(76)
East	0.9×	1	x	5.56	x	16.15	x	0.85	×	0.7	j =	37.03	– (76)
West	0.9x	0.77	x	1.21	x	19.64	×	0.85	×	0.7	i =	9.8	(80)
West	0.9x	0.77	x	1.21	x	38.42	×	0.85	x	0.7	1 =	19.17	(80)
West	0.9x	0.77	x	1.21	x	63.27	×	0.85	×	0.7	1 =	31.57	(80)
West	0.9x	0.77	x	1.21	x	92.28	×	0.85	×	0.7	i =	46.04	(80)
West	0.9x	0.77	x	1.21	x	113.09	×	0.85	x	0.7	1 =	56.42	(80)
West	0.9×	0.77	x	1.21	x	115.77	x	0.85	x	0.7	1 =	57.76	(80)
West	0.9×	0.77	x	1.21	x	110.22	x	0.85	x	0.7	i =	54.99	(80)
West	0.9×	0.77	x	1.21	x	94.68	x	0.85	×	0.7	j =	47.24	(80)
West	0.9x	0.77	x	1.21	x	73.59	x	0.85	x	0.7	i =	36.72	(80)
West	0.9×	0.77	x	1.21	x	45.59	x	0.85	x	0.7	i =	22.75	(80)
West	0.9×	0.77	x	1.21	x	24.49	×	0.85	×	0.7	1 =	12.22	_ (80)
West	0.9x	0.77	x	1.21	x	16.15	x	0.85	x	0.7	i =	8.06	م (80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m			
(83)m=	72.36	140.77	233.58	349.08	438.93	455.1	430.84	362.01	273.9	167.16	90	59.71	(83)
Total g	ains – ii	nternal a	ind solar	⁻ (84)m =	= (73)m -	+ (83)m	, watts						-
(84)m=	593.82	660.02	738.99	832.23	899.49	802.5	764.23	701.51	624.92	632.11	580.71	569.73	(84)

7. Me	an interi	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area t	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	a, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	0.99	0.98	0.97	0.94	0.95	0.99	0.99	1	1		(86)
Mean	internal	temper	ature in	living are	a T1 (fr	nllow ste	ns 3 to 7	, 7 in Table	- 9c)					
(87)m=	17.9	18.06	18.42	18.97	19.56	20.1	20.47	20.41	19.92	19.21	18.48	17.88		(87)
- -							· -			-				
I emp	erature	during h	leating p	eriods in	rest of	dwelling	from Ta	able 9, 11	n2 (°C)	40.00	40.00	10.00		(99)
(00)11=	18.07	16.07	10.00	18.06	16.06	18.09	18.09	18.09	16.09	10.00	10.00	16.06		(00)
Utilisa	tion fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.99	0.96	0.89	0.64	0.72	0.95	0.99	1	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	14.4	14.63	15.17	15.96	16.82	17.58	18	17.96	17.34	16.32	15.25	14.38		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.53	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwel	llina) – fl	Δ 🗙 Τ1	+ (1 – fl	Δ) x T2					
(92)m=	16.26	16.46	16.9	17.56	18.28	18.92	19.31	19.26	18.71	17.86	16.97	16.24		(92)
Apply	adiustr	hent to t	ne mear	internal	temper	ature fro	m Table	4e whe	re appro	priate				, í
(93)m=	16.26	16.46	16.9	17.56	18.28	18.92	19.31	19.26	18.71	17.86	16.97	16.24		(93)
8. Spa	ace heat	tina real	Jirement											
Set Ti	to the r	nean int	ernal ter	nperatur	e 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	ble 9a				,		<i>c)</i> c			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>	ation fac	tor for g	ains, hm	1:										
(94)m=	1	1	0.99	0.98	0.96	0.93	0.85	0.88	0.96	0.99	1	1		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	591.92	657.03	733.25	818.85	866.85	746.05	646.26	616.62	602.65	624.09	577.89	568.13		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	oss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	4970.3	4793.11	4307.25	3560.58	2701.36	1762.56	1107.85	1165.75	1885.98	2981.77	4063.47	4972.66		(97)
Space	e heating	g require	ement fo	r each m	nonth, k\	/Vh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	3257.52	2779.45	2659.05	1974.04	1364.87	0	0	0	0	1754.11	2509.62	3276.97		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	19575.64	(98)
Space	e heating	g require	ement in	kWh/m²	/year								238.73	(99)
9a. En	ergy reg	uir <u>emer</u>	nts <u>– Ind</u> i	ivid <u>ual h</u>	eating s	yst <u>ems i</u>	ncl <u>uding</u>	mi <u>cro-C</u>	:HP)					
Space	e heatin	ng:					0							
Fracti	on of sp	ace hea	t from s	econdary	/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatii	ng from	main svs	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	- ace heat	ina syste	em 1								88.9	(206)
Efficie	anov of a	acondo	ry/cuppl	omentor	v heatin	a evetor	<u>م</u>						00.0	
		BOUIUd	i y/suppl	emental	y neating	y องอเษก	ı, <i>1</i> 0						U	(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))	1	1	1			1	1	
	3257.52	2779.45	2659.05	1974.04	1364.87	0	0	0	0	1754.11	2509.62	3276.97	J	
(211)m	1 = {[(98)m x (20	04)] } x 1	00 ÷ (20)6) [4505.00]					4070.40	0000.07	0000.40	1	(211)
	3664.25	3126.49	2991.06	2220.52	1535.29	0	0	U Tota	U U (kWb/ve	$r_{1973.13}$	2822.97	3686.13	22010.94	7(211)
Snac	a haatin	a fual (s	econdar	v) k\//h/	month				(15,1012	1	22019.04	
= {[(98)m x (20)1)]}x1	00 ÷ (20)8)	monur									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0]	
								Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water	heating	J												
Output	from w	ater hea	ter (calc	ulated a	bove) 331.65	226.55	223.5	237 09	234 11	341 11	345 55	364 23	1	
Efficier	ncv of w	ater hea	ter	020.00	001.00	220.00	220.0	201.00	20111	01111	0 10.00	001.20	78.8	(216)
(217)m=	87.76	87.71	87.58	87.3	86.73	78.8	78.8	78.8	78.8	87.08	87.54	87.77		(217)
Fuel fo	r water	heating,	kWh/m	onth		I	1	1	1			I	1	
(219)m	1 = (64)	<u>m x 100</u>	$) \div (217)$)m	000.44	007.5	000.00	000.07	007.4	004 74	004 70	444.00	1	
(219)m=	420.54	375.06	404.39	377.47	382.41	287.5	283.62	300.87	297.1	19a) =	394.73	414.96	4220.29	
Annua	l totals									k	Wh/vear		kWh/vear	
Space	heating	fuel use	ed, main	system	1						, your		22019.84	7
Water	heating	fuel use	d										4330.38	ī
Electric	city for r	oumps, f	ans and	electric	keep-ho	t								_
centra	al heatin											120	1	(230c
boilor	with a f	an-assis	tod fluo									120		(230e
					_			cum	of (220a)	(220a) -		40		
	lectricity	y for the	above, I	kvvn/yea	ſ			Sum	01 (230a)	(2309) =			165	
Electric	city for li	ighting											373.27	(232)
12a. (CO2 em	issions ·	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHF)					
						En	ergy			Emiss	ion fac	tor	Emissions	
						kW	/h/year			kg CO	2/kWh		kg CO2/yea	ar
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	4756.29	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	935.36	(264)
Space	and wa	ter heati	ing			(26	1) + (262)	+ (263) + ((264) =				5691.65	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	85.64	(267)
Electric	city for li	ighting				(23	2) x			0.5	19	=	193.73	(268)
Total C	CO2, kg/	/year							sum c	of (265)(2	271) =		5971.01](272)
Dwelli	ng CO2	Emissi	on Rate	•					(272)	÷ (4) =			72.82](273)
El ratir	na (secti	on 14)												$\Box^{(274)}$
		J											41	()

			User D	etails:										
Assessor Name: Software Name:	Stroma FSAP 201	2		Stroma Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.3.4					
Addross	london	PI	openy <i>F</i>	Address.	Unit o									
1 Overall dwelling dimen	, ionuon													
Basement	510110.		Area	i(m²) 70	(1a) x	Av. He	ight(m) 3.5	(2a) =	Volume(m ³ 245) (3a)				
Total floor area $TFA = (1a)$)+(1b)+(1c)+(1d)+(1e)+(1n)	70	(4)									
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	245	(5)				
2. Ventilation rate:		_		_		_								
Number of chimneys Number of open flues	$ \begin{array}{ccc} main & se \\ heating & h \\ \hline 0 & + \\ \hline 0 & + \\ \end{array} $	econdary eating 0 0	y + [] + []	0 0] = [total 0 0	x 2 x 2	40 = 20 =	m³ per hou 0	(6a) (6b)				
Number of intermittent fan	S				Γ	2	x ´	10 =	20	(7a)				
Number of passive vents					Ē	0	x ′	10 =	0	(7b)				
Number of flueless gas fire	es				Ē	0	X 4	40 =	0	(7c)				
Infiltration due to chimpour	ber of open flues $0 + 0 + 0 = 0$ $x 20 = 0$ ber of intermittent fans $2 + 10 = 0$ ber of passive vents $0 + 10 = 0$ ber of flueless gas fires $0 + 10 = 0$ ation due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0$ pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) mber of storeys in the dwelling (ns) ditional infiltration [(9)-1]x0.1 = 0													
Initiation due to chimneys If a pressurisation test has be Number of storeys in the Additional infiltration Structural infiltration: 0.2	en carried out or is intende e dwelling (ns) 25 for steel or timber f	frame or	0.35 for	c) = htherwise c masonr	ontinue fro	20 om (9) to (uction	(16)	÷ (5) = •1]x0.1 =	0.08 0 0 0 0 0 0	(8) (9) (10) (11)				
if both types of wall are pre deducting areas of opening If suspended wooden flo	sent, use the value corres s); if equal user 0.35 oor. enter 0.2 (unseal	ponding to ed) or 0.	the greate	er wall area d). else v	a <i>(after</i> 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			0	(15)				
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)				
Air permeability value, q	50, expressed in cub	oic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	10	(17)				
If based on air permeabilit	y value, then (18) = [(1	7) ÷ 20]+(8), otherwis	se (18) = (16)				0.58	(18)				
Air permeability value applies	if a pressurisation test has	s been don	e or a deg	ree air per	meability	is being us	sed	ĺ		-				
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			1	(19)				
Infiltration rate incorporatir	ng shelter factor			(21) = (18)	x (20) =	/-			0.92	(20)				
Infiltration rate modified for	r monthly wind speed	I		. , . ,					0.54	(21)				
Jan Feb M	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Monthly average wind spe	ed from Table 7	L												
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7						
Wind Factor (22a)m = (22))m ÷ 4	- -												
(22a)m= 1.27 1.25 1.	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18						

Adjuste	ed infilti	ation rat	e (allow	ing for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
<u> </u>	0.69	0.67	0.66	0.59	0.58	0.51	0.51	0.5	0.54	0.58	0.61	0.63]	
Calcula If me	ate ette echanic	<i>ctive air</i> al ventila	<i>change</i> ition:	rate for t	he applic	cable ca	se						0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If bala	anced wit	h heat reco	overy: effic	ciency in %	allowing for	or in-use f	actor (from	n Table 4h) =	, , ,			0	(23c)
a) If	balance	ed mech	anical v	entilation	with hea	at recove	erv (MVI	HR) (24a	a)m = (2)	2b)m + ((23b) × [1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	ed mech	anical v	entilation	without	heat rec	overv (N	и ЛV) (24b	m = (22)	1 2b)m + (23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	nouse ex	tract ve	ntilation c	or positiv	e input v	ventilatic	n from o	outside		!		1	
í	f (22b)r	n < 0.5 >	(23b),	then (24c	c) = (23b); otherv	vise (24	c) = (22k	o) m + 0.	.5 × (23k	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	e positiv	e input	ventilatio	on from I	oft					
i	f (22b)r	n = 1, th	en (24d)m = (22t	o)m othe	rwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]	1	1	1	
(24d)m=	0.74	0.73	0.72	0.68	0.67	0.63	0.63	0.62	0.64	0.67	0.68	0.7	J	(240)
Effec	ctive air	change	rate - e	nter (24a) or (24b	o) or (240	c) or (24	d) in box	(25)	0.07	0.00	0.7	1	(25)
(25)m=	0.74	0.73	0.72	0.68	0.67	0.63	0.63	0.62	0.64	0.67	0.68	0.7		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	1ENT	Gros	SS (m 2)	Openin	gs	Net Ar	ea	U-valu	ue	AXU		k-value	e la la la la la la la la la la la la la	A X k
Doore		area	(m²)	m	2	A,r	n²	vv/m2	.ĸ	(/ / /	K)	KJ/M ² ·I	ĸ	KJ/K
Mindo		. 1				1.9		3	=	5.7	H			(20)
VVIndov	ws Type					8.7		/[1/(4.8)+	0.04] =	35.03				(27)
vvindov	ws Type	e 2				6.5	x1/	/[1/(4.8)+	0.04] =	26.17	Ц.			(27)
Window	ws Type	e 3				2.2	x1,	/[1/(4.8)+	0.04] =	8.86				(27)
Floor						70	x	1.25	=	87.5				(28)
Walls		116	.5	19.3		97.2	X	2.1	=	204.12	2			(29)
Roof		26.	7	0		26.7	x	0.28	=	7.48				(30)
Total a	rea of e	elements	, m²			213.2	2							(31)
Party v	vall					24.2	x	0	=	0				(32)
Party v	vall					8.6	x	0	=	0				(32)
* for win ** includ	dows and le the are	l roof wind as on both	ows, use sides of i	effective wi nternal wall	ndow U-va 's and part	alue calcul itions	ated using	formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	n 3.2	
Fabric	heat lo	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				374.8	36 (33)
Heat c	apacity	Cm = S	(Axk)						((28).	(30) + (3	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TM	P = Cm ÷	- TFA) in	ı kJ/m²K			Indica	tive Value	e: High		450	(35)
For desig can be u	gn asses ised inste	sments wh ad of a de	ere the de tailed cald	etails of the culation.	constructi	on are not	t known pr	ecisely the	e indicative	e values of	f TMP in Ta	able 1f		
Therma	al bridg	es : S (L	x Y) ca	lculated u	using Ap	pendix ł	<						31.9	8 (36)
if details	of therm	al bridging	are not ki	nown (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			406.8	34 (37)
Ventila	tion he	at loss ca	alculate	d monthly	/				(38)m	= 0.33 ×	(25)m x (5))	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	

(38)m=	59.45	58.71	57.98	54.58	53.95	50.99	50.99	50.44	52.13	53.95	55.23	56.58		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	466.29	465.55	464.83	461.43	460.79	457.83	457.83	457.28	458.97	460.79	462.08	463.42		
				/ 21/					(10)	Average =	Sum(39)1	12 /12=	461.42	(39)
Heat IC	ss para		ΗLΡ), W	/m²K	6.59	6.54	6.54	6.52	(40)m	= (39)m ÷	(4)	6.62		
(40)11=	0.00	0.05	0.04	0.59	0.56	0.04	0.04	0.00	0.50	Average =	5.0 Sum(40)1	0.02	6.59	(40)
Numbe	er of day	/s in mo	nth (Tab	le 1a)						lioiago			0.00	
	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	L	(41)
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	([1 - exp	(-0.0003	949 x (TF	-A -13.9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . 9)	25		(42)
Annual	averag	e hot wa	ater usag	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36	a target a	87	.55		(43)
not more	the annua that 125	litres per	not water person pe	usage by r day (all w	o% ir the d ater use, l	not and co	aesignea i ld)	o achieve	a water us	se target o	Γ			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	<mark>9</mark> 6.3	92.8	<mark>8</mark> 9.3	85.79	82.29	78.79	78.79	82.29	85.79	89.3	92.8	<mark>9</mark> 6.3		
_										Total = Su	m(44) ₁₁₂ =		1 <mark>0</mark> 50.55	(44)
Energy o	content of	hot water	used - cal	lculated mo	onthly = 4.	190 x Vd,r	n x nm x C	0Tm / 3600) kWh/mor	nth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	142.81	124.9	128.89	112.37	107.82	93.04	86.22	98.93	100.12	116.67	127.36	138.3	1077.40	
lf instant	aneous w	vater heati	ng at point	t of use (no	o hot water	· storage),	enter 0 in	boxes (46) to (61)	l otal = Su	m(45) ₁₁₂ =		13/7.43	(45)
(46)m=	21.42	18.74	19.33	16.86	16.17	13.96	12.93	14.84	15.02	17.5	19.1	20.75		(46)
Water	storage	loss:	I	Į	1		1	1		1		<u> </u>		
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		160		(47)
If comr Otherw Water	nunity h /ise if no storage	eating a stored loss:	and no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar	litres in neous co	(47) mbi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	[.] storage	e, kWh/ye	ear			(48) x (49)) =		1	60		(50)
b) If m	anufact	urer's de	eclared (cylinder l	loss fact	or is not	known:							(= 1)
If comr	nunitv h	age ioss neating s	ee secti	on 4.3	ie z (kvv	n/iitie/ua	iy)				0.	03		(51)
Volume	e factor	from Ta	ble 2a								0.	91		(52)
Tempe	rature f	actor fro	m Table	2b							0.	78	L	(53)
Energy	lost fro	om water	⁻ storage	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =	2.	84		(54)
Enter	(50) or ((54) in (5	55)								2.	84		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m		,		
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	iv Ll	(56)
ii cyiinde	er contains	s dedicate	u solar sto I	nage, (57)i T	m = (סכ) חו	x [(00) – (⊡ ।)] ÷ (5 I	u), eise (5	()III = (56)	m where (rii) is tro I	m Append	хп	
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	1	(57)

Primar	y circuit	loss (ar	nual) fro	om Table	93							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)	r	ı	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	loss cal	culated	for each	month (61)m =	(60) ÷ 36	65 × (41))m		-	-	-		
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	359.22	320.37	345.3	321.8	324.23	220.15	217.56	230.28	227.23	333.09	336.79	354.72		(62)
Solar DI	-IW input o	alculated	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 V	VWHRS	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from wa	ater hea	ter											
(64)m=	359.22	320.37	345.3	321.8	324.23	220.15	217.56	230.28	227.23	333.09	336.79	354.72		_
								Outp	out from wa	ater heate	r (annual)₁	12	3590.76	(64)
Heat g	ains fror	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	150.19	134.29	145.56	136.75	138.55	64.47	63.32	67.55	66.82	141.5	141.74	148.69		(65)
inclu	ıde (57)ı	n in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	tern <mark>al g</mark> a	ains (see	Table 5	5 and 5a):									
Metab	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	112.31	112.3 <mark>1</mark>	11 <mark>2.31</mark>	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equati	on L9 oi	r L9a), a	lso see ⁻	Table 5					
(67)m=	17.59	15.62	12.71	9.62	7.19	6.07	6.56	8.53	11.44	14.53	16.96	18.08		(67)
Applia	nces gai	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Tal	ble 5			_	
(68)m=	197.3	199.34	194.19	183.2	169.34	156.31	147.6	145.55	150.71	161.7	175.56	188.59		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5				
(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23		(69)
Pumps	and far	ns gains	(Table 5	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84		(71)
Water	heating	gains (T	able 5)											
(72)m=	201.86	199.84	195.64	189.93	186.23	89.54	85.1	90.79	92.81	190.18	196.86	199.85		(72)
Total i	nternal	gains =				(66)	ı m + (67)m	ı + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	483.44	481.5	469.22	449.44	429.44	318.61	305.96	311.56	321.66	433.1	456.07	473.21		(73)
6. So	lar gains	s:												
Solar g	ains are c	alculated	using sola	r flux from	Table 6a a	and associ	iated equa	tions to co	nvert to th	e applicat	le orientat	ion.		

Orientat	tion:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	8.7	x	10.63	x	0.85	x	0.7	=	38.15	(74)
North	0.9x	0.77	x	8.7	×	20.32	x	0.85	×	0.7] =	72.9	(74)

North	0.9x	0.77	x	8.7	×		34.53	x	0.85	x	0.7	=	123.87	(74)
North	0.9x	0.77	×	8.7	×		55.46] ×	0.85	×	0.7	=	198.97	(74)
North	0.9x	0.77	×	8.7	×		74.72	X	0.85	x	0.7	=	268.03	(74)
North	0.9x	0.77	x	8.7	×		79.99] x	0.85	x	0.7	=	286.93	(74)
North	0.9x	0.77	×	8.7	×		74.68	X	0.85	x	0.7	=	267.89	(74)
North	0.9x	0.77	x	8.7	×		59.25	x	0.85	x	0.7	=	212.54	(74)
North	0.9x	0.77	×	8.7	×		41.52	x	0.85	x	0.7	=	148.93	(74)
North	0.9x	0.77	x	8.7	×		24.19	x	0.85	x	0.7	=	86.78	(74)
North	0.9x	0.77	x	8.7	×		13.12	x	0.85	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	8.7	×		8.86	x	0.85	x	0.7	=	31.8	(74)
South	0.9x	0.77	x	2.2	×		46.75	x	0.85	x	0.7	=	42.41	(78)
South	0.9x	0.77	x	2.2	×		76.57	x	0.85	x	0.7	=	69.46	(78)
South	0.9x	0.77	x	2.2	×		97.53	x	0.85	×	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.2	×	1	10.23	x	0.85	x	0.7	=	100	(78)
South	0.9x	0.77	x	2.2	x	1	14.87	x	0.85	x	0.7	=	104.2	(78)
South	0.9x	0.77	x	2.2	×	1	10.55	x	0.85	×	0.7	=	100.28	(78)
South	0.9x	0.77	x	2.2	x	1	08.01	x	0.85	x	0.7	=	97.98	(78)
South	0.9x	0.77	x	2.2	X	1	04.89	х	0.85	x	0.7	=	95.15	(78)
South	0.9x	0.77	×	2.2	×	1	01.89] x	0.85	x	0.7	=	92.42	(78)
South	0.9x	0.77	×	2.2	×		82.59] ×	0.85	x	0.7	=	74.92	(78)
South	0.9x	0.7 <mark>7</mark>	×	2.2	×		55.42	x	0.85	x	0.7	=	50.27	(78)
South	0.9x	0. <mark>77</mark>	×	2.2	×		40.4	x	0.85	x	0.7	=	36.65	(78)
West	0.9x	0.77	×	6.5	×		19.64	x	0.85	x	0.7	=	52.64	(80)
West	0.9x	0.77	×	6.5	×		38.42	x	0.85	×	0.7	=	102.97	(80)
West	0.9x	0.77	x	6.5	×		63.27	x	0.85	x	0.7	=	169.58	(80)
West	0.9x	0.77	x	6.5	×		92.28	x	0.85	x	0.7	=	247.33	(80)
West	0.9x	0.77	x	6.5	x	1	13.09	x	0.85	x	0.7	=	303.11	(80)
West	0.9x	0.77	x	6.5	×	1	15.77	x	0.85	x	0.7	=	310.29	(80)
West	0.9x	0.77	x	6.5	x	1	10.22	x	0.85	x	0.7	=	295.4	(80)
West	0.9x	0.77	x	6.5	×		94.68	x	0.85	x	0.7	=	253.75	(80)
West	0.9x	0.77	x	6.5	x		73.59	x	0.85	x	0.7	=	197.23	(80)
West	0.9x	0.77	x	6.5	x		45.59	x	0.85	x	0.7	=	122.19	(80)
West	0.9x	0.77	x	6.5	×		24.49	x	0.85	x	0.7	=	65.64	(80)
West	0.9x	0.77	x	6.5	×		16.15	x	0.85	x	0.7	=	43.29	(80)
Solar	nains in	watts calc	ulated	for each m	onth			(83)m	– Sum(74)m	(82)m				
(83)m=	133.2	245.33 3	81.93	546.29 67	75.34	697.5	661.27	561	.44 438.59	283.88	3 162.96	111.73		(83)
Total g	gains – i	nternal and	d solar	(84)m = (7	3)m +	(83)m	, watts	1	- 1	I	-1	I	I	
(84)m=	616.64	726.83 8	51.15	995.74 11	04.79	1016.11	967.23	87	3 760.24	716.98	619.03	584.95]	(84)
7. Me	ean inter	nal temper	ature ((heating se	ason)									
Temp	perature	during hea	ating p	eriods in th	e living	g area	from Tal	ble 9,	Th1 (°C)				21	(85)
Utilis	ation fac	tor for gair	ns for li	iving area,	h1,m (see Ta	able 9a)							

Jul

Aug

Oct

Sep

Nov

Dec

Mar

Apr

May

Jun

Feb

Jan

(86)m=	1	1	0.99	0.98	0.97	0.94	0.89	0.92	0.97	0.99	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	17.35	17.55	18	18.65	19.35	19.99	20.41	20.33	, 19.75	18.91	18.03	17.32		(87)
Temp	erature	durina h	eating p	eriods ir	n rest of	dwellina	from Ta	able 9. Tl	h2 (°C)					
(88)m=	18	18	18	18	18	18	18	18	18	18	18	18		(88)
Utilisa	tion fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.97	0.93	0.83	0.54	0.63	0.91	0.98	0.99	1		(89)
Mean	interna	temper	ature in	the rest	of dwelli	na T2 (fe	n Now ste	ens 3 to 7	7 in Tabl	e 9c)				
(90)m=	13.7	13.99	14.64	15.58	16.59	17.46	17.91	17.86	17.18	15.97	14.69	13.66		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.81	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) – fl	Δ 🗙 Τ1	+ (1 – fl	Δ) x T2			I		
(92)m=	16.65	16.87	17.35	18.06	18.82	19.5	19.93	19.86	19.26	18.35	17.39	16.62		(92)
Apply	adjustn	nent to th	he mear	internal	temper	L ature fro	n Table	4e, whe	ere appro	opriate				
(93)m=	16.65	16.87	17.35	18.06	18.82	19.5	19.93	19.86	19.26	18.35	17.39	16.62		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti	to the r	nean int	ernal te	mperatu	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 la	ible 9a	lur	1.1	A	0	Oct	New	Dee		
 Itilies	Jan tion fac	tor for a	iviar	Apr	May	Jun	Jui	Aug	Sep	Oct	INOV	Dec		
(94)m=	0.99	0.99	0.98	0.97	0.94	0.9	0.83	0.86	0.95	0.98	0.99	0.99		(94)
Usefu	l gains,	hmGm ,	W = (9	4)m x (84	4)m									
(95)m=	613.03	720.4	838.32	966.64	1040.82	916.99	805.14	754.98	720.19	701.82	613.68	581.94		(95)
Month	nly avera	age exte	rnal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	1 <mark>0.6</mark>	7.1	4.2		(96)
Heat	oss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	5759.1	5572.48	5044.58	4226.07	3282.9	2244.54	1525.22	1581.5	2368.83	3570.03	4756.13	5756.78		(97)
Space	e heatin	g require	ement fo	or each m	nonth, k	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m	2050.00		
(98)m=	3828.67	3260.6	3129.46	2346.79	1668.1	0	0	0	0	2133.95	2982.57	3850.08	00000.00	
_								lota	i per year	(kvvn/year	') = Sum(9	8)15,912 =	23200.22	
Space	e heatin	g require	ement in	kWh/m ²	/year								331.43	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space Eracti	e heatir	ig:	t from s	econdar	v/supple	montary	system					1	0	(201)
Fracti	on of on		t from n		y/supple	mentary	System	(202) - 1	_ (201) _				0	
Fracti	on of sp			iain syst				$(202) = 1^{-1}$	- (201) -	(202)]			1	
Fracti		tai neatii	ng trom	main sys	stem 1			(204) = (20	02) x [1 – 1	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								88.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	1, %	1	r		i		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space	e heatin	g require	ement (c		d above))								
/ _ · · · ·	3828.67	3260.6	3129.46	2346.79	1668.1	Ű	0	0	U	2133.95	2982.57	3850.08		
(211)m	4200 70)m x (20	4)] } x 1	$100 \div (20)$)6) 1970-00	0	0		0	0400.00	2254.07	4000.0		(211)
	4306.72	3007.72	3520.2	2039.81	10/0.38	U	U		U I (kWh/ves	2400.39	3354.97 211)	4330.8	00000.00	(214)
								1010					20090.98	(~ ' ')

Space heating fuel (secondary), kWh/month

= {[(98)m x (20	01)]}x1	00 ÷ (20	8)					_	-		_	_	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	ll (kWh/yea	ar) =Sum(2	2 15) _{15,101}	2=	0	(215)
Water	heating	l												
Output	359.22	ater hea 320.37	ter (calc 345.3	ulated al 321.8	324.23	220.15	217.56	230.28	227.23	333.09	336.79	354.72	1	
Efficier	L of w	ater hea	l iter										78.8	(216)
(217)m=	87.93	87.89	87.78	87.55	87.08	78.8	78.8	78.8	78.8	87.39	87.76	87.95		(217)
Fuel fo (219)m	r water n = (64)	heating, m x 100	kWh/mo) ÷ (217)	onth m								•		
(219)m=	408.52	364.51	393.36	367.57	372.32	279.38	276.1	292.24	288.36	381.16	383.77	403.32		
								Tota	I = Sum(2)	19a) ₁₁₂ =			4210.61	(219)
Annua	I totals									k	Wh/yea	r	kWh/yea	<u>'</u>
Space	heating	fuel use	ed, main	system	1								26096.98	
Water	heating	fuel use	d										4210.61	
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatin	g pump:	:									120]	(230c)
boi <mark>ler</mark>	with a f	an-assis	sted flue									45		(230 <mark>e</mark>)
Tota <mark>l e</mark>	lectricity	/ for the	above, l	<mark>kWh/</mark> yea	r			sum	of (230a).	<mark>(2</mark> 30g) =			165	(231)
Electric	city for li	ghting											310.63	(232)
12a. (CO <mark>2 em</mark>	issions -	– Individ	ual h <mark>eat</mark> i	ng syste	ems inclu	uding mi	cro-CHP			_			
						Fn	erav			Fmiss	ion fac	tor	Emissions	:
						kW	/h/year			kg CO	2/kWh		kg CO2/ye	ar
Space	heating	(main s	ystem 1)		(211	l) x			0.2	16	=	5636.95	(261)
Space	heating	(second	dary)			(215	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	909.49	(264)
Space	and wa	ter heati	ng			<mark>(26</mark> 1) + (262)	+ (263) + ((264) =				6546.44	(265)
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t (231	l) x			0.5	19	=	85.64	(267)
Electric	city for li	ghting				(232	2) x			0.5	19	=	161.22	(268)
Total C	02, kg/	year							sum o	f (265)(2	271) =		6793.29	(272)
Dwelli	ng CO2	Emissi	on Rate	•					(272)	÷ (4) =			97.05	(273)
EI ratir	ng (secti	on 14)											32	(274)

User Details:	
Assessor Name: Stroma FSAP 2012 Software Version: Version Property Address: Unit 9	n: 1.0.3.4
Address : london	
1. Overall dwelling dimensions:	
Area(m²) Av. Height(m) Basement 124 (1a) x 2.37 (2a) =	Volume(m ³) 293.88 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 124 (4)	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = $	293.88 (5)
2. Ventilation rate:	
Mumber of chimneysmain heatingsecondary heatingothertotalNumber of open flues 0 $+$ 0 $+$ 0 $=$ 0 $\times 40 =$ $x = 10$	m³ per hour 0 (6a) 0 (6b)
Number of intermittent fans 2 x 10 =	20 (7a)
Number of passive vents $0 \times 10 =$	0 (7b)
Number of flueless gas fires	0 (7c)
Air cha	ange <mark>s per</mark> hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ If a pressurisation test has been carried out or is intended, proceed to (17) otherwise continue from (0) to (16)	0.07 (8)
Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (9) 0 (10) 0 (11)
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 no draught lobby enter 0.05, else enter 0	0 (12)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	0 (15)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	10 (17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$	0.57 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	
Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$	1 (19)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	0.52 (20)
Infiltration rate modified for monthly wind speed	0.55
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Monthly average wind speed from Table 7	
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	
Wind Factor (22a)m = (22)m \div 4	
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18	

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m		-			
	0.67	0.66	0.64	0.58	0.56	0.5	0.5	0.49	0.53	0.56	0.59	0.62		
Calcul If m	ate etter	ctive air al ventila	change	rate for t	he appli	cable ca	se							(220)
lf exh	aust air h	eat pump i	usina App	endix N. (2	3b) = (23a	i) x Fmv (e	equation (I	N5)) . othei	rwise (23b) = (23a)			0	(23a)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(230)
a) If	halance	d mech	anical ve	ntilation	with he	at recove	⊃rv (M\/I	HR) (24a) m = (22	2h)m + (23h) x [′	l – (23c)	0 ∸ 100]	(200)
(24a)m=				0	0	0			0			0]	(24a)
b) If	balance	l d mech:	I anical ve	Intilation	without	heat rec	L coverv (N	L MV) (24b	l = (22)	I 2b)m + ()	L 23b)		l	
(24b)m=	0	0		0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	ract ver	tilation o	or positiv	re input v	ı ventilatio	on from c	utside				I	
•)	if (22b)n	n < 0.5 ×	(23b), 1	hen (240	c) = (23b); otherv	wise (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	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from l	oft		•			
	if (22b)n	n = 1, th	en (24d)	m = (22k	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		r	1	
(24d)m=	0.72	0.72	0.71	0.67	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)	i		i	1	
(25)m=	0.72	0.72	0.71	0.67	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	oaramete	er:									
ELEN	/IENT	Gros	s	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e l	AXk
_		area	(m²)	m	2	A ,r	n²	W/m2	K	(VV/I	K)	kJ/m ² ·l	K	kJ/K
Doors						1.6	×	1.4	= [2.24				(26)
Windo	ws Type	e 1				5.49	x1	/[1/(4.8)+	0.04] =	22.11				(27)
Windo	ws Type	e 2				4.7	x1	/[1/(4.8)+	0.04] =	18.93				(27)
Walls	Type1	11.8	85	1.6		10.25	5 X	2.1	=	21.52				(29)
Walls	Type2	122	2	10.19	Э	111.8	1 X	1.27	=	142.22				(29)
Roof		68.	1	0		68.1	x	0.28	=	19.07				(30)
Total a	area of e	elements	, m²			201.9	5							(31)
Party v	wall					4.8	x	0	=	0				(32)
* for win	idows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
** incluc	le the area	as on both	sides of in	nternal wal	ls and par	titions		(00) (00)	(22)				r	
Fabric	heat los	SS, W/K =	= S (A x	U)				(26)(30)	(32) =	(00) (0)			226.08	(33)
Heat c	apacity	Cm = S((A X K)			1 1/ 21/			((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
I nerm	al mass	parame) = Cm ÷	- TFA) Ir	i KJ/M²K			Indica	tive Value	: High	- h l = 15	450	(35)
ror desi can be ι	ign assess used inste	sments wn ad of a dei	ere the de tailed calc	talis of the ulation.	CONSTRUCT	on are not	t known pr	recisely the	e indicative	e values of	TMPINT	adie 11		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						30.4	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			256.48	(37)
Ventila	ation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	70.25	69.41	68.58	64.69	63.96	60.57	60.57	59.95	61.88	63.96	65.43	66.97		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	326.74	325.89	325.06	321.17	320.45	317.06	317.06	316.43	318.36	320.45	321.92	323.46		
										Average =	Sum(39)1	12 /12=	321.17	(39)

Heat lo	ss para	meter (H	HLP), W/	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	2.63	2.63	2.62	2.59	2.58	2.56	2.56	2.55	2.57	2.58	2.6	2.61		
			I						,	Average =	Sum(40)1	.12 /12=	2.59	(40)
numbe	r of day	/s in moi	nth (Tab		May	lun	lul.	Δυσ	Son	Oct	Nov	Dec	1	
(41)m-	31	28	31	30	1VIA y	30	31	71 Aug	30	31	30	31		(41)
(41)11-	51	20			- 01		51	51	- 50	51	50	51		()
4. Wat	ter heat	ting enei	rgy requi	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	ıpancy, l 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	349 x (TF	- A -13.9)2)] + 0.(0013 x (⁻	TFA -13	2.; .9)	38]	(42)
Annual Reduce t not more	averag he annua that 125	e hot wa al average litres per j	ater usag hot water person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	102 f	2.54]	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	r day for ea	ach month I	Vd,m = fa	ctor from T	Table 1c x	(43)					1	
(44)m=	112.8	108.69	104.59	100.49	96.39	92.29	92.29	96.39	100.49	104.59	108.69	112.8		-
Ener <mark>gy c</mark>	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 10	c, 1d)	1230.5	(44)
(45)m=	1 <mark>6</mark> 7.27	146.3	150.97	131.62	126.29	108.98	100.98	115.88	117.26	136.66	149.18	161.99		_
lf instanta	aneous w	ater heati	ng at point	of use (no	o hot water	r storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1613.38	(45)
(46)m=	25.09	21.94	22.64	19.74	18.94	16.35	15.15	17.38	17.59	20.5	22.38	24.3		(46)
Water s	storage	loss:										20		
Storage	e volum	e (litres)) includir	ng any so	olar or N	/WHRS	storage	within sa	a <mark>me ve</mark> s	sel	· ·	160		(47)
If comm	hunity h	eating a	and no ta	ink in dw	velling, e	nter 110) litres in	(47)			(47)			
Water s	ise it no	loss [.]	not wate	er (this ir	iciudes i	nstantar	ieous co	iiod iama	ers) ente	er 'U' in (47)			
a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				()		(48)
Temper	rature fa	actor fro	m Table	2b							()		(49)
Energy	lost fro	m water	[.] storage	, kWh/ye	ear			(48) x (49)) =		16	60		(50)
b) If ma	anufact	urer's de	eclared o	cylinder l	oss fact	or is not	known:						1	
Hot wat	ter stora	age loss leating s	tactor fr	om I abl	e 2 (kvv	h/litre/da	ay)				0.	03		(51)
Volume	e factor	from Ta	ble 2a	011 4.0							0.9	91		(52)
Temper	rature fa	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	[.] storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	2.8	34		(54)
Enter (50) or ((54) in (5	55)								2.	34		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(56)
If 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	lix H	
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primary	/ circuit	loss (ar	nnual) fro	om Table	e 3						()		(58)
Primary	circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	ified by	tactor fi	rom Tab	IE H5 if t	nere is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)	100.55	1	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for eac	h month	(61)m =	(60)) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(61)
Total h	neat rec	uired for	water I	neating o	alculated	d fo	r eac	h month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	383.69	341.77	367.38	341.05	342.7	2	36.09	232.33	247.23	244.38	353.07	358.61	378.41]	(62)
Solar DI	-IW input	calculated	using Ap	pendix G o	or Appendix	(H)	(negati [,]	ve quantity	/) (enter '	0' if no sola	r contribu	ition to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	S and/or	WWHRS	S ap	plies	, see Ap	pendix	G)				_	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	t from w	vater hea	iter												
(64)m=	383.69	341.77	367.38	341.05	342.7	23	36.09	232.33	247.23	244.38	353.07	358.61	378.41]	
								•	Ou	tput from w	ater heat	er (annual)	12	3826.7	(64)
Heat g	ains fro	m water	heating	g, kWh/m	nonth 0.2	5 ´	[0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	n + (57)m	+ (59)m	1]	
(65)m=	158.32	141.41	152.9	143.15	144.69	6	69.77	68.23	73.18	72.52	148.14	148.99	156.56]	(65)
inclu	de (57))m in calo	culation	of (65)n	n only if c	ylir	nder i	s in the a	dwelling	, g or hot w	ater is t	from com	munity ł	neating	
5. In	ternal q	ains (see	e Table	5 and 5a	a):										
Metab	olic gai	ns (Table	5) Wa	atts											
motab	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	143.88	143.88	143.88	143.88	143.88	14	43.88	143.88	143.88	143.88	143.88	143.88	143.88		(66)
Liahtin	a dains	(calcula	ted in A	ppendix	L. equat	ion	L9 o	r L9a), a	lso see	Table 5	-				
(67)m=	30.38	26.98	21.94	16.61	12.42	1	0.48	11.33	14.72	19.76	25.09	29.29	31.22	1	(67)
Annlia		ins (calc	ulated	in Apper	dix Lea	uat	tion I	13 or I 1	(3a) als	o see Ta	ble 5	1		1	
(68)m=	290.33	293.35	285.75	269.59	249.19	2	30.01	217.2	214.19	221.78	237.95	258.35	277.52	1	(68)
Cookir			ted in a	Appendix		tion	1 15	or 152			5			J	
(69)m=	37.39	37 39	37.39	37 39	37 39		7 39	37.39	37 39	37.39	37.39	37.39	37.39	1	(69)
Dump	and fo			50)	0.00			01100	01100	01.00	01100		01100		()
(70)m-				Ja)	10	\mathbf{r}	10	10	10	10	10	10	10	1	(70)
							F)	10	10	10	10	10	10	J	()
(71)-	5 e.y. e) 115 1	115 1	115 1	115 1	1151	115 1	115 1	1	(71)
(71)11=	-115.1	-115.1	-115.1 [-115.1	-115.1	-115.1	-	115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	J	(71)
vvater	neating	gains (1		400.00	404.40		00.0	04.7	00.00	400 70	400.44	000.00	040.44	1	(72)
(72)11=	212.0	210.43	205.51	190.02	194.40	<u> </u>	90.9	91.7	90.30	100.73	(70) (200.93	210.44	J	(12)
Iotal	nterna	I gains =		504.40	500.05		(66)	m + (67)m	1 + (68)m	+ (69)m +	(70)m + ((1)m + (72)		1	(72)
(73)m=	609.67	606.92	589.37	561.19	532.25	4	13.56	396.4	403.44	418.43	538.32	570.73	595.34		(73)
0. Solar (iar gain ains are	S.	using sol	ar flux from	n Table 6a	and	25500	iated equa	tions to c	convert to th	ne annlica	ble orientat	tion		
	ation:	Access F	Factor		a	unu	Flu	Y		a		FF		Gains	
onona		Table 6d	uotor	m²			Tal	ble 6a		9_ Table 6b	٦	Table 6c		(W)	
North	0 9x	0.77	<u> </u>	c 5	49	×	1	0.63		0.85	_ <u>_</u> ر	0.7		24.07	7(74)
North	0.9x	0.77			10	Ŷ		20.32		0.00		0.7	=	/AG](74)
North	0.0A	0.77			10	Ŷ		24.52		0.00	╡ᆠ╞	0.7	=	70 17](74)
North	0.04	0.77			40	Ŷ		5 46		0.00	╡ᆠ┟	0.7	=	125.56	$]_{(74)}^{(17)} $
North	0.98	0.77			49	Ŷ		74.70		0.05	╡╏	0.7		120.00	
North	0.9X	0.77		<u> </u>	.49	×		4.72		0.85	×	0.7	=	169.14	(74)

North	0.9x	0.77		x	5.4	9	x	79.99		x	0.85		× [0.7		=	181.06	(74)
North	0.9x	0.77		x	5.4	9	x	74.68		x	0.85		× [0.7		=	169.05	(74)
North	0.9x	0.77		x	5.4	9	x	59.25		x	0.85		x [0.7		=	134.12	(74)
North	0.9x	0.77		x	5.4	9	×	41.52		x	0.85		× [0.7		= [93.98	(74)
North	0.9x	0.77		x	5.4	9	x	2	24.19		0.85		×	0.7		=	54.76	(74)
North	0.9x	0.77		x	5.4	9	x	13.12		x	0.85		× [0.7		= [29.69	(74)
North	0.9x	0.77		x	5.4	9	x		8.86	x	0.85		x [0.7		=	20.07	(74)
South	0.9x	0.77		x	4.7	7	x	4	6.75	x	0.85		x [0.7		= [90.6	(78)
South	0.9x	0.77		x	4.7	7	x	76.57		x	0.85		x	0.7		=	148.39	(78)
South	0.9x	0.77		x	4.7	7	x	97.53		x	0.85		× [0.7		=	189.02	(78)
South	0.9x	0.77		x	4.7	7	x	110.23		x	0.85		x [0.7		= [213.63	(78)
South	0.9x	0.77		x	4.7	7	x	114.87		x	0.85		x [0.7		=	222.62	(78)
South	0.9x	0.77		x	4.7	7	x	1	10.55	x	0.85		x [0.7		=	214.24	(78)
South	0.9x	0.77		x	4.7	7	x	1	08.01	x	0.85		x [0.7		= [209.32	(78)
South	0.9x	0.77		x	4.7	7	x	104.89		x	0.85		x [0.7		=	203.28	(78)
South	0.9x	0.77		x	4.7	7	x	1	01.89	x	0.85		x	0.7		=	197.45	(78)
South	0.9x	0.77		x	4.7	7	x	82.59		x	0.85		x [0.7		=	160.05	(78)
South	0.9x	0.77		x	4.7	7	×	55.42		х	0.85		х	0.7		=	107.4	(78)
South	0.9x	0.77		x	4.7	7	x		40.4	x	0.85		х [0.7		=	78.29	(78)
Solar (gains in	watts, ca		ed	for each		th	005.0	070.07	(83)m	= Sum(74)	m(82	2)m	407.00	00.0			(92)
(83)m=	= 114.68 194.39 267.18 339.19 391.75 395.3 378.37 337.4 291.43 214.81 137.09 98.36													(03)				
(84)m-	Jams – Internal and Solar (84)m = (73)m + (83)m , Watts												(84)					
(04)11-	124.04	001.0	000.0		000.01	524		00.00	114.11	140	.04 1 700.0	<u>, 1,0</u>	0.12	101.02	000	.,		(0.)
7. Me	ean inter	nal temp	eratu	re (heating	seaso	on)		· -		714 (80)					г		
Temp	berature	during h	eating	ј ре 	eriods ir	the li	ving	area	from Tak	ole 9	, Th1 (°C))					21	(85)
Utilis	ation fac	tor for ga	ains fo	or Ir T	ving are	ea, h1,	m (s		ible 9a)			-	2-4	Nevi				
(00)~~	Jan	Feb	IVIa	r	Apr	May	<u>/</u>	Jun	Jui					INOV	De	ec		(86)
(00)11=					I	I		0.99	0.96	0.8	0.99	,	1		I			(00)
Mear	n interna	l tempera	ature i	in li	iving are	ea T1	(follo	w ste	ps 3 to 7	7 in T	able 9c)							
(87)m=	19.12	19.23	19.46	5	19.81	20.18	2	20.51	20.74	20	.7 20.4	19	9.97	19.5	19.1	1		(87)
Temp	erature	during h	eating	j pe	eriods ir	rest o	of dw	/elling	from Ta	able 9	9, Th2 (°C)		-				
(88)m=	18.94	18.95	18.95	5	18.97	18.97	1	8.99	18.99	18.	99 18.98	8 18	3.97	18.97	18.9	96		(88)
Utilis	ation fac	ctor for ga	ains fo	or re	est of d	velling	j, h2	,m (se	e Table	9a)								
(89)m=	1	1	1		1	0.99		0.96	0.8	0.8	35 0.98	3	1	1	1			(89)
Mear	n interna	l tempera	ature i	in tl	he rest	of dwe	elling	T2 (f	ollow ste	eps 3	to 7 in Ta	able 9	c)					
(90)m=	16.58	16.74	17.09)	17.6	18.14		18.62	18.91	18.	88 18.4	8 17	, 7.84	17.14	16.5	57		(90)
	F	•									I	fLA =	= Liv	ing area ÷ (4	4) =		0.3	(91)
Mear	interna	l temper	atur≏	(for	· the wh	ole du	ellin	a) – f	A v T1	+ (1	– fl ∆) ∨ [−]	Т2				L		
(92)m=	17.34	17.49	17.8		18.27	18.76		9, <u>-</u> 1 19.19	19.46	19.	43 19.00	- <u>-</u> 6 18	3.48	17.85	17.3	34		(92)
1.1		1				-			I	1								1

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.34	17.49	17.8	18.27	18.76	19.19	19.46	19.43	19.06	18.48	17.85	17.34		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calcu the utilisation factor for gains using Table 9a											ulate			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm):										
(94)m=	1	1	1	1	0.99	0.96	0.87	0.9	0.98	1	1	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	723.97	800.59	855.06	896.47	911.42	778.06	672.23	665.33	696.54	749.93	707.11	693.41		(95)
Month	nly avera	age exte	ernal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	4261.51	4104.2	3674.62	3008.13	2260.84	1456.08	906.78	958.58	1578.66	2525.77	3461.71	4249.7		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	2631.94	2220.02	2097.75	1520.39	1003.97	0	0	0	0	1321.22	1983.31	2645.88		٦
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	15424.48	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								124.39	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Sp <mark>ac</mark>	e heatir	ng:												-
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)			(20 <mark>2)</mark> = 1 ·	- (201) =				1	(202)
Fracti	on of to	tal hea <mark>ti</mark>	<mark>ng f</mark> rom	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1											88.9	(206)		
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						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)									
	2631.94	2220.02	2097.75	1520.39	1003.97	0	0	0	0	1321.22	1983.31	2645.88		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	2960.56	2497.21	2359.68	1710.23	1129.33	0	0	0	0	1486.19	2230.94	2976.24		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	17350.37	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									_
= {[(98)m x (20)1)]}x1	00 ÷ (20	8)	-		-				-	-		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water	heating	J												
Output	from w	ater hea	ter (calc	ulated a	bove)									
	383.69	341.77	367.38	341.05	342.7	236.09	232.33	247.23	244.38	353.07	358.61	378.41		-
Efficier	ncy of w	ater hea	ater										78.8	(216)
(217)m=	87.47	87.41	87.23	86.86	86.09	78.8	78.8	78.8	78.8	86.56	87.19	87.5		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100) ÷ (217) 421 14	m 392.64	398 07	299 61	294 84	313 74	310 12	407 80	411 3	432 48		
(210)11=	-00.00	001.01	721.14	002.04	000.07	200.01	207.04	Tota	= Sum(2)	19a) =		-02.40	1511 10	(210)
Annua	l totala							1010	2011/2		Nh/voo-		4011.40	
Space	heating	fuel use	ed. main	system	1					ĸ	wiivyedi		17350.37	7
Space neating tuel used, main system 1 17350.37														

Water heating fuel used			Г	4511.48	1
Electricity for pumps, fans and electric keep-hot			L		l
central heating pump:	120		(230c)		
		Ĺ	120		(2000)
boiler with a fan-assisted flue		l	45		(230e)
Total electricity for the above, kWh/year	sum of (230a		165	(231)	
Electricity for lighting			Γ	536.46	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP		-		
	Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	=	3747.68	(261)
Space heating (secondary)	(215) x	0.519	= [0	(263)
Water heating	(219) x	0.216	= [974.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4722.16	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= [85.64	(267)
Electricity for lighting	(232) x	0.519	- [278.42	(268)
Total CO2, kg/year	sum	n of (265)(271) =	[5086.22	(27 <mark>2)</mark>
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	Γ	41.02	(273)
El rating (section 14)				60	(274)

User Details:														
Assessor Name: Software Name:	Stroma FSAP 201	troma FSAP 2012			a Num are Ver	ber: sion:		Version: 1.0.3.4						
Address :	. london	FI	openy r	Audress.										
1. Overall dwelling dime	nsions:													
Basement			Area	1(m²) 79	(1a) x	Av. He	ight(m) 2.6	(2a) =	Volume(m³ 205.4	') (3a)				
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n)		79	(4)									
Dwelling volume					(3a)+(3b)	+(3c)+(3c	d)+(3e)+	.(3n) =	205.4	(5)				
2. Ventilation rate:														
Number of chimneys Number of open flues	$\begin{array}{c} main \\ heating \\ \hline 0 \\ \hline 0 \\ \hline \end{array} + \\ \hline \end{array}$	econdary eating 0 0) +] +	0 0 0] = [total 0 0	x 2	40 = 20 =	m ³ per hou	r (6a) (6b)				
Number of intermittent fai	ns					2	X ?	10 =	20	(7a)				
Number of passive vents						0	x ′	10 =	0	(7b)				
Number of flueless gas fires										0 (7c) hange <mark>s per</mark> hour				
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20 \div (5) =$										(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) Additional infiltration [(9)-1]x0.1 = [Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after the dwelling of the present o										(9) (10) (11)				
If suspended wooden f	loor, enter 0.2 (unseal	ed) or 0.1	(seale	d), else	enter 0				0	(12)				
If no draught lobby, ent	ter 0.05, else enter 0								0	(13)				
Percentage of windows	s 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,	q50, expressed in cub	ic metres	per ho	ur per so	quare m	etre of e	envelope	area	10	(17)				
If based on air permeabili	Ity value, then $(18) = [(1$	7) ÷ 20]+(8)	, otherwis	se (18) = (rmoobility	is hoing u	sod		0.6	(18)				
Number of sides sheltere	d	been done	or a deg	iee all pei	meaning	is being u	seu		1	(19)				
Shelter factor	-			(20) = 1 - [0.075 x (1	9)] =			0.92	(20)				
Infiltration rate incorporat	ing shelter factor			(21) = (18)	x (20) =				0.55	(21)				
Infiltration rate modified for	or monthly wind speed													
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Monthly average wind sp	eed from Table 7													
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7						
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4													
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18						
Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
----------------------	--------------------------	-------------------------	---------------------------	--------------------------	-------------	---------------	-----------------	----------------	-------------	----------------	-------------	--------------------	-------------	-------
<u> </u>	0.7	0.69	0.68	0.61	0.59	0.52	0.52	0.51	0.55	0.59	0.62	0.65		
Calcul If ma	ate etter	ctive air	change	rate for t	he appli	cable ca	se						0	(220)
lf exh	aust air h	eat pump	usina Appe	endix N. (2	3b) = (23a	a) x Fmv (e	equation (I	N5)) . other	wise (23b) = (23a)			0	(23a)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(23c)
a) If	halance	d mech	, anical ve	ntilation	with he	at recove	∘rv (M\/I	/ HR) (24a	m = (2)	2h)m + (23h) x [′	l – (23c)	0 ∸ 1001	(200)
(24a)m=				0	0	0			0	0		0		(24a)
b) If	balance	l d mech	I anical ve	Intilation	without	L heat rec	L coverv (N	L /IV) (24b)m = (22	l 2b)m + (;	L 23b)			
(24b)m=	0	0		0	0	0		0	0	0	0	0		(24b)
c) If	whole h	u ouse ex	ract ver	tilation o	or positiv	input v	ı ventilatio	on from c	outside					
c)	if (22b)n	n < 0.5 ×	(23b), t	hen (240	c) = (23b	o); 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	natural	ventilatio	on or wh	ole hous	e positiv	ve input	ventilatio	on from l	oft					
	if (22b)n	n = 1, th	en (24d)	m = (22	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		r	1	
(24d)m=	0.75	0.74	0.73	0.68	0.68	0.64	0.64	0.63	0.65	0.68	0.69	0.71		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in box	(25)					
(25)m=	0.75	0.74	0.73	0.68	0.68	0.64	0.64	0.63	0.65	0.68	0.69	0.71		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN		Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e	AXk
		area	(m²)	m	2	A ,r	n²	W/m2	ĸ	(W/I	K)	kJ/m²·l	<	kJ/K
Doors						1.6	x	1.4	= [2.24				(26)
Windo	ws Type	e 1				3.12	x1	/[1/(4.8)+	0.04] =	12.56				(27)
Windo	ws Type	e 2				3.66	x1	/[1/(4.8)+	0.04] =	14.74				(27)
Walls ⁻	Type1	89.	2	6.78		82.42	<u>2</u> X	1.27	=	104.83				(29)
Walls 7	Type2	26.6	63	1.6		25.03	3 X	2.1	=	52.56				(29)
Roof		46.	5	0		46.5	x	0.28	=	13.02				(30)
Total a	area of e	elements	, m²			162.3	3							(31)
Party v	wall					5.3	x	0		0				(32)
* for win	idows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	 1 3.2	
** inclua	le the area	as on both	sides of ir	nternal wal	ls and par	titions								
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				199.96	(33)
Heat c	apacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: High		450	(35)
For desi can be i	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pr	recisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						24.8	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)							2110	()
Total f	abric he	at loss							(33) +	(36) =			224.76	(37)
Ventila	ation hea	at loss ca	alculated	monthl	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	50.71	50.06	49.42	46.41	45.85	43.23	43.23	42.74	44.24	45.85	46.99	48.18		(38)
Heat tr	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	275.47	274.82	274.18	271.17	270.61	267.99	267.99	267.5	269	270.61	271.75	272.94		
	E									Average =	Sum(39)1	₁₂ /12=	271.17	(39)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	3.49	3.48	3.47	3.43	3.43	3.39	3.39	3.39	3.41	3.43	3.44	3.45		
L	r of do		oth (Toh						/	Average =	Sum(40) ₁ .	12 /12=	3.43	(40)
	l ul uay	Feb	Mar		May	lun	lul	Διια	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,=	01						01	01						()
4. Wat	ter heat	ting ener	gy requi	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	ipancy, f 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ΓFA -13.	2. .9)	44]	(42)
Annual Reduce t not more	averag the annua that 125	e hot wa al average litres per p	ater usag hot water person per	ge in litre usage by s day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	92 f	.24]	(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x T	(43)	1		1		1	
(44)m=	101.46	97.77	94.08	90.39	86.7	83.01	83.01	86.7	90.39	94.08	97.77	101.46		
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mon	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1106.83	(44)
(45)m=	150.46	131.59	135.79	118.39	113.6	98.02	90.83	104.23	105.48	122.93	134.18	145.71		- 1
lf instanta	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)	Fotal = Su	m(45) ₁₁₂ =		1451.23	(45)
(46)m=	<mark>2</mark> 2.57	19.74	20.37	17. <mark>76</mark>	17.04	14.7	13.63	15.64	15.82	18.44	20.13	21.86		(46)
Water s	storage	loss:												
Storage	e volum	e (litres)	includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		160		(47)
It comn Otherw	nunity h ise if no	eating a	nd no ta hot wate	ink in dw er (this in	velling, e Icludes i	nter 110 nstantar	nitres in Neous co	(47) mbi boil	ers) ente	er '0' in (47)			
Water s	storage	loss:							,		,			
a) If ma	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		16	60]	(50)
b) If ma	anufact	urer's de	eclared of factor fr	cylinder l	oss fact	or is not	known:					~~	1	(54)
If comm	nunitv h	eating s	ee secti	on 4.3		1/11110/02	iy)				0.	03		(51)
Volume	factor	from Tal	ble 2a								0.	91		(52)
Tempe	rature f	actor fro	m Table	2b							0.	78		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	2.	84		(54)
Enter ((50) or ((54) in (5	55)								2.	84		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	m				
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(56)
If cylinde	r contains	s dedicated	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primary	/ circuit	loss (an	inual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated f	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	ified by	tactor fr	om Tab	ie H5 if t	nere is s	solar wat	ter heati	ng and a	cylindei	r thermo	stat)	400.00	1	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for eac	h mont	h (61)m =	(60)	÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(61)
Total h	eat rec	quired for	water	heating	calculate	d for	each	n month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	- · (59)m + (61)m	
(62)m=	366.87	327.06	352.21	327.8	2 330.01	22	5.14	222.18	235.58	232.59	339.34	343.61	362.13]	(62)
Solar DI	-IW input	calculated	using Ap	pendix C	or Appendi	x H (n	egativ	ve quantity	/) (enter '()' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	S and/c	r WWHR	S app	olies,	see Ap	pendix	G)				-	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	from v	vater hea	ter								-			_	
(64)m=	366.87	327.06	352.21	327.8	2 330.01	22	5.14	222.18	235.58	232.59	339.34	343.61	362.13		-
									Out	put from w	ater heate	er (annual)₁	12	3664.55	(64)
Heat g	ains fro	om water	heating	g, kWh	month 0.2	:5 ´ [(0.85	× (45)m	+ (61)r	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	<u>[</u>]	
(65)m=	152.73	136.52	147.85	5 138.7	5 140.47	66	.13	64.85	69.31	68.6	143.57	144	151.15		(65)
inclu	ide (57)m in calo	culatior	of (65	m only if o	cyline	der is	s in the c	dwelling	or hot w	vater is f	rom com	munity ł	neating	
5. Int	ternal g	jains (see	e Table	5 and	5a):										
Metab	olic gai	<u>ns (Table</u>	5), Wa	atts					-				-	_	
	Jan	Feb	Mar	Ар	r May	J	un	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	122.18	122.18	122.18	122.1	8 122.18	122	2.18	122.18	122.18	122.18	122.18	122.18	122.18		(66)
Ligh <mark>tin</mark>	g gains	s (calcula	ted in A	Append	x L, equa	tion	L9 or	⁻ L9a), a	lso see	Table 5					
(67)m=	22.54	20.02	16.28	12.3	9.21	7.	78	8.4	10.92	14.66	18.62	21.73	23.16		(67)
App <mark>lia</mark>	nces ga	ains (ca <mark>lc</mark>	ulat <mark>ed</mark>	in Appe	endix L, ec	uatio	on L'	13 o <mark>r L1</mark> :	3a), also	o see Ta	ble <mark>5</mark>				
(68)m=	217.34	219.59	21 <mark>3.91</mark>	201.8	1 186.54	172	2.18	162.59	160.34	166.02	178.12	193.39	207.75		(68)
Coo <mark>kir</mark>	ng gains	s (calcula	ted in a	Append	ix L, equa	tion	L15	or L15a)), also s	ee Table	5				
(69)m=	35.22	35.22	35.22	35.2	2 35.22	35	.22	35.22	35.22	35.22	35.22	35.22	35.22		(69)
Pumps	and fa	ans gains	(Table	5a)											
(70)m=	10	10	10	10	10	1	10	10	10	10	10	10	10]	(70)
Losses	s e.g. e	vaporatic	n (neg	ative va	lues) (Tal	ble 5)							-	
(71)m=	-97.74	-97.74	-97.74	-97.7	4 -97.74	-97	7.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74]	(71)
Water	heating	g gains (T	able 5)		-			-		-	-		_	
(72)m=	205.28	203.15	198.73	192.7	1 188.81	91	.84	87.17	93.16	95.28	192.98	200.01	203.16]	(72)
Total i	nterna	l gains =	1				(66)	m + (67)m	n + (68)m	+ (69)m +	(70)m + (71)m + (72)	m		
(73)m=	514.81	512.42	498.57	476.	5 454.21	34	1.46	327.82	334.07	345.62	459.37	484.78	503.73]	(73)
6. So	lar gair	ns:													
Solar g	ains are	calculated	using so	lar flux fr	om Table 6a	and a	associ	ated equa	tions to c	onvert to th	ne applica	ble orientat	ion.		
Orienta	ation:	Access F	actor	Ar	ea		Flu	X No Go	-	g_ Fable Ch	-	FF		Gains	
						_	Tat	Die ba				able oc		(vv)	-
North	0.9x	0.77		×	3.66	×L	1	0.63	×	0.85	× [0.7	=	16.05	(74)
North	0.9x	0.77		×	3.66	×	2	0.32	×	0.85	_ × [0.7	=	30.67	(74)
North	0.9x	0.77		×	3.66	×L	3	4.53	×	0.85	×	0.7	=	52.11	(74)
North	0.9x	0.77		×	3.66	×	5	5.46	×	0.85	×	0.7	=	83.7	(74)
North	0.9x	0.77		x	3.66	x	7	4.72	×	0.85	×	0.7	=	112.76	(74)

North	0.9x	0.77		x	3.66		x	7	9.99	x	0.85	x	0.7	=	120.7	1 (74)
North	0.9x	0.77		x	3.66		x	7	4.68	×	0.85	x	0.7	=	112.7	(74)
North	0.9x	0.77		x	3.66		x	5	9.25	x	0.85	x	0.7	=	89.41	(74)
North	0.9x	0.77		x	3.66		x	4	1.52	x	0.85	x	0.7	=	62.65	(74)
North	0.9x	0.77		x	3.66		x	2	4.19	x	0.85	x	0.7	=	36.51	(74)
North	0.9x	0.77		x	3.66		x	1	3.12	×	0.85	x	0.7	=	19.8	(74)
North	0.9x	0.77		x	3.66		x	8	3.86	x	0.85	x	0.7	=	13.38	(74)
South	0.9x	0.77		x	3.12		x	4	6.75	x	0.85	x	0.7	=	60.15	(78)
South	0.9x	0.77		x	3.12		x	7	6.57	×	0.85	x	0.7	=	98.5	(78)
South	0.9x	0.77		x	3.12		x	9	7.53	x	0.85	x	0.7	=	125.48	3 (78)
South	0.9x	0.77		x	3.12		x	1'	10.23	x	0.85	x	0.7	=	141.8	1 (78)
South	0.9x	0.77		x	3.12		x	1'	14.87	x	0.85	x	0.7	=	147.78	3 (78)
South	0.9x	0.77		x	3.12		x	1'	10.55	x	0.85	x	0.7	=	142.22	2 (78)
South	0.9x	0.77		x	3.12		x	10	08.01	x	0.85	x	0.7	=	138.9	6 (78)
South	0.9x	0.77		x	3.12		x	10	04.89	×	0.85	x	0.7	=	134.9	5 (78)
South	0.9x	0.77		x	3.12		x	10	01.89	x	0.85	x	0.7	=	131.0	7 (78)
South	0.9x	0.77		x	3.12		x	8	2.59	x	0.85	x	0.7	=	106.2	5 (78)
South	0.9x	0.77		x	3.12		x	5	5.42	x	0.85	x	0.7	=	71.29	(78)
South	0.9x	0.77		x	3.12		х	4	40.4	x	0.85	x	0.7	=	51.97	(78)
Solar (<mark>pain</mark> s in	watts, <mark>ca</mark>	l <mark>cu</mark> late	ed	for each	mont	1			(83)m	n = Sum(74)m	<mark>(8</mark> 2)m	1		-	
(83)m=	76.19	129.17	177.59	э	225.52	260.54	2	62.93	251.65	224	.36 193.73	142.7	5 91.09	65.35		(83)
Total g	jains – i	nternal a	nd sol	ar	(84)m = ((73)m	+ (83)m	, watts			_	_	r	-	
(84)m=	591.01	641.59	676.10	6	702.02	714.75	6	04.39	579.47	558	.43 539.35	602.1	2 575.87	569.08		(84)
7. Me	an inter	nal temp	eratur	e (heating s	seaso	n)									
Temp	erature	during h	eating	pe	eriods in	the liv	ing	area f	rom Tab	ole 9	, Th1 (°C)				21	(85)
Utilisa	ation fac	tor for ga	ains fo	r li	ving area	a, h1,r	n (s	ee Ta	ble 9a)						-	
	Jan	Feb	Ma	ſ	Apr	May		Jun	Jul	A	ug Sep	Oc	t Nov	Dec	4	
(86)m=	1	1	1		1	0.99		0.98	0.95	0.9	0.99	1	1	1		(86)
Mean	interna	l tempera	ature i	n li	ving area	a T1 (1	follo	w ste	ps 3 to 7	7 in T	able 9c)				_	
(87)m=	18.68	18.81	19.09		19.5	19.95	2	20.35	20.64	20	.6 20.23	19.7	1 19.14	18.67		(87)
Temp	erature	during h	eating	pe	eriods in	rest o	f dw	elling	from Ta	able 9	9, Th2 (°C)					
(88)m=	18.53	18.53	18.53		18.55	18.55	1	8.57	18.57	18.	57 18.56	18.5	5 18.55	18.54]	(88)
Utilis	ation fac	tor for a	ains fo	r re	est of dw	ellina.	h2.	.m (se	e Table	9a)		•	•			
(89)m=	1	1	1	T	0.99	0.98	T	0.93	0.74	0.7	79 0.96	0.99	1	1	7	(89)
Mean		l temper:	ature i	L n tl	he rest of	f dwel	lina	T2 (fr	nllow ste	i ans 3	to 7 in Tab		I	I	4	
(90)m=	15.71	15.9	16.31	T	16.92	17.57		8.14	18.48	18.	45 17.98	17.2	3 16.39	15.7	7	(90)
V 1	L											fLA = Li	ving area ÷ (4) =	0.28	(91)
N 4	late	1.40.000	. .	4.0	4 ha la -	ام دارر		~) /!	Δ	. /4						` ` `
(92)m-		1 temperative		IO		18 23	eiiin ∎ ₁	(y) = TL	_A X I 1	+ (1	$-ILA) \times I2$	17.0	1 17 15	16.52	7	(92)
	1 10.00	1 10.7 I	17.00	· •	11.00 1	10.20		0.10	10.00	1 3.		1 11.3	i j 17.10	1 10.02	1	(54)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.53	16.7	17.08	17.63	18.23	18.75	19.08	19.04	18.6	17.91	17.15	16.52		(93)
8. Spa	ace hea	iting requ	uiremen	t					1					
Set Ti the ut	i to the ilisation	mean int factor fo	ternal te or gains	mperatui using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(7	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	n:										
(94)m=	1	1	0.99	0.99	0.97	0.94	0.82	0.86	0.96	0.99	1	1		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									(05)
(95)m=	589.67	639.49	672.49	694.33	695.32	568.49	478.05	478.74	520.43	595.04	573.67	567.98		(95)
Montr	nly aver	age exte	ernal tem	perature	e from 1a	able 8	16.6	16.4	444	10.6	74	42		(06)
	4.3	4.9				14.0	10.0	10.4 v [(02)m	(06)m	10.0	7.1	4.2		(90)
(97)m=	3369 21	3244 01	2899.81	2367.34	1765 89	LIII , VV =	-[(39)117 663.53	706.98	1211 09] 1979 48	2731 27	3362 99		(97)
Space	e heatin		ement fo	pr each n	rrooth k	Nh/mont	h = 0.02	24 x [(97))m – (95)ml x (4^{2})	1)m	0002.00		(0.)
(98)m=	2067.98	1750.24	1657.13	1204.57	796.5	0	0.02			1030.02	1553.47	2079.49		
` '								Tota	l per vear	(kWh/vear) = Sum(9	8)1.59.12 =	12139.41	(98)
Snace	a heatin	a requir	ement in	kMh/m^2	?/vear					(,	,(-	- ,	152.66	
	5 neatin	grequit			/ycai							l	155.00	
9a. Ene	ergy red	quiremer	nts – Ind	ividual n	eating s	ystems i	ncluding	micro-C	(HP)					
Fracti	e neatil on of sr	ng: bace hea	t from s	econdar	v/supple	mentary	system						0	7(201)
Fracti	on of sr	ace hes	at from n	nain syst	em(s)		e y e te ni	(202) = 1 -	(201) =				1	$\frac{1}{202}$
Fracti		tal basti		main aya				(204) - (2)	(<u> </u>	(203)] -		_	1	
				inain sys				(204) - (2	02) ~ [1	(200)] –	_		1	
Efficie	ency of	main spa	ace neat	ing syste									88.9	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	1, %	-					0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c		d above))	0			4000.00	4550 47	0070 40		
	2067.98	1750.24	1657.13	1204.57	796.5	0	0	0	0	1030.02	1553.47	2079.49		
(211)m	1 = {[(98	5)m x (20	04)] } x 1	100 ÷ (20)6)	-	-				<u> </u>			(211)
	2326.19	1968.77	1864.04	1354.97	895.95	0	0			1158.63	1747.44	2339.14		
-			_					Tota	ii (Kvvn/yea	ar) =5um(2	211) _{15,1012}	2=	13655.13	(211)
	e heatin	g fuel (s	econdar	y), kWh/ אמו	month									
$= \{[(90)]$	0		$\frac{00 \div (20)}{0}$		0	0	0	0	0	0	0	0		
(210)11-	0			Ů		Ŭ	0	Tota	l (kWh/yea	ar) =Sum(2	215)	=	0	7(215)
Wator	hostin	Y								, ,	/ 10,1012	2	Ŭ	
Output	from w	ater hea	ter (calc	ulated a	bove)									
	366.87	327.06	352.21	327.82	330.01	225.14	222.18	235.58	232.59	339.34	343.61	362.13		
Efficier	ncy of w	ater hea	ter									•	78.8	(216)
(217)m=	87.22	87.14	86.95	86.53	85.68	78.8	78.8	78.8	78.8	86.16	86.88	87.24		(217)
Fuel fo	r water	heating,	kWh/m	onth					-					
(219)m	1 = (64)	m x 100) ÷ (217))m	005 :-	005 = 1	001.00	000.00	007	000.00	005 15	445.00		
(219)m=	420.65	375.33	405.08	378.86	385.15	285.71	281.96	298.96	295.17	393.83	395.49	415.09	1001	
A	14-1							rota	n = Sum(2	1 9a) ₁₁₂ =	A/I. 4 -		4331.28	(219)
Annua Space	heating	i fuel uca	nain he	system	1					K\	wn/year	r I	13655 12	7
Space	nealing		su, main	System	1							l	13055.13	

Water heating fuel used			Γ	4331.28]
Electricity for pumps, fans and electric keep-hot			L		
central heating pump:		[120		(230c)
boiler with a fan-assisted flue		[45		(230e)
Total electricity for the above, kWh/year	sur	m of (230a)(230g) =	[165	(231)
Electricity for lighting			[398.03	(232)
12a. CO2 emissions – Individual heating systems	including micro-CH	Р			-
	Energy kWh/year	Emission factor kg CO2/kWh	or	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	= [2949.51	(261)
Space heating (secondary)	(215) x	0.519	= [0	(263)
Water heating	(219) x	0.216	= [935.56	(264)
Space and water heating	(261) + (262) + (263) +	(264) =	[3885.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= [85.64	(267)
Electricity for lighting	(232) x	0.519	- [206.58	(268)
Total CO2, kg/year		sum of (265)(271) =	[4177.28	(272 <mark>)</mark>
Dwelling CO2 Emission Rate		(272) ÷ (4) =	[52.88	(273)
El rating (section 14)				55	(274)

			User D	etails:									
Assessor Name: Software Name:	Stroma FSAP 201	2 Pr	operty /	Stroma Softwa	a Num ire Ver	ber: sion:		Versio	on: 1.0.3.4				
Address :	london		openty r	-uuress.	Onit i i								
1. Overall dwelling dimens	ions:												
Basement			Area	a(m²) 51	(1a) x	Av. He	ight(m) 1.9	(2a) =	Volume(m³ 96.9) (3a)			
Total floor area TFA = (1a)-	+(1b)+(1c)+(1d)+(1e)+(1n)	51	(4)			1					
Dwelling volume		/ (, <u> </u>		(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	96.9	(5)			
2. Ventilation rate:													
Number of chimneys Number of open flues	$ \begin{array}{ccc} main & se \\ heating & h \\ \hline 0 & + \\ \hline 0 & + \\ \hline 0 & + \\ \end{array} $	eating 0 0	y] + [_] + [_	0 0 0] = [total 0 0	x 4	40 = 20 =	m ³ per hou	r (6a) (6b)			
Number of intermittent fans					Ī	2	x ′	10 =	20	(7a)			
Number of passive vents						0	x ^	10 =	0	(7b)			
Number of flueless gas fires	6					0	X 4	40 =	0	(7c)			
Number of intermittent fans 2 $x 10 =$ 20 Number of passive vents 0 $x 10 =$ 0 Number of flueless gas fires 0 $x 40 =$ 0 Air changes pInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) =$ 20 $\div (5) =$ 0.2													
Infiltration due to chimneys, If a pressurisation test has been	0.21	(8)											
Number of storeys in the Additional infiltration	dw <mark>elling (ns)</mark>						[(9)	-1]x0.1 =	0	(9) (10)			
Structural infiltration: 0.25 if both types of wall are pres deducting areas of openings	5 for steel or timber f ent, use the value corres); if equal user 0.35	frame or ponding to	0.35 for the greate	' masonr er wall area	y constr a (after	uction			0	(11)			
If suspended wooden floo	or, enter 0.2 (unseal	ed) or 0.	1 (seale	d), else	enter 0				0	(12)			
If no draught lobby, enter	0.05, else enter 0								0	(13)			
Percentage of windows a	ind doors draught st	ripped		0.05 10.0	~ (1 4) • 4	001			0	(14)			
vvindow inflitration				(8) ± (10) .	X (14) ÷ 1 ⊾ (11) ⊥ (1	(00] =	± (15) –		0	(15)			
	0 expressed in cub	ic motro	s nor ho			etre of e		area	0	(10)			
If based on air permeability	value then $(18) = [(1)$	7) ÷ 20]+(8), otherwi	se (18) = (16)		invelope	aica	10	(17)			
Air permeability value applies if	a pressurisation test has	s been don	e or a deg	ree air pei	, meability	is being u	sed		0.71	(10)			
Number of sides sheltered									1	(19)			
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.92	(20)			
Infiltration rate incorporating	g shelter factor			(21) = (18)	x (20) =				0.65	(21)			
Infiltration rate modified for	monthly wind speed								L				
Jan Feb M	ar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind spee	d from Table 7								L				
(22)m= 5.1 5 4.9	9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7					
Wind Factor (22a)m = (22)r	n ÷ 4												
(22a)m= 1.27 1.25 1.2	3 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18					

Adjust	ed infiltra	ation rat	e (allowi	ng for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m				_		
	0.83	0.82	0.8	0.72	0.7	0.62	0.62	0.6	0.65	0.7	0.74	0.77			
Calcul	ate effec	ctive air	change i tion:	rate for t	he appli	cable ca	se								
lf exh	aust air he		using Anne	endix N (2	3h) - (23a) x Fmv (e	equation (N	(15)) other	wise (23h) – (23a)			0		
If bal	anced with	heat reco		iency in %	allowing f	or in-use f	actor (from	n Table 4h) –) = (200)			0		
a) If		d moch			with hor				y = (2)	2b)m i (22b) v [1 (220)	0		(230)
a) II (24a)m-									() (22)	$\frac{20}{10}$		1 - (230)]]		(24a)
(2-40)11-		d moob			without	boot roc			m = (2)		22h)	Ū	l		(2.103)
(24b)m-								0 (240	0 $11 = (22)$		230)	0	1		(24b)
(240)III-			tract vor				vontilatio	n from c	vuteido	Ŭ	Ů	Ů	J		(,
0) 11	if (22b)n	1 < 0.5 ×	(23b), t	hen (24	c) = (23b)); other	vise (24	c) = (22b)	b) m + 0.	5 × (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	on or wh en (24d)	ole hous m = (22)	e positiv	/e input v erwise (2	ventilatio 4d)m –	on from 1 0.5 + [(2)	oft 2h)m² x	0 51					
(24d)m=	0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.71	0.75	0.77	0.79]		(24d)
Fffe	ctive air	change	rate - er	L ter (24a) or (24t) or (24	L c) or (24	d) in boy	(25)			I	1		
(25)m=	0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.71	0.75	0.77	0.79			(25)
													1		
3. He	at losse	s and he	eat loss p	Daramet	ər:							1 -1			· •
ELEN	/IEN I	area	ss (m²)	Openin	gs I ²	Net Ar A ,r	ea n²	W/m2	K	AXU (W/I	<)	k-value	e K	A X kJ/l	к К
Doo <mark>rs</mark>						1.9	x	1.4	= [2.66					(26)
Windo	ws Type	:1				1.67	x1.	/[1/(4.8)+	0.04] =	6.72					(27)
Windo	ws Type	2				0.84	x1.	/[1/(4.8)+	0.04] =	3.38	Ē.				(27)
Walls	Type1	45.3	3	2.51		42.79) X	2.1	=	89.86					(29)
Walls	Type2	15.3	9	1.9		13.49) X	2.1	=	28.33					(29)
Roof		31.9	9	0		31.9	x	0.28	=	8.93					(30)
Total a	area of e	lements	, m²			92.59)								(31)
* for win ** includ	ndows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	formula 1,	/[(1/U-valu	ie)+0.04] a	ns given in	paragraph	1 3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				139	.89	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0		(34)
Therm	al mass	parame	ter (TMF		- TFA) ir	n kJ/m²K			Indica	tive Value	: High		45	0	(35)
For desi can be ι	ign assess used instea	ments wh ad of a de	ere the de tailed calci	tails of the ulation.	constructi	ion are not	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f			_
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						14	1	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)									_
Total f	abric he	at loss							(33) +	(36) =			153	.89	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)	1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	27.09	26.65	26.23	24.25	23.88	22.15	22.15	21.83	22.81	23.88	24.63	25.41	J		(38)
Heat ti	ransfer o	coefficier	nt, W/K	-					(39)m	= (37) + (3	38)m				
(39)m=	180.97	180.54	180.12	178.14	177.76	176.04	176.04	175.72	176.7	177.76	178.52	179.3			-
									/	Average =	Sum(39)1	12 /12=	178	.13	(39)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	3.55	3.54	3.53	3.49	3.49	3.45	3.45	3.45	3.46	3.49	3.5	3.52		
L	r of dov		oth (Tab						/	Average =	Sum(40) ₁ .	12 /12=	3.49	(40)
	.lan	Feb	Mar	Anr	May	Jun	Jul	Αυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
Ľ														
4. Wat	ter heat	ting ener	gy requi	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	upancy, I 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (1	ΓFA -13.	1. 9)	72		(42)
Annual Reduce t not more	averag he annua that 125	e hot wa al average litres per p	ater usag hot water person per	ge in litre usage by s day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed : ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.04		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					1	
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54		
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	OTm / 3600) kWh/mon	Fotal = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	900.48	(44)
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55		_
lf instanta	aneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Fotal = Su	m(45) ₁₁₂ =		1180.67	(45)
(46)m=	18.36	16.06	16.57	14. <mark>45</mark>	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78		(46)
Water s	storage	loss: e (litres)	includir	ng any so	olar or M	/WHRS	storage	within sa	ame ves	sel		160		(47)
lf comm	nunity h	eating a	nd no ta	ink in dw	velling e	nter 110	litres in	(47)				100		(47)
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water s	storage	loss:		<i>.</i>		(1.1.6.(1	/ I						I	
a) If ma 	anufact	urer's de	eclared l	oss facto	or is kno	wn (kvvr	n/day):					0		(48)
l empei	rature f	actor fro	m l able	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/y€ wlinder l	ear loss fact	or is not	known:	(48) x (49)) =		16	60		(50)
Hot wat	ter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)				0.	03		(51)
Volume	e factor	from Tal	ee secu ble 2a	011 4.3							0	01		(52)
Temper	rature f	actor fro	m Table	2b							0.	78		(52)
Enerav	lost fro	m water	storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =	2	84		(54)
Enter (50) or ((54) in (5	55)	, .,							2.	84		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	m				
(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(56)
If cylinde	r contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04		(57)
Primary	/ circuit	loss (an	inual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated f	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
mod) ר	ified by	factor fi	om Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	t cylinder	r thermo	stat)		I	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)

Combi	loss ca	alculated	for eac	h n	nonth ((61)m =	(60) ÷ 36	65 × (41)	m						
(61)m=	0	0	0		0	0		0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water	hea	ating ca	alculated	l fo	r eacl	n month	(62)m :	= 0.85 ×	(45)m -	+ (46)m +	(57)m +	- (59)m + (61)m	
(62)m=	338.82	302.53	326.89) (305.75	308.83	20	06.86	205.25	216.15	212.93	316.42	318.6	334.96]	(62)
Solar DH	HW input	calculated	using Ap	pen	ndix G or	Appendix	:Н(negativ	ve quantity	v) (enter '	0' if no sola	r contrib	ution to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	Sa	nd/or V	WWHRS	ap	plies	, see Ap	pendix	G)				_	
(63)m=	0	0	0		0	0		0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter				_							_	_	
(64)m=	338.82	302.53	326.89) (305.75	308.83	20	06.86	205.25	216.15	212.93	316.42	318.6	334.96		_
										Ou	tput from w	ater hea	er (annual)	12	3393.99	(64)
Heat g	ains fro	m water	heating	g, k	Wh/mo	onth 0.2	5 ´	[0.85	× (45)m	+ (61)ı	m] + 0.8 x	x [(46)r	n + (57)m	+ (59)m	n]	
(65)m=	143.4	128.36	139.44	, ,	131.41	133.43	6	0.05	59.22	62.85	62.07	135.95	135.69	142.12		(65)
inclu	de (57)	m in calo	culatior	n of	(65)m	only if c	ylir	nder is	s in the c	dwelling	or hot w	ater is	from com	munity ł	neating	
5. Int	ernal g	ains (see	Table	5 a	and 5a)):										
Metab	olic gaiı	ns (Table	e 5), Wa	atts												
	Jan	Feb	Mar		Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	85.98	85.98	85.98		85.98	85.98	8	5.98	85.98	85.98	85.98	8 <mark>5.98</mark>	85.98	85.98		(66)
Lightin	g gains	(calcula	ted in A	٠ ٩	endix l	L, equat	ion	L9 oi	r L9a), a	lso see	Table 5					
(67)m=	17.13	15.21	12.37		9.36	7	5	5.91	6.39	8.3	11.14	14.15	16.51	17.6		(67)
Applia	nces ga	ains (ca <mark>lc</mark>	ulated	in /	Append	dix L, eq	uat	ion L'	13 or L1:	3a), als	o see Ta	ble 5			-	
(68)m=	149.83	151.39	147.47	· [·	139 <mark>.13</mark>	128.6	1	18.7	112.09	110.54	114.45	122.8	133.32	143.22]	(68)
Cookir	g gains	s (calcula	ted in <i>i</i>	App	pendix	L, equat	ion	L15	or L15a)	, also s	ee Table	5			-	
(69)m=	31.6	31.6	31.6	Ť	31.6	31.6	3	31.6	31.6	31.6	31.6	31.6	31.6	31.6	1	(69)
Pumps	and fa	ns gains	(Table	5a	ı)											
(70)m=	10	10	10	Τ	, 10	10		10	10	10	10	10	10	10]	(70)
Losses	s e.a. e	vaporatic	n (nea	 ativ	ve valu	es) (Tab	le (5)			1	1			1	
(71)m=	-68.78	-68.78	-68.78		-68.78	-68.78	-6	, 8.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78]	(71)
Water	heating	u dains (1	able 5)			I				1				1	
(72)m=	192.75	191.01	187.41	, .	182.52	179.34	6	33.4	79.6	84.47	86.2	182.73	188.45	191.02	1	(72)
Total i	nterna	l gains =	I	_				(66)	m + (67)m	+ (68)m	+ (69)m +	(70)m +	 (71)m + (72))m	1	
(73)m=	418.5	416.4	406.04		389.8	373.73	26	6.81	256.87	262.1	270.59	378.47	397.08	410.63	1	(73)
6. So	lar gain	s:									1				1	
Solar g	ains are	calculated	using so	lar fl	lux from	Table 6a	and	associ	ated equa	tions to c	onvert to th	ne applic	able orientat	tion.		
Orienta	ation:	Access F	actor		Area			Flu	х		g_		FF		Gains	
		Table 6d			m²			Tab	ole 6a	-	Table 6b		Table 6c		(W)	
East	0.9x	1		×	1.6	67	x	1	9.64	x	0.85	x	0.7	=	13.52	(76)
East	0.9x	1		×Ē	1.6	67	x	3	8.42	x	0.85	x	0.7	=	26.46	(76)
East	0.9x	1		×Ī	1.6	67	x	6	3.27	x	0.85	x	0.7	=	43.57	(76)
East	0.9x	1		×Ī	1.6	67	x	9	2.28	x	0.85	x	0.7	=	63.54	(76)
East	0.9x	1		×Ī	1.6	67	x	1'	13.09	x	0.85	x	0.7	=	77.88	(76)

East	0.9x	1)	(1.67		x	1	15.77	1 x	0.85	x	0.7	=	79.72	(76)
East	0.9x	1	,	(1.67		x	1	10.22] x	0.85	×	0.7	=	75.9	(76)
East	0.9x	1		(1.67		x	9	94.68	x	0.85	×	0.7	=	65.19	(76)
East	0.9x	1		(1.67		x	7	73.59	x	0.85	×	0.7	=	50.67	(76)
East	0.9x	1		(1.67		x	4	15.59	x	0.85	×	0.7	=	31.39	(76)
East	0.9x	1	,	(1.67		x	2	24.49	x	0.85	×	0.7	= =	16.86	(76)
East	0.9x	1)	(1.67		x	1	6.15	×	0.85	×	0.7	=	11.12	(76)
West	0.9x	0.77)	(0.84		x	1	9.64	×	0.85	×	0.7	=	6.8	(80)
West	0.9x	0.77		(0.84		x	3	38.42	x	0.85	x	0.7	=	13.31	(80)
West	0.9x	0.77)		0.84		x	6	63.27	x	0.85	x	0.7	= =	21.92	(80)
West	0.9x	0.77)		0.84		x	g	92.28	x	0.85	x	0.7	=	31.96	(80)
West	0.9x	0.77)	(0.84		x	1	13.09	x	0.85	x	0.7	=	39.17	(80)
West	0.9x	0.77)	(0.84		x	1	15.77	x	0.85	x	0.7	=	40.1	(80)
West	0.9x	0.77)	(0.84		x	1	10.22	x	0.85	x	0.7	=	38.18	(80)
West	0.9x	0.77)	(0.84		x	g	94.68	x	0.85	x	0.7	=	32.79	(80)
West	0.9x	0.77)	(0.84		x	7	73.59	x	0.85	x	0.7	=	25.49	(80)
West	0.9x	0.77)	(0.84		x	4	15.59	x	0.85	x	0.7	=	15.79	(80)
West	0.9x	0.77)		0.84		x	2	24.49	x	0.85	x	0.7	=	8.48	(80)
West	0.9x	0.77	>	<	0.84		x	1	6.15	x	0.85	x	0.7	-	5.59	(80)
Solar (<mark>gains in</mark>	watts, <mark>ca</mark>	lculate	d '	for each n	nont	h			(83)m	n = Sum(74)m	<mark>(8</mark> 2)m			-	
(83)m=	20.33	39.76	65.49		95.51 1	17.05		19.82	114.07	97.	99 76.16	47.18	25.35	16.72		(83)
l otal g	jains – I	nternal a	nd sola	ar ((84)m = (1)	(3)m) + (83)m	, watts					r	-	(2.1)
(84)m=	438.82	456.17	471.53		485.31 4	90.78		86.63	370.94	360	.09 346.75	425.6	5 422.43	427.35		(84)
7. Me	ean inter	nal temp	erature	e (heating se	easo	n)									
Temp	perature	during h	eating	pe	eriods in th	ne liv	/ing	area	from Tab	ole 9	, Th1 (°C)				21	(85)
Utilis	ation fac	tor for ga	ains for	' liv	ving area,	h1,ı	n (s	ee Ta	uble 9a)				-1	. <u> </u>	-	
	Jan	Feb	Mar	\downarrow	Apr	Мау	′	Jun	Jul	A	ug Sep	Oct	: Nov	Dec	4	
(86)m=	1	1	1		1 (0.99		0.98	0.96	0.9	06 0.99	0.99	1	1		(86)
Mear	interna	l tempera	ature in	ı li	ving area	T1 (follo	w ste	ps 3 to 7	7 in T	able 9c)		1		-	
(87)m=	18.7	18.82	19.09		19.5 1	9.95	2	20.33	20.62	20.	59 20.21	19.72	19.16	18.69		(87)
Temp	erature	during h	eating	ре	eriods in re	est o	f dw	elling	from Ta	able 9	9, Th2 (°C)					
(88)m=	18.5	18.5	18.51		18.52 1	8.53	1	8.54	18.54	18.	54 18.54	18.53	8 18.52	18.51		(88)
Utilis	ation fac	tor for ga	ains for	re	est of dwe	lling	, h2	,m (se	e Table	9a)						
(89)m=	1	1	1	Τ	0.99	0.97		0.93	0.74	0.7	79 0.96	0.99	1	1	7	(89)
Mear	interna	l tempera	ature in	n tł	ne rest of	dwe	llina	T2 (f	ollow ste	eps 3	to 7 in Tab	le 9c)	•		_	
(90)m=	15.72	15.89	16.3	Ť	16.91 1	7.56	T	18.1	18.45	18.	42 17.95	17.23	3 16.4	15.72	7	(90)
	L	ı 1			I						I	fLA = Li	ving area ÷ (4) =	0.56	(91)
Mear	interna	l tempera	ature (f	٥r	the whole	wh e	ellin	a) – ti	A 🖌 T1	+ (1	– fl Δ) ∨ Т2				L	I
(92)m=	17.4	17.54	17.88	T	18.37 1	8.91		97 – 11 19.36	19.68	19.	64 19.23	18.64	17.96	17.4	7	(92)
· / ···	·									L .		1		I	_	

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.4	17.54	17.88	18.37	18.91	19.36	19.68	19.64	19.23	18.64	17.96	17.4		(93)
8. Spa	ace hea	ting requ	uirement	1										
Set Ti the ut	i to the i ilisation	mean int factor fo	ernal ter or gains	mperatui using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	1:										
(94)m=	1	1	0.99	0.99	0.98	0.96	0.89	0.91	0.98	0.99	1	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	437.56	454.52	468.92	480.21	478.93	371.28	331.46	328.34	338.5	420.71	420.51	426.26		(95)
Month	nly aver	age exte	ernal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	2371.45	2282.87	2048.88	1687.65	1282.2	838.12	541.94	570.08	905.94	1429.07	1938.56	2366.27		(97)
Space	e heatin	g require	ement fo	r each n	honth, k	Nh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	1438.81	1228.65	1175.49	869.36	597.63	0	0	0	0	750.22	1092.99	1443.37		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	8596.54	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								168.56	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	HP)					
Spac	e heatir	ng:												-
Space heating: Fraction of space heat from secondary/supplementary system														(201)
Fracti	ion of sp	bace hea	at from n	nain syst	em(s)			(20 <mark>2)</mark> = 1 ·	- (201) =				1	(202)
Fracti	ion of to	tal hea <mark>ti</mark> i	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of i	main s <mark>pa</mark>	ace heat	ing syste	em 1								88.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						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))								
	1438.81	1228.65	1175.49	869.36	597.63	0	0	0	0	750.22	1092.99	1443.37		
(211)m	n = {[(98)m x (20	94)] } x 1	00 ÷ (20)6)									(211)
	1618.46	1382.06	1322.27	977.91	672.25	0	0	0	0	843.9	1229.46	1623.59		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	II.	9669.9	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)]}x1	00 ÷ (20	8)		-					-			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	F	0	(215)
Water	heating	J												_
Output	from w	ater hea	ter (calc	ulated a	bove)									
	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		-
Efficier	ncy of w	ater hea	iter										78.8	(216)
(217)m=	86.78	86.7	86.49	86.03	85.18	78.8	78.8	78.8	78.8	85.64	86.4	86.8		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100) ÷ (217) 377.06	M 355 20	362 56	262 52	260 /17	274 2	270 21	360 /6	368 75	385 88		
(213)11=	550.44	0-10.92	577.90	555.58	502.00	202.02	200.47	Tota	= Sum(2)	19a) -	500.75	000.00	1006.06	
Annua	l totala							1010	. Juni2		Nh/voo-		4020.00	_(<u>219)</u>
Space	heating	fuel use	ed. main	system	1					ĸ	wii/year		9669 9	7
Opulle	nouting	1001 000	sa, mun	5,50011	•								3003.3	

Water heating fuel used			4026.86	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		12	.0 (230	
boiler with a fan-assisted flue		4	5 (230	
Total electricity for the above, kWh/year	sum	n of (230a)(230g) =	165 (231	
Electricity for lighting			302.44 (232	
12a. CO2 emissions – Individual heating systems including micro-CHP				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	2088.7 (261	
Space heating (secondary)	(215) x	0.519 =	0 (263	
Water heating	(219) x	0.216 =	869.8 (264	
Space and water heating	(261) + (262) + (263) +	(264) =	2958.5 (265	
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	85.64 (267	
Electricity for lighting	(232) x	0.519 =	156.96 (268	
Total CO2, kg/year		sum of (265)(271) =	3201.1 (272	
Dwelling CO2 Emission Rate		(272) ÷ (4) =	62.77 (273	
El rating (section 14)			55 (274	