MLM

Energy Statement

for

317 Finchely Road London

produced for

317 Finchley Road Limited



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Multidisciplinary Consulting

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1 Introduction

MLM were commissioned to undertake an Energy Statement to accompany the planning application for the re-development of the site at 317 Finchley Road, Camden, London.

The development consists of the demolition of existing buildings and erection of 22 new build residential units and one commercial unit, associated landscaping and ancillary works.

The proposed development is located in the London Borough of Camden. The Greater London Authority and London Borough of Camden are the Regional and Local Bodies that set the Planning Policy Context, referencing to National Standards and Regulations.

The proposed development is required by the London Borough of Camden and the Greater London Authority to make carbon emission reductions in accordance with the London Plan's Energy Hierarchy and meet a 35% carbon emissions reduction over the current Building Regulations Part L2013 minimum requirements. The London Borough of Camden requires the development to achieve 20% carbon reduction by renewable energy on-site where feasible.

The aim of this report is to assess feasible carbon emissions reductions through the implementation of efficient energy measures, the use of an on-site Combined Heat and Power (CHP) system and finally the use of zero carbon technologies.

This report demonstrates how the design has followed the London Plan's Energy Hierarchy by reducing energy demand of the development. Measures proposed include passive design, energy efficiency measures, generating heat in a clean and efficient system and by using on-site renewable energy systems to further reduce the overall carbon emissions of the development.

The methodology applied follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the London Plan: The Spatial Development Strategy for London consolidated with alterations since 2011 (March 2015).

The energy consumption figures for the proposed development are based on SAP modelling data produced under Building Regulations Part L1A 2013 software compliant for the residential part of the scheme. The energy consumption figures, for the communal part of the scheme are based on SBEM Benchmark in line with Building Regulations Part L2A 2013 Compliant Software.

The proposed Sustainability Principles and Engineering Concepts incorporate the requirements and guidelines of the relevant British Standards, CIBSE Guides and DfE Building Bulletins.

2 Executive Summary

The proposed development will implement significant energy efficiency measures, a Combined Heat and Power System, Air Source Heat Pumps and Photovoltaic system to achieve the required carbon emission reductions by the Local Authority and the London Plan. The strategy detailed within this report follows the Greater London Authority's Energy Hierarchy and achieves a 35.03% improvement in CO_2 emissions over Building Regulations 2013 minimum requirements.

The carbon emissions baseline for the scheme has been identified at 39,160kg CO_2/yr for space heating, domestic hot water, lighting and auxiliary (regulated emissions). To ensure Compliance with the Planning Requirements, the schemes needs to reduce its carbon emission by 13,706 kg CO_2/yr .

The following strategy has been implemented site wide:

- 'Be Lean': Energy efficiency measures to improve the building fabric and services includes: High performance U-Values (0.13 for external walls, 0.12 for roof, 0.12 for the ground floor, 0.00 for partition walls and 0.8 for windows (Triple glazed) in W/m²K, good air tightness (maximum of 3m³/m²/hr at 50Pa).
- 'Be Clean': A CHP has been deemed feasible for the scheme and will provide approximately 60% of the heating and hot water demand.
- 'Be Green': Air Source Heat Pumps and photovoltaic systems have been identified as suitable for the proposed scheme. Other zero carbon technologies are assessed within this report.

The energy efficiency measures included within this report represent current best practice and the use of a low and zero carbon technology.

	Carbon Dioxide Emissions (Tonnes/ Annum)	Incremental CO ₂ Emissions Reduction (%)	Cumulative CO2 Emissions Reduction (%)
Step 1 – Baseline	39.16	-	-
Step 2 – 'Be Lean'	36.32	7.26	
Step 3 – 'Be Clean'	28.16	20.82	-
Step 4 – `Be Green'	25.44	6.95	35.03

The conclusions of the assessment can be summarised by the following table:

The following graph illustrates the carbon savings for each stage of the Greater London Authority's Energy Hierarchy against the previous stage.



3 Planning Requirement

This energy statement has been designed to adhere to the National, Regional and Local Policies. The proposed development is located within the Greater London area and is therefore requested to implement the London Plan Energy Hierarchy from GLA Energy Team Guidance on Planning Energy Assessments, Version 1, 2011, with amendment March 2015.

3.1 Baseline Model

The baseline has been taken from the Target Emission Rate (TER) worksheet of the SBEM and SAP Models. Following the London Plan Guidance, the baseline has been created with a gas boiler.

3.2 'Be Lean'

Implementation of energy efficient 'Be Lean' measures specific to the scheme is encouraged at the earliest Design Stage of a development and aims to reduce the energy demand. Measures typically include passive design: both Architectural and building fabric measures, and active design: energy efficient services. It is possible to exceed Building Regulations Requirements (Part L 2013) through reduced energy demand ('Be Lean') measures alone.

3.3 'Be Clean'

3.3.1 Decentralised Energy Networks Section

The GLA require developers to prioritise connection to existing or planned decentralised energy networks where feasible. The London heat map below has been developed to help Developers identify decentralised energy opportunities in London.



Map 5.1 Heat density in London (relative heat demand based on fuel use kWh/m2/year)

Source: Centre for Sustainable Energy. © Crown copyright. All rights reserved. Greater London Authority 100032379 (2009)

3.4 Decentralised Energy in Development Proposals Section 3.6

The use of the 'clean' energy supply refers to the energy efficiency of heating, cooling and power systems. Planning applications should demonstrate how the heating, cooling and power systems have been selected to minimise carbon emissions in accordance with the following hierarchy (Policy 5.6):

- a The proposed development should evaluate the feasibility of the use of Combined Heat and Power (CHP) systems. Where a new CHP system is appropriate, opportunities to extend the system beyond the site boundary to adjacent sites should be examined.
- b Major developments should select energy systems in accordance with the following hierarchy:
 - Connection to existing heating or cooling networks;
 - Site wide CHP network;
 - Communal heating and cooling.
- c Potential opportunities to meet the first priority in this hierarchy are outlined in the above London heat map. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Cooling

Where design measures and the use of natural and/or mechanical ventilation will not guarantee occupant comfort, a cooling strategy should be specified.

Where appropriate, the cooling strategy should investigate opportunities to improve efficiency through the use of locally available sources such as ground cooling, river/dock water cooling.

3.5 'Be Green' Section

The use of renewable energy in developments is encouraged at the 'Be Green' stage. Each renewable energy technology in Policy 5.7 of the London Plan are technically feasible in London and each should be considered in the Energy Statement.

All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets.

Figure 2 provides a graphical representation of the London Plan Energy Hierarchy.



DIAGRAM: GLA, The London Plan - consolidated with alterations since 2004 (2008) www.london.gov.uk/thelondonplan

Figure 2 - Energy Hierarchy Diagram, London Plan

The sample Output Documents and Energy Reports can be found in Appendix A.

4 'Be Lean' Stage – Reduction by Energy Efficiency Measures

Specific energy efficient measures have been identified, reviewed and appraised for the proposed scheme. The sample Output Documents and Energy Reports can be found in Appendix B.

The measures outlined in this section result in an annual carbon emission saving of 7.26% which equate to 2,843kg CO₂/yr saved over the baseline.

4.1.1 Proposed Measures (Residential Part of the Development)

The following measures are applicable to the residential part of the scheme and allow the proposed development to comply with Building Regulation Part L1A 2013.

The energy efficiency measures include:

Passive

The development has been orientated to suit the site conditions.

Enhanced Building Fabric U-Values

Enhancements of the building fabric will be used.

The table below demonstrates the limiting U-Value set by Approved Document Part L and the proposed U-Value for the development.

Elements	Building Regulations Part L 1A 2013 minimum U-Value (W/m ² K)	Proposed U-Value (W/m²K) Indicative Build-Up
External Walls	0.30	0.13
Party Walls	0.50	0.00
Floor	0.25	0.13
Roof	0.20	0.12
Windows (Triple Glazing)	2.00	0.80

Enhanced Air Tightness

The proposed development will be designed to high performance with good air tightness. It is proposed that the scheme not exceed an air permeability level of $3m^3/hr/m^2$ at 50Pa during testing.

This target will be achieved by ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed and all punctures through the seal are air-tight. The Design Team must ensure that all opening both major and minor, such as services, be accounted for and assessed to reduce air leakage.

Thermal Junctions

Heat lost through thermal bridges has a significant impact on the performance of a building's external envelope; this becomes ever more so as buildings become more airtight and more carefully insulated.

High-impact thermal bridges generally occur where two thermal elements meet (for example, the floor slab and perimeter wall), or where a thermal element is penetrated by a conductive material, such as steel or concrete. The heat loss through this junction is measured in W/m.K, and is known as a ' ψ ' (psi) value; the average of these values is taken to provide the Y-Value, a figure which is ultimately entered into SAP software to measure the overall fabric energy efficiency.

The Design Team has agreed to mitigate the cold bridges and eliminate the potential for surface condensation; therefore, the average Y-Value targeted will be no more than 0.08W/mK.

Ventilation

The dwellings will be fitted with mechanical ventilation with heat recovery.

Dwelling Type	Efficiency	Specific Fan Power (W/I/s)
Kitchen + 1 Wet Room	94%	0.40
Kitchen + 2 Wet Rooms	94%	0.43
Kitchen + 3 Wet Rooms	94%	0.53
Kitchen + 4 Wet Rooms	93%	0.65

Heating

Space heating is to be supplied from a central heating system. The energy centre will include boiler and Combined Heat and Power Unit. Space heating will be distributed via an under floor heating systems.

The flues will be extended to roof level. Flue discharge will be in line with the Clean Air Act.

Cooling

Cooling will not be provided.

Domestic Hot Water

The domestic hot water will be provided by the main system.

Lighting

All lighting will be dedicated low energy fittings.

Lighting systems to a number of spaces may include LED technology where viable and subject to the performance of each product being able to deliver to the performance requirements of the space served.

4.1. 2 Proposed Measures (Commercial Part of the Development)

The following measures are applicable to the commercial part of the scheme and allow the proposed development to comply with Building Regulation Part L2A 2013.

The energy efficiency measures include:

Passive

The development has been orientated to maximise the benefit from solar gain.

Enhanced Building Fabric U-Values

Enhancements of the building fabric will be used, the table below demonstrates the limiting U-Values set by the Approved Document Part L and the proposed U-Value for the proposed development.

Elements	Building Regulations Part L 2A 2013 minimum U-Value (W/m ² K)	Proposed U-Value (W/m²K) Indicative Build-Up
External Walls	0.35	0.13
Party Walls	0.50	0.00
Floor	0.25	0.13
Roof	0.25	0.12
Windows (Double Glazing)	2.20	1.4

Enhanced Air Tightness

The proposed development will be designed to high performance with good air tightness. It is proposed that the scheme does not exceed an air permeability level of $7m^3/hr/m^2$ at 50Pa during testing.

This target will be achieve by ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed and all punctures through the seal are air-tight.

The Design Team must ensure that all openings, both major and minor, such as services, be accounted for and assessed to reduce air leakage.

Ventilation

The ventilation has been assumed to have a specific fan power of 1.80W/l/s.

Heating/Cooling

Space heating and Cooling will be supplied by a split system. The condenser will be located outside at lower level.

Domestic Hot Water

The domestic hot water will be provided by instantaneous electric point of use water heaters.

Lighting

The lighting for the retail area and storage areas has been modelled at 85 luminaire lumens per circuit watt, tall other area will be at 70 lamp lumens per circuit watt.

5 'Be Clean' – Selection of Low Carbon Energy Supply Strategy

5.1 Connection to Existing Low Carbon Heating Infrastructure

The site is not located near an existing communal heating network. The plant room of the proposed development will be design to ensure that enough space is available when a district heating system will be available.

5.2 Feasibility of CHP Scheme

It is possible to incorporate CHP (energy centre) into the scheme to meet the London Plan Hierarchy of providing 'clean' energy. The electricity generated will be harnessed directly by the development. Should the demand not be there at all times, excess electricity generated will be exported to the grid.

The CHP will be sized to deliver 60% of the annual energy demand of the development.

Flue arrangements for the CHP and boiler plant will be carefully considered and calculated against all relevant British Standard Criteria to ensure flue gases are dissipated above dwellings and buildings, both on the development site and any adjacent and in close proximity to the site.

Combined Heat and Power (CHP) – only applicable to the residential part of the development

Combined Heat and Power Generation (CHP) is an important technology for efficient fuel use and can use biomass or gas as the fuel source. The sample Output Documents and Energy Reports can be found in Appendix C.

A gas-fired CHP is regarded as a low carbon technology, not a true renewable. Should the supply of fuel to the CHP be biomass then the system can be considered as a true renewable system.

CHP primarily offers carbon emission reductions by reducing the amount of electricity imported from the national grid – a 'carbon heavy' source of electricity.

The system produces electricity that can be used in the building or exported to the grid, and heat for space, water and even process heating. Systems must be heat led for high efficiency, which best suits applications to situations where there is a significant demand for heat for long periods of time (particularly through the summer period). This will also apply to residential developments, hospitals, hotels and leisure centres (swimming pools being ideal).

The split of heat to power and losses in both types of CHP systems are slightly different, but in principal each unit of gas supplied would generate approx 35% electricity, 50% heat and 15% in losses.

CHP units operate most efficiently when supplying the base load of the building. Given the nature of the building (predominantly domestic) the base load will be on the lower side and with peaks and troughs throughout the occupied period; we are, therefore, proposing a base load of 60% of the annual energy demand.

6 'Be Green' – Renewable Technologies

6.1 Green Technologies

The following types of green/renewable energy technologies have been considered:

- Air Source Heat Pump.
- Photovoltaic Cells;

Other renewable technology options were investigated and discounted.

These alternative technologies included:

- Solar Thermal;
- Wind Turbines;
- Biomass Boiler;
- Ground Source Heat Pump.

The justification for discounting these technologies can be found in Appendix E.

6.2 Proposed Green Measures

Subject to the consideration of the technologies previously discussed, the following green measures will be incorporated into the proposed building to reduce fossil fuel consumption and mitigate carbon emissions:

6.2.1 Chosen Technology

Air Source Heat Pump (only applicable to the commercial part of the development)



A heat pump extracts heat from the ground, air or water and transfers it to a heating system. Often coupled to underfloor heating, as the temperatures involved are usually lower (around 40° where a boiler will be 80°), an electric pump circulates the water in the system. Ground source heat pumps (GSHP) and air source heat pumps (ASHP) are currently the most common type of heat pump used in the UK, and use technology which is essentially the same as a

fridge. A typical GSHP system will include a ground heat exchanger (for extracting heat from the ground), the heat pump itself and a heating system.

The overall efficiency of a heat pump is determined by the difference in temperature between the heat source itself (the ground, air or water) and the temperature of the area or environment to be heated. The smaller the temperature difference the higher the coefficient of performance (COP) will be.

Typical COPs will be in the range two - four depending upon operating conditions. Heat pumps can supply 100% of heat demand, but it will usually only pre-heat domestic hot water, so an additional method of heating the hot water (e.g. an immersion heater) may be needed.

Units range in size but the smaller ones only require equipment approximately the size of a small air conditioning unit on the outside of the property.

Air source heat pumps can be connected in series and thus provide a heating system, modules only work as and when demand requires thus providing excellent efficiencies. The commercial unit will have its own system to reduce the number of units needed in order to serve this development and associated space.

Photovoltaic Panels (PV)



PV systems convert energy from the sun into electricity through semi-conductor cells. A cell consists of two thin layers of different semi-conducting materials, usually based on silicon. When light shines on the cell, a difference in energy is created – otherwise known as voltage. This voltage is used to produce a direct

current (DC), which can be used directly or converted into alternating current (AC). AC can be exported to the local electricity network/national grid. The brighter the sunlight, the more power is produced. Shading from other objects (such as nearby buildings and trees) will affect performance and PV cells are more likely to show a drop in output than solar thermal panels. As with solar hot water, the panels should face as close to due south as possible and be unshaded for most of the day. An individual PV cell only produces a small amount of power, therefore they are usually connected together to form a module. Modules can then be linked to form an array and sized to meet the required demand.

The size of a Photovoltaic (PV) installation is expressed by its kilowatt peak (kWp) potential, which is an indication of how much electricity the system could generate at peak/optimum conditions. The electricity generated on-site by Photovoltaic cells would be a direct saving on electricity otherwise sourced from the national grid. The electricity generated would be a direct saving on electricity required for power, lighting, heating and hot water (depending on systems installed). Whilst expensive it should be noted that PV technology off-sets three times the carbon dioxide from grid supplied electricity compared to technology which reduces natural gas consumption therefore as a single simplistic solution it compares favourably.

Initial calculations suggest that the proposed scheme should be able to accommodate a 5.5 kWp system. The arrays of photovoltaic cells will be provided on the scheme, which will contribute approximately 4,750kWh of renewable electricity per annum. This contribution equates to approximately 33m² of cells.

This area may reduce significantly dependant on final cell specification and optimum orientation and pitch angle being achieved. The Project Team has identified and established adequate roof space to accommodate a photovoltaic array of this size and provide appropriate safe access for maintenance purposes.

7 Conclusion

This report has followed the London Plan: The Spatial Development Strategy for London consolidated with alterations since 2011 (March 2015) Strategy and Philosophy and in doing so has identified measures to improve energy efficiency and mitigate CO_2 emissions of the proposed development.

The following table provides a summary of the improvements recognised by each step of the energy hierarchy approach:

	Carbon Dioxide Emissions (Tonnes/ Annum)	Incremental CO₂ Emissions Reduction (%)	Cumulative CO2 Emissions Reduction (%)
Step 1 – Baseline	39.16	-	-
Step 2 – 'Be Lean'	36.32	7.26	
Step 3 – 'Be Clean'	28.16	20.82	-
Step 4 – 'Be Green'	25.44	6.95	35.03

The use of on-site CHP unit with an overall efficiency of 96% and a heat to power ration of 2 will allow the development to achieve 20.82% carbon reduction against the 'Be Lean' stage. The incorporation of the air source heat pumps and photovoltaic systems will allow the development to achieve an overall carbon savings of 35.06% against Building Regulations Part L 2013. This will exceed the required 35% reduction in emissions, as per the Local Authority Strategy and London Plan. The proposed development has enhanced the fabric and passive measures to high level and followed the London Plan energy hierarchy with the implementation of a combined heat and power unit. All renewable have been assessed and due to site constraint, the site is only suitable for air source heat pumps.

Appendix A - Step One - Baseline Output Document and Energy Report Figures

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	2		Strom Softwa	a Num are Vei	ber: rsion:		Versio	on: 1.0.1.24	
			P	roperty .	Address	flat 1					
Address :											
1. Overall dwelling dime	ensions:			Aro	o(m ²)			iaht(m)		Volumo(m ³)	
Ground floor				Area	a(III-) 57.7	(1a) x		1911(11) > 5	(2a) =	144.25](3a)
					51.1	(10)				144.25	
FIIST HOOF				4	5.67	(1D) X	2	2.5	(20) =	114.17	(30)
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Number of open flues	0	i + [-	0] + [0] = [0	x 2	20 =	0] (6b)
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Number of storeys in th	he dw <mark>elling</mark> (na	5)								0	(9)
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deducting areas of openir	ngs); if equal user	0.35	0	0		,					_
If suspended wooden f	floor, enter 0.2	(unseale	d) or 0.	1 (seale	ed), else	enter 0				0	(12)
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Vindow infiltration	s and doors dr	aught stri	pped		0 25 - [0 2	$\mathbf{x}(14) \div 1$	001 -			0	
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Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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(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					
	0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37		
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		a mecha			without				$p_{\rm m} = (22)$	20)m + (2	230)	0	1	(24b)
(240)11=		0	0		0	0				0	0	0	J	(240)
C) If V if	/hole h (22b)m	ouse ex	tract ver	tilation (or positiv	ve input v	ventilatio	on from c	houtside	5 v (23h)			
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(24d) <mark>m=</mark>	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effec	tive air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)					
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
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ELEW	ENI	area	(m²)	r	95 1 ²	A,r	n ²	W/m2	K K	(W/ł	()	kJ/m²-l	K	kJ/K
Doors						2.1	X	1		2.1				(26)
Window	s Type	1				3.69	x1/	/[1/(1.4)+	0.04] =	4.89	=			(27)
Window	s Type	2				4.83	x1/	/[1/(1.4)+	0.04] =	6.4	=			(27)
Window	s Type	3				3.01		/[1/(1.4)+	0.04] =	3.99	=			(27)
Window	s Type	4				5.01		/[1/(1.4)+	0.04] =	6.64	=			(27)
Floor	51					57.7		0.13		7 501	= г			(28)
Walls T						01.1	~ ~	0.10		7.001				(==)
	vnei	54 0	6	8.52		15.54		0.18		8.2	= F		\dashv	(29)
Walls T	ype1 vne2	54.0	6	8.52		45.54		0.18		8.2				(29)
Walls T	ype1 ype2	54.0 48.7	6 74 m ²	8.52 8.02		45.54	ц х 2 х	0.18		8.2 7.33				(29)
Walls T Total ar	ype1 ype2 ea of e	54.0 48.7 lements	¹⁶ 14 , m ²	8.52 8.02		45.54 40.72 162.6	x 2 x 1	0.18		8.2 7.33				(29) (29) (31)
Walls T Total ar Party w	ype1 ype2 ea of e all	54.0 48.7 lements	6 '4 , m²	8.52 8.02		45.54 40.72 162.6 44.05	x 2 x 1 x	0.18		8.2 7.33 0				(29) (29) (31) (32)
Walls T Total ar Party w * for wind ** include	ype1 ype2 ea of e all ows and the area	48.7 48.7 lements roof winde	6 4 , m ² bws, use e sides of ir	8.52 8.02	ndow U-va	45.54 40.72 162.6 44.05 alue calcul titions	x 2 x 1 5 x ated using	0.18 0.18 0 formula 1	= [= [= [/[(1/U-valu	8.2 7.33 0 re)+0.04] a	s given in	paragraph		(29) (29) (31) (32)
Walls T Total ar Party w * for wind ** include Fabric h	ype1 ype2 ea of e all ows and the area neat los	48.7 48.7 Iements roof winde as on both as, W/K :	, m ² , m ² , m ² sides of ir = S (A x	8.52 8.02 effective wi nternal walk	ndow U-va	45.54 40.72 162.6 44.05 alue calculatitions	x 2 x 1 x 5 x ated using	0.18 0.18 0 1 formula 1 (26)(30)	= [= [= [//(1/U-value) + (32) =	8.2 7.33 0 re)+0.04] a	s given in	paragraph		(29) (29) (31) (32)
Walls T Total ar Party w * for wind ** include Fabric h Heat ca	ype I ype2 ea of e all ows and the area neat los pacity (48.7 48.7 Iements roof winde is on both is, W/K = Cm = S(16 4 , m ² , m ² = S (A x A x k)	8.52 8.02 effective wi nternal walk U)	ndow U-va	45.54 40.72 162.6 44.05 alue calcul titions	x 2 x 1 5 x ated using	0.18 0.18 0 1 formula 1 (26)(30)	= [= [= [//((1/U-value)) + (32) = ((28))	8.2 7.33 0 re)+0.04] a	s given in	paragraph (32e) =		(29) (29) (31) (32) 6 (33) (34)
Walls T Total ar Party w * for wind ** include Fabric I Heat ca Therma	ype1 ype2 ea of e all ows and the area neat los pacity (I mass	54.0 48.7 lements roof winder as on both is, W/K = Cm = S(parame	6 4 , m ² , m ² = S (A x A x k) ter (TMF	8.52 8.02 effective wi nternal wal U) P = Cm ÷	ndow U-va Is and part	45.54 40.72 162.6 44.05 alue calcul titions	x 2 x 1 5 x ated using	0.18 0.18 0 formula 1 (26)(30)	= [= [= [= [//((1/U-valu)) + (32) = ((28) Indica	8.2 7.33 0 (a)+0.04] a .(30) + (32) tive Value:	2) + (32a)	paragraph (32e) =		(29) (29) (31) (32) (6 (33) (34) (34)
Walls T Total ar Party w * for wind ** include Fabric h Heat ca Therma For desig	ype I ype2 ea of e all ows and the area neat los pacity (I mass n assess red instat	54.0 48.7 lements roof winde as on both ss, W/K = Cm = S(parame sments wh ad of a de	4 , m ² , m ² = S (A x A x k) ter (TMF ere the de tailed calc	B.52 $B.02$	ndow U-va ls and part - TFA) ir construct	45.54 40.72 162.6 44.05 alue calcul titions	x 2 3 3 3 4 1 3 5 4 8 4 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8	0.18 0.18 0 formula 1 (26)(30)	= [= = [= = [//((1/U-value) + (32) = ((28) Indica e indicative	8.2 7.33 0 re)+0.04] a .(30) + (32 tive Value: values of	2) + (32a) Medium TMP in Ta	paragraph (32e) = able 1f		(29) (29) (31) (32) (6 (33) (34) (34) (35)

if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	:1)								
Total fabric heat loss									(33) +	(36) =			50.56	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	49.46	49.2	48.94	47.72	47.49	46.43	46.43	46.23	46.84	47.49	47.95	48.43		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	100.02	99.75	99.49	98.27	98.05	96.98	96.98	96.79	97.39	98.05	98.51	98.99		
Heat le	oss para	meter (I	HLP), W/	/m²K					(40)m	Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	98.27	(39)
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.95	0.96		
										Average =	Sum(40)1.	12 /12=	0.95	(40)
Numb	er of day	vs in mo	nth (Tab	le 1a)	i	i	i	i	i	i	i	i		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
Δεειιά	ned occi	inancy	N									77	1	(42)
if TF	FA > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.0	0013 x (⁻	TFA -13.	9)	11		(42)
if TF	A £ 13.9	9, N = 1				· ·								
Annua	I averag	e hot wa	ater usag	ge in litre	es per da 5% if the c	ay Vd,av	erage =	(25 x N)	+ 36 a water us	se target o	99	.95		(43)
not mor	e that 125	litres per	person per	r day (all w	ater use, l	hot and co	ld)	to actileve	a water ut	se largel o	1			
	Jan	Feb	Mar	Apr	May	Jun		Aug	Sep	Oct	Nov	Dec	1	
Hot wat	er usage i	n litres per	r day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from	Table 1c x	(43)		001		000		
(44)m=	109.95	105.95	101.95	97.96	93.96	89.96	89.96	93.96	97.96	101.95	105.95	109.95	1	
			<u> </u>							L Total = Su	m(44) ₁₁₂ =	=	1199.45	(44)
Energy	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,i	m x nm x L	DTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	163.05	142.61	147.16	128.3	123.1	106.23	98.44	112.96	114.31	133.21	145.41	157.91		
										Total = Su	m(45) ₁₁₂ =	-	1572.67	(45)
lf instan	itaneous w	ater heati	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46	i) to (61)	r	r	r	1	
(46)m=	24.46	21.39	22.07	19.24	18.47	15.93	14.77	16.94	17.15	19.98	21.81	23.69		(46)
Storac		IUSS. 0 (litros)) includir	na anv si	olar or M	////HRS	storade	within s	ame ves	مما		150	1	(47)
lf com	munity h	e (illics)	and no ta	nk in du	velling e	ntor 110) litres in	(<i>1</i> 7)		501		150		(47)
Other	vise if no	stored	hot wate	er (this in	ocludes i	nstantar	nues in 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):				1.	39		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energ	y lost fro	m watei	r storage	, kWh/ye	ear			(48) x (49) =		0.	75		(50)
b) If n	nanufact	urer's d	eclared o	cylinder l	oss fact	or is not	known:				·		1	
Hot wa	ater stora	age loss	actor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	nunity n e factor	from Ta	hle 22	011 4.3								0	1	(52)
Tempe	erature f	actor fro	m Table	2b								0		(52)
Energ	v lost fro	m water	storage	. kWh/v	ear			(47) x (51) x (52) x (53) =		0	1	(54)
Enter	(50) or ((54) in (5	55)	, ,				x 7 x ⁻¹			0.	75		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33]	(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3			-		-		0	1	(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 heatii	ng and a	cylinde	r thermo	ostat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	n 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)m	l
(62)m=	209.65	184.69	193.75	173.39	169.7	151.32	145.03	159.55	159.4	179.81	190.5	204.5		(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=	209.65	184.69	193.75	173.39	169.7	151.32	145.03	159.55	159.4	179.81	190.5	204.5		_
								Outp	out from w	ater heate	r (annual)₁	12	2121.29	(64)
Hea <mark>t g</mark>	jains fro	m water	heating	, kWh/m	onth 0.2	<mark>5 ´</mark> [0.85	× (45)m	ı + (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	1	
(65)m=	91.49	81.09	86.21	78.73	78.21	71.39	70.01	74.83	74.08	81.57	84.42	89.78		(65)
in <mark>clu</mark>	ude (57)	m in calo	<mark>cula</mark> tion	of (65)m	only if c	ylinder i	s in t <mark>he</mark> o	dwelling	or hot w	vate <mark>r is f</mark> i	rom com	<mark>mu</mark> nity ł	neating	
5. In	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	s (Table	<u>5), Wat</u>	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43		(66)
Lightir	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				_	
(67)m=	24.34	21.62	17.58	13.31	9.95	8.4	9.08	11.8	15.83	20.1	23.46	25.01		(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=	261.66	264.38	257.54	242.97	224.58	207.3	195.76	193.04	199.88	214.45	232.84	250.12		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5			_	
(69)m=	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84		(69)
Pumps	s and fa	ns gains	(Table &	5a)									-	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3]	(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)							-	
(71)m=	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74		(71)
Water	heating	gains (T	able 5)										-	
(72)m=	122.97	120.66	115.87	109.35	105.12	99.16	94.09	100.58	102.89	109.64	117.25	120.67]	(72)
Total	internal	gains =				(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	(1)m + (72)	m	-	
(73)m=	476 5	474.19	458.51	433.16	407.18	382.39	366.45	372.95	386.13	411.72	441.08	463.33]	(73)
	470.0													

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

Orienta	ientation: Access Factor Table 6d		Area Flux m² Table 6a				g_ Table 6b		FF Table 6c	Gains (W)			
North	0.9x	0.77	x	3.69	×	10.63	×	0.63	x	0.7] =	11.99	(74)
North	0.9x	0.77	x	4.83	×	10.63	×	0.63	x	0.7] =	15.7	(74)
North	0.9x	0.77	x	3.01	x	10.63	x	0.63	x	0.7] =	9.78	(74)
North	0.9x	0.77	x	5.01	×	10.63	×	0.63	x	0.7] =	16.28	(74)
North	0.9x	0.77	x	3.69	x	20.32	x	0.63	x	0.7	=	22.92	(74)
North	0.9x	0.77	x	4.83	×	20.32	x	0.63	x	0.7	=	30	(74)
North	0.9x	0.77	x	3.01	x	20.32	x	0.63	x	0.7	=	18.69	(74)
North	0.9x	0.77	x	5.01	x	20.32	x	0.63	x	0.7	=	31.11	(74)
North	0.9x	0.77	x	3.69	x	34.53	x	0.63	x	0.7	=	38.94	(74)
North	0.9x	0.77	x	4.83	x	34.53	x	0.63	x	0.7	=	50.97	(74)
North	0.9x	0.77	x	3.01	×	34.53	x	0.63	x	0.7	=	31.76	(74)
North	0.9x	0.77	x	5.01	×	34.53	x	0.63	x	0.7] =	52.87	(74)
North	0.9x	0.77	x	3.69	x	55.46	x	0.63	x	0.7	=	62.55	(74)
North	0.9x	0.77	x	4.83	×	55.46	x	0.63	x	0.7	=	81.87	(74)
North	0.9x	0.77	x	3.01	x	55.46	x	0.63	x	0.7	=	51.02	(74)
North	0.9x	0.77	x	5.01	×	55.46	x	0.63	х	0.7] =	84.92	(74)
North	0.9x	0.77	x	3.69	x	74.72	x	0.63	x	0.7] =	84.26	(74)
North	0.9x	0.77	x	4.83	х	74.72] ×	0.63	x	0.7	=	110.29	(74)
North	0.9x	0.7 <mark>7</mark>	x	3.01	x	74.72	x	0.63	x	0.7	=	68.73	(74)
North	0.9x	0.77	x	5.01	x	74.7 <mark>2</mark>	x	0.63	x	0.7	=	114.4	(74)
North	0.9x	0.77	x	3.69	x	79.99	×	0.63	x	0.7] =	90.2	(74)
North	0.9x	0.77	x	4.83	x	79.99	x	0.63	x	0.7	=	118.07	(74)
North	0.9x	0.77	x	3.01	×	79.99	×	0.63	x	0.7] =	73.58	(74)
North	0.9x	0.77	x	5.01	×	79.99	x	0.63	x	0.7	=	122.47	(74)
North	0.9x	0.77	x	3.69	x	74.68	x	0.63	x	0.7] =	84.21	(74)
North	0.9x	0.77	x	4.83	×	74.68	x	0.63	x	0.7] =	110.23	(74)
North	0.9x	0.77	x	3.01	x	74.68	×	0.63	x	0.7	=	68.69	(74)
North	0.9x	0.77	x	5.01	x	74.68	×	0.63	x	0.7	=	114.34	(74)
North	0.9x	0.77	x	3.69	×	59.25	×	0.63	x	0.7	=	66.81	(74)
North	0.9x	0.77	x	4.83	x	59.25	x	0.63	x	0.7	=	87.45	(74)
North	0.9x	0.77	x	3.01	x	59.25	x	0.63	x	0.7	=	54.5	(74)
North	0.9x	0.77	x	5.01	×	59.25	×	0.63	x	0.7	=	90.71	(74)
North	0.9x	0.77	x	3.69	x	41.52	×	0.63	x	0.7	=	46.82	(74)
North	0.9x	0.77	x	4.83	x	41.52	x	0.63	x	0.7	=	61.28	(74)
North	0.9x	0.77	x	3.01	x	41.52	x	0.63	x	0.7	=	38.19	(74)
North	0.9x	0.77	x	5.01	×	41.52	x	0.63	x	0.7	=	63.57	(74)
North	0.9x	0.77	x	3.69	×	24.19	×	0.63	×	0.7] =	27.28	(74)
North	0.9x	0.77	x	4.83	×	24.19	×	0.63	x	0.7] =	35.71	(74)
North	0.9x	0.77	x	3.01	x	24.19	x	0.63	x	0.7] =	22.25	(74)

North	0.9x	0.77	x	5.	01	x	2	24.19	x		0.63	x	0.7		=	37.04	(74)
North	0.9x	0.77	×	3.	69	x	1	3.12	x		0.63	×	0.7		=	14.79	(74)
North	0.9x	0.77	×	4.	83	x	1	3.12	x		0.63	x	0.7		=	19.36	(74)
North	0.9x	0.77	×	3.	01	x	1	3.12	x		0.63	×	0.7		=	12.07	(74)
North	0.9x	0.77	×	5.	01	x	1	3.12	x		0.63	×	0.7		=	20.08	(74)
North	0.9x	0.77	×	3.	69	x		8.86	x		0.63	×	0.7		=	10	(74)
North	0.9x	0.77	×	4.	83	x		8.86	x		0.63	×	0.7		=	13.09	(74)
North	0.9x	0.77	×	3.	01	x		8.86	x		0.63	×	0.7		=	8.15	(74)
North	0.9x	0.77	×	5.	01	x		8.86	x		0.63	×	0.7		=	13.57	(74)
	•																
Solar	gains in	watts, ca	alculate	d for eac	h month	۱.			(83)m	า = Sเ	um(74)m .	(82)m					
(83)m=	53.75	102.72	174.54	280.36	377.68	4	04.31	377.48	299	.48	209.86	122.27	7 66.31	44.8	1		(83)
Total o	gains – i	nternal a	and sola	r (84)m	= (73)m	+ (83)m	, watts									
(84)m=	530.25	576.91	633.06	713.52	784.85		786.7	743.93	672	.43	595.99	533.99	9 507.39	508.1	4		(84)
7. Me	ean inter	nal temp	perature	(heating	g seasor	า)											
Temp	perature	during h	neating	periods i	n the livi	ng	area	from Tab	ole 9	, Th	1 (°C)					21	(85)
Utilis	ation fac	tor for g	ains for	living ar	ea, h1,m	า (ร	ее Та	ble 9a)									
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	De	с		
(86)m=	1	1	1	0.98	0.91		0.74	0.56	0.6	64	0.9	0.99	1	1			(86)
Mear	n interna	l temper	ature in	living ar	ea T1 (f	ollo	ow ste	ps 3 to 7	7 in T	able	9c)						
(87)m=	19.93	20.03	20.24	20.54	20.81		20.96	20.99	20.	99	20.87	20.54	20.19	19.9 [,]	1		(87)
Tem		during h	eating i	periods i	n rest of	dv	velling	from Ta	able 9	9 TH)2 (°C)						
(88)m=	20.11	20.11	20.11	20.12	20.13		20.14	20.14	20.	14	20.13	20.13	20.12	20.12	2		(88)
Litilio	ction for	tor for a	oine for	root of c	l	<u>г</u> ьо	m (or		<u>(</u>)							1	
(89)m-							,III (Se		9a)	53	0.85	0.98	1	1	_		(89)
(00)	L		0.00	0.01							0.00	0.00	·				()
Mear		l temper	ature in	the rest	of dwell	ing	1 T2 (f	ollow ste	eps 3	$\frac{1}{12}$ to 7	in Tabl	e 9c)	10.05	10.00			(00)
(90)m=	10.00	10.02	19.11	19.56	19.93	<u> </u>	20.11	20.13	20.	13	20.02 f	19.50	19.05	4) -	2	0.00	(90)
																0.29	(91)
Mear	n interna	l temper	ature (fo	or the wh	nole dwe	llin	ig) = f	LA × T1	+ (1	– fL	A) x T2		1	.		1	()
(92)m=	19.03	19.17	19.44	19.84	20.19		20.36	20.38	20.	.38	20.27	19.85	19.38	19.02	2	ł	(92)
Apply	/ adjustr	$\frac{10.17}{10.17}$	he mea	n interna	I temper	ratu	ure fro	m Table	e 4e,	whe	re appro	opriate	10.20	10.0		1	(02)
(93)III=	19.03	ting rog	19.44 Jiromon	19.64	20.19	-	20.36	20.38	20.	30	20.27	19.65	19.38	19.02	2		(93)
0. Sp Sot T	i to the	mean inf	ornal to	mperatu	re obtai	000	t at st	on 11 of	Tabl	la Qh	so tha	t Ti m-	-(76)m an	d re-c	alc		
the u	tilisation	factor fo	or gains	using Ta	able 9a	iec	1 81 30	epiror	Tabl		, so ina	L 11,111-	-(70)11 an	u ie-c	aic	ulate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	De	с		
Utilis	ation fac	tor for g	ains, hn	n:													
(94)m=	1	1	0.99	0.97	0.88		0.68	0.49	0.5	56	0.86	0.98	1	1			(94)
Usef	ul gains,	hmGm	, W = (9	4)m x (8	4)m	-			i					1		1	
(95)m=	529.33	575.08	627.82	690.56	689.61	!	535.1	364.19	379	9.2	511.82	523.97	505.57	507.4	6		(95)
Mont	hly aver	age exte	ernal ten	nperatur	e from T	abl		40.5			44.7	10.5			— ,	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		l	(96)
	1472 56			1075 50		∟m ⊺ ⊧	1, VV =	=[(39)m	x [(9)	o)m- عدال	– (96)m 600 º		1200.06	1/66	66		(97)
(5,)11=	1 1 0.00	I 1720.08	l '20'.'2	1 010.08	1 002.00	1 7	55.40	1 007.02	1 .00		0.000	000.02	- 1 1203.30	1 ' - 00.'		1	(3.)

						En	ergy			Emiss	ion fac	tor	Emission	S
12a. C	CO2 em	issions ·	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHF						
Electric	ity for li	ghting											429.8	(232)
Total e	lectricity	/ for the	above,	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
boiler	with a f	an-assis	sted flue									45		(230e)
centra	I heatin	g pump	:									30		(230c)
Electric	ity for p	umps, f	ans and	electric	keep-ho	t								
Water I	neating	fuel use	d										2507.2	
Space	heating	fuel use	ed, main	system	1								3906.7	
Annua	l totals									k	Wh/year	,	kWh/yea	ur
L								Tota	I = Sum(2	19a) ₁₁₂ =			2507.2	(219)
(219)m (219)m=	r water = (64) 238.79	neating, m x 100 210.78	кууп/m) ÷ (217 222.21	ontn)m 201.47	202.97	189.62	181.74	199.94	199.75	208.99	218.21	232.72		
(217)m=	87.79	87.63	87.19	86.06	83.61	79.8	79.8	79.8	79.8	86.03	87.3	87.88		(217)
Efficien	icy of w	ater hea	ater		1	ı —		1	· · · · ·	i			79.8	(216)
	209.65	184.69	193.75	173.39	169.7	151.32	145.03	159.55	159.4	17 <mark>9.81</mark>	190.5	204.5		
Water Output	heating	ater hea	ter (calc	ulated a	bove)						715,1012			
(215)111=	0	0	0	0		U		Tota	l (kWh/vea	ar) =Sum(2	0 (15).	=	0	(215)
Space = {[(98)	heatin m x (20	g fuel (s 01)] } x 1	econdar 00 ÷ (20	y), kWh/)8)	month						71			
	751.54	000.04	020.1	230.43	110.77		0	Tota	l (kWh/yea	ar) =Sum(2	211), 510 12	=	3906.7	(211)
(211)m]	= {[(98)m x (20)4)] } X ^	$100 \div (20)$)6)	0	0	0	0	304.48	542 42	763.26		(211)
	702.5	570.2	490.97	277.22	106.37	0	0	0	0	284.69	507.16	713.65		
Space	heatin	g require	ement (o	calculate	d above)	-	-					I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	ear
Efficie	ncy of s	seconda	ry/suppl	ementar	y heatin	g system	ח, %						0	(208)
Efficie	ncy of r	nain spa	ace heat	ting syste	em 1								93.5	(206)
Fractio	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Fractio	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 ·	- (201) =				1	(202)
Space Fraction	e heatir on of sp	ig: ace hea	at from s	econdar	y/supple	ementary	system		, , , ,				0	(201)
9a Ene	erav rea	uiremer	nts – Ind	ividual h	eating s	vstems i	ncluding	umicro-C	HP)					
Space	heatin	a require	ement ir	∖kWh/m²	2/vear					() can(c	C)1	35 34	`´´
(90)11=	702.5	570.2	490.97	211.22	100.37	0	0	Tota	l per vear	(kWh/year	307.10	8), 50, 12 =	3652 77	(98)
Space		g require		or each n	106.27		$\ln = 0.02$	24 X [(97)m – (95 I	5)mj x (4)	1)m	712 65		

b = k M/b/m(05) ml v (41)**h** f/ ~h onth $-0.024 \times [(07)]$ 1-.... . . .

kWh/year

Emission factor kg CO2/kWh

Emissions kg CO2/year

Space heating (main system 1)	(211) x	0.216	=	843.85	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	541.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1385.4	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	223.06	(268)
Total CO2, kg/year	sum	of (265)(271) =		1647.39	(272)

TER =

15.94 (273)

			User D	etails:										
Assessor Name: Software Name:	Stroma FS	AP 2012		Stroma Softwa	a Num Ire Ver	ber: sion:		Versic	on: 1.0.1.24					
		P	roperty A	Address:	Flat 2									
Address :														
1. Overall dwelling dirr	iensions:		A	(um 2)					Valuma/m3					
Ground floor			Area	a(m-)	(1a) x	AV. He		(2a) =)](3a)				
Total floor area TEA = (1-2) (1d).(1o). (1r	<u>م</u>	0.32	(10) x		2.5	(24) -	125.6					
	ia)+(ib)+(ic)+(10)+(16)+(11) 5	0.32	(4) (20) (2b)	(20) 1 (20		(2n) =						
					(5a)+(5b)	H(30)+(30	i)+(3e)+	.(31) –	125.8	(5)				
2. Ventilation rate:	moin			o the or		total			m3 nor hou					
	heating	heating	У	otner		total			m ³ per nou	1				
Number of chimneys	0	+ 0	+	0] = [0	X 4	40 =	0	(6a)				
Number of open flues	0	+ 0	+	0] = [0	×	20 =	0	(6b)				
Number of intermittent	fans					2	x ′	10 =	20	(7a)				
Number of passive vent	ts					0	x ′	10 =	0	(7b)				
Number of flueless gas	fires				Ē	0	X 4	40 =	0	(7c)				
Jumber of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour														
Infiltration due to chimn	eys, flues and fa	ins = (6a)+(6b)+(7)	a)+(7b)+(7	7c) =		20	(16)	÷ (5) =	0.16	(8)				
Number of storeys in	the dwelling (ns)	<i>110 (17),</i> C	ninei wise c	onunue no	5111 (9) 10 (10)		0					
Additional infiltration		,					[(9)	-1]x0.1 =	0	(10)				
Structural infiltration:	0.25 for steel or	timber frame or	0.35 for	masonr	y constr	uction			0	(11)				
if both types of wall are deducting areas of ope	present, use the val nings); if equal user	ue corresponding to 0.35	the greate	er wall area	a (after					_				
If suspended wooder	n floor, enter 0.2	(unsealed) or 0.	1 (seale	d), else	enter 0				0	(12)				
lf no draught lobby, e	nter 0.05, else e	nter 0							0	(13)				
Percentage of window	ws and doors dra	aught stripped							0	(14)				
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)				
Infiltration rate				(8) + (10) ·	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)				
Air permeability value	e, q50, expresse	d in cubic metre	s per ho	our per so $(18) = ($	quare m	etre of e	nvelope	area	5	(17)				
If based on air permean	bility value, then	$(18) = [(17) \div 20] + (6)$	s), otherwis	se(10) = (roopility	is hoing u	ood		0.41	(18)				
Number of sides shelte	red	n lest has been don	e or a deg	nee an per	пеартту	is being us	seu		3] (19)				
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.78	(10)				
Infiltration rate incorpora	ating shelter fact	or		(21) = (18)	x (20) =				0.32	(21)				
Infiltration rate modified	for monthly win	d speed												
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec]					
Monthly average wind s	speed from Table	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 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						
L	· · · · ·						•							

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m			-	_	
	0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se							
lf exh	aust air h		using Ann	endix N (2	3h) - (23a	a) x Emv (e	equation (1	N5)) othe	rwise (23h) – (23a)			0	(238)
If bal	anced with		overv: effic	$\frac{1}{10000000000000000000000000000000000$	allowing f	or in-use f	actor (fron	n Table 4b) –) = (200)			0	(230)
a) If		d moch		ntilation	with hor	of in about) = (2)	2h)m i (22h) v [/	l (22a)	0	(230)
a) 11 (24a)m-								$\left[\frac{1}{10} \right] \left[\frac{24a}{10} \right]$	$\frac{1}{1} = \frac{1}{2}$			0	÷ 100]	(24a)
(24a)III-		d maab			without						22h)	0	l	(210)
D) II					without			VIV) (24L	$p_{\text{III}} = (22)$	$\frac{1}{2} \frac{1}{2} \frac{1}$	230)	0	1	(24b)
(240)III-			tractiver							0	0	0	İ	(210)
C) II	if (22b)n	ouse ex n < 0.5 ×	(23b), 1	then (24	c) = (23b); other	ventilatio wise (24	c) = (22t	butside 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	ole hous	e positiv	/e input	ventilatio	on from I	oft					
()	if (22b)n	n = 1, th	en (24d)	m = (22t	o)m othe	erwise (2	.4d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	l	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24)	c) or (24	d) in box	(25)	r			1	
(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	<mark>/E</mark> NT	Gros	SS (m ²)	Openin	gs	Net Ar	rea	U-valu W/m2	ue	A X U	K)	k-value	e e e e e e e e e e e e e e e e e e e	A X k
Doors		area	(111)			21		1		2 1			·	(26)
Windo		1				2.1		/[1/(14)+	0.041 -	4.44	Ħ			(27)
Windo		2				5.55		/[1/(1 4)+		4.41	H			(27)
Wollo	wa type	, 2				5.01			0.04] =	6.64	╘┤┍			(27)
Totol o	roo of a	59.4	19 	10.44	4	49.05		0.18	= [8.83				(29)
Dente		lements	, m∸			59.49)							(31)
Party	wali			<i></i>		17.5	X	0	=	0				(32)
* tor win	laows and le the area	root wina as on both	ows, use e sides of ii	nternal wal	ndow U-va Is and part	aiue caicui titions	ated using	g tormula 1	/[(1/U-Valu	ie)+0.04] a	as given in	paragraph	13.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				21.99	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	eter (TMI	- = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign assess	ements wh	ere the de	tails of the	constructi	ion are noi	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al brida	es : S (L	x Y) cal	culated i	usina Ap	pendix I	<						47	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)							4.7	(
Total f	abric he	at loss		()	,	,			(33) +	(36) =			26.69	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × ((25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	24.15	24.02	23.89	23.28	23.17	22.64	22.64	22.54	22.84	23.17	23.4	23.64		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	50.83	50.7	50.57	49.97	49.85	49.32	49.32	49.23	49.53	49.85	50.08	50.32	1	
			-			-		-		Average =	Sum(39)1	12 /12=	49.97	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.01	1.01	1.01	0.99	0.99	0.98	0.98	0.98	0.98	0.99	1	1		
Numb	er of day	ı vs in mo	nth (Tab	le 1a)				1	,	Average =	Sum(40)1.	12 /12=	0.99	(40)
Traine	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned 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)	.7		(42)
Annua Reduce not mor	Il averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c 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	f 74	.56		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei I	r day for ea T	ach month T	Vd,m = fa I	ctor from	Table 1c x	(43) T					l	
(44)m=	82.02	79.04	76.06	73.07	70.09	67.11	67.11	70.09	73.07	76.06	79.04	82.02	00470	
Energy	content of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,r	n x nm x L	OTm / 3600) kWh/mor	total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	894.76	(44)
(45)m=	121.63	106.38	109.78	95.71	91.83	79.24	73.43	84.26	85.27	9 <mark>9.37</mark>	108.47	117.8		_
lf instan	taneous w	ater heati	ing at point	t of use (no	o hot water	storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1173.18	(45)
(46)m=	18.25	15.96	16.47	14.36	13.77	11.89	11.01	12.64	12.79	14.91	16.27	17.67		(46)
Vvater Storac	storage	loss: e (litres)	Vincludir	ng any si	olar or M	/WHRS	storage	within sa	ame ves	sel		150		(47)
If com	munity h	eating a	and no ta	ank in dv	velling e	nter 110	litres in	(47)		001		150		(47)
Otherv	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	ər '0' in ((47)			
Water	storage	loss:					<i>.</i>						1	
a) If m 	nanufact	urer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	39		(48)
Tempe	erature f	actor fro	m lable	2b							0.	54		(49)
Energy	y lost fro papufact	m watei urer's d	r storage	e, kWh/ye cylinder	ear loss fact	or is not	known:	(48) x (49)) =		0.	75		(50)
Hot wa	ater stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a	011 4.5								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energ	y lost fro	m wate	r storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (8	55)								0.	75		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Prima	ry circuit	loss cal	lculated	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 heati	ng and a	cylinde	r thermo	ostat)		I	(===)
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month (61)m = (60) \div 365 x (41)m															
(61)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(61)
Total h	eat rec	uired for	water h	neating c	alculated	l for	each	month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	168.23	148.47	156.37	140.8	138.43	124	4.34	120.03	130.86	130.36	145.97	153.57	164.39		(62)
Solar DI	-IW input	calculated	using Ap	pendix G o	r Appendix	H (n	negative	quantity) (enter 'C)' if no sola	r contribu	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	S and/or V	WWHRS	app	plies, 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=	168.23	148.47	156.37	140.8	138.43	124	4.34	120.03	130.86	130.36	145.97	153.57	164.39		
			-						Out	put from wa	ater heate	er (annual)₁	12	1721.8	(64)
Heat g	ains fro	om water	heating	j, kWh/m	onth 0.2	5 ´ [0.85 ×	: (45)m	+ (61)n	n] + 0.8 >	۲ [(46)m	n + (57)m	+ (59)m]	
(65)m=	77.72	69.04	73.78	67.9	67.81	62	2.42	61.69	65.29	64.43	70.32	72.14	76.44		(65)
inclu	ide (57))m in calo	culation	of (65)m	only if c	ylin	der is i	in the c	dwelling	or hot w	ater is f	from com	munity ł	neating	
5. Int	ernal g	ains (see	Table	5 and 5a):	-			-				-	-	
Metab	olic gai	ns (Table	5) Wa	tts	,										
motab	Jan	Feb	Mar	Apr	May	J	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	84.98	84.98	84.98	84.98	84.98	84	1.98	84.98	84.98	84.98	8 <mark>4.98</mark>	84.98	84.9 <mark>8</mark>		(66)
Liahtin	d dains	(calcula	ted in A		L. equat	ion	L9 or l	_9a), a	lso see	Table 5	1				
(67)m=	13.68	12.15	9.88	7.48	5.59	4.	.72	5.1	6.63	8.9	11.3	13.19	14.06	1	(67)
Applia	nces da	ains (calc	ulated i	n Appen	dix L. ea	uatio	on L13	3 or L1:	3a), also	see Ta	ble 5	-	1		
(68)m=	148.07	149.6	145.73	137.49	127.08	11	7.3	110.77	109.23	113.11	121.35	131.75	141.53	1	(68)
Cookir		s (calcula	ted in A	I	L equat	ion		r I 15a)	also s	ee Table	5				
(69)m=	31.5	31.5	31.5	31.5	31.5	3	1.5	31.5	31.5	31.5	31.5	31.5	31.5	1	(69)
Pump	and fa	ans gains	I (Table	52)								1	I		
(70)m=			3	3	3		3	3	3	3	3	3	3	1	(70)
		vaporatio		tivo valu			<u> </u>	0			<u> </u>		<u> </u>	J	
(71)m-	-67 98				-67 98		7) 7 98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	1	(71)
Wotor	hooting			-07.50	-07.50	-01	1.50	07.50	-07.50	-07.50	-07.50	-07.50	-07.50	J	()
		J gains (1		04.2	01 14	0/	67	82.02	97.76	80.49	04.51	100.2	102 75	1	(72)
(72)III-	104.40	102.74	33.10	94.5	31.14		(66)m	02.32	07.70	(60)m + ((70) m + (71)m + (72)	102.75	J	(12)
	nterna	I gains =	206.26	200.76	075.04	200		250.20			070 65	$\frac{71}{1}$		1	(73)
(73)m=		315.98	306.26	290.76	275.31	200	0.21	250.26	255.12	202.98	276.05	296.63	309.83		(73)
Solar o	ains are	calculated	usina soli	ar flux from	Table 6a	and a	associat	ted equa	tions to c	onvert to th	e applica	ble orientat	tion.		
Orient	ation:	Access F	actor	Area			Flux	.ou oquu		a		FF		Gains	
onona		Table 6d	aotor	m²			Table	e 6a	٦	able 6b	٦	Table 6c		(W)	
North	0.9x	0.77	×	3	33	хΓ	10	.63	x	0.63	ר _x ר	0.7		10.82	(74)
North	0.9x	0.77		5)1	хГ	10	.63		0.63		0.7		16.28	」`´´](74)
North	0.9x	0.77			33	хГ	20	32		0.63		0.7	─ _	20.68	」`´´´](74)
North	0.9x	0.77		5)1	х Г	20.	32		0.63		0.7		31 11	」`´´´](74)
North	0.9x	0.77			33	х Г	34	53		0.63		0.7	╡_	35 14	_``'](74)
	0.57	0.77	^	. 3.,	55	^ L	54.	.55		0.65	^ L	0.7	_	55.14	(14)

North	0.9x	0.77		x	5.01		x	3	1 53	1 x	0.63	×	0.7		₌ Γ	52.87	(74)
North	0.9x	0.77		x	3.01		x	5	5.46] ^] _x	0.03	\exists	0.7		_ L	56.45	
North	0.9x	0.77		x	5.00		x	5	5.46	l ^ l x	0.63	=	0.7			84.92	
North	0.9x	0.77		x	3 33		x		4 72	l ^ l x	0.63		0.7		_ L	76.04	
North		0.77		Ŷ	5.01		Ŷ		4.72		0.03	⊢ ^	0.7		_ L	114.4	
North		0.77		Ŷ	3.01		Ŷ		0.00		0.03	╡ ੑ	0.7		_	91 <i>/</i>	
North		0.77		Ŷ	5.01		Ŷ		0.00		0.03	╡ ੑ	0.7		_	122.47	$ \begin{bmatrix} (74) \\ (74) \end{bmatrix} $
North		0.77		Ŷ	3.01		Ŷ		9.99 1.69		0.03	╡ Û	0.7			76	$\begin{bmatrix} (74) \\ (74) \end{bmatrix}$
North		0.77		Ŷ	5.03		Ŷ		4.00		0.03	╡ Û	0.7			114.24	
North		0.77		Ŷ	3.01		Ŷ		9.25		0.03	╡ ੑ	0.7		_	60.20	$ \begin{bmatrix} (74) \\ (74) \end{bmatrix} $
North		0.77		Ŷ	5.03		Ŷ	5	0.25		0.03	╡ Û	0.7			00.29	$\begin{bmatrix} (74) \\ (74) \end{bmatrix}$
North	0.9	0.77		^ v	2.01		Ŷ	 	9.20]	0.63	╡ Û	0.7			40.25	
North	0.9×	0.77		×	3.33		~ ~	4	1.52		0.63	╡ Û	0.7			42.25	$= \begin{bmatrix} (74) \\ (74) \end{bmatrix}$
North	0.9x	0.77		x	5.01		×	4	1.52		0.63	╡ 、	0.7			63.57	$= \begin{pmatrix} 74 \\ 74 \end{pmatrix}$
North	0.9x	0.77		x	3.33		×	2	4.19		0.63	╡ 、	0.7			24.62	$\begin{bmatrix} (74) \\ (74) \end{bmatrix}$
North	0.9x	0.77		x	5.01		x	2	4.19	× 	0.63		0.7		= L	37.04	
North	0.9x	0.77		x	3.33		x		3.12	× 	0.63		0.7		= L	13.35	
North	0.9x	0.77		x	5.01		x		3.12		0.63		0.7			20.08	(74)
North	0.9x	0.77		×	3.33		X	3	3.86	X	0.63		0.7			9.02	
NOTUT	0.9x	0.77		x	5.01		Х	8	3.86] ×	0.63	x	0.7		=	13.57	(74)
Color	noine in	watta			for each	an a in th				(00)	0	(00)					
Solar (watts, ca	1CUIAte	ed	141 37 1	montr		03.87	190 34	(83)m	1 = Sum(74)m	(82)m	33.43	22.5	9		(83)
Total o	rains - i	nternal a	nd sol	ar	(84)m = (73)m	+ (8	83)m	watts		.01 103.02	01.0	00.40	22.0	5		(00)
(84)m=	344.8	367.78	394.28	3	432.13	465.75	4	64.08	440.62	406	.12 368.79	340.3	1 330.06	332.4	42		(84)
										L		1		1			. ,
7. Me	ean inter	nal temp	eratur	e (heating s	easor	ר) 		ino no Tok						Г	<u></u>	
remp	berature	auring ne	eating	pe	enoas in t		ing	area i	rom Tac	bie 9	, Int (°C)				L	21	(85)
Utilis		tor for ga	uns to	r II . T	ving area	, n1,n Mov	n (s T		ble 9a)	<u>م</u>							
(96)m-	Jan				Apr		+	Jun	Jui					De	¢C		(86)
(00)11=	I	0.99	0.99		0.95	0.65		0.05	0.49	0.0	0.02	0.97	0.99				(00)
Mear	n interna	l tempera	ature i	n li	iving area	T1 (f	ollo	w ste	ps 3 to 7	7 in T	able 9c)	1		1	_		(07)
(87)m=	20.03	20.14	20.34		20.63	20.87	2	20.98	21	20.	99 20.92	20.64	4 20.29	20.0	1		(87)
Temp	perature	during h	eating	pe	eriods in r	est of	dw	elling	from Ta	ble 9	9, Th2 (°C)						
(88)m=	20.07	20.08	20.08		20.09	20.09		20.1	20.1	20	.1 20.1	20.0	20.09	20.0	8		(88)
Utilis	ation fac	tor for ga	ins fo	r re	est of dwe	elling,	h2,	,m (se	e Table	9a)							
(89)m=	0.99	0.99	0.98		0.94	0.8	(0.57	0.39	0.4	15 0.75	0.95	0.99	1			(89)
Mear	n interna	l tempera	ature i	n tl	he rest of	dwel	lina	T2 (fc	ollow ste	eps 3	to 7 in Tab	ole 9c)	-	-			
(90)m=	18.79	18.94	19.24	T	19.65	19.96	2	20.08	20.1	20	.1 20.03	19.6	7 19.18	18.7	7		(90)
	L	I			I						!	fLA = Li	ving area ÷ ((4) =	╋	0.48	(91)
Mear	n interna	l tempera	ature (for	the whole	e dwe	nille	u) – ti	Δ 🗸 Τ1	+ (1	_ fl Δ) 🗸 Τα	,			L		
(92)m=	19.39	19.52	19.77	T	20.12	20.4	2	20.51	20.53	20.	53 20.46	20.1	3 19.71	19.3	7		(92)
X = -1,		1								~.				1			· · /

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

(93)m=	19.39	19.52	19.77	20.12	20.4	20.51	20.53	20.53	20.46	20.13	19.71	19.37		(93)
8. Spa	ace hea	ating req	uiremen	t										
Set Ti the ut	i to the ilisatior	mean in factor fo	ternal te or gains	mperatui using Ta	re obtair Ible 9a	ned 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	jains, hr	ו:										
(94)m=	0.99	0.99	0.98	0.94	0.82	0.61	0.44	0.5	0.78	0.95	0.99	0.99		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	342.6	364.06	385.77	404.61	381.06	283.73	192.85	201.29	286.38	324.03	325.99	330.67		(95)
Month	nly aver	age exte	ernal terr	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 rat	e for me	an interr	nal tempe	erature,	Lm , W =	=[(39)m :	x [(93)m I	– (96)m]	i	i	I	()
(97)m=	766.85	741.01	670.91	560.74	433.63	291.68	193.84	203.23	315.05	475.31	631.65	763.19		(97)
Space	e heatir	ig require	ement fo	or each m	nonth, k	Wh/mont	h = 0.02	24 x [(97])m – (95)m] x (4 ⁻	1)m		I	
(98)m=	315.64	253.31	212.14	112.41	39.12	0	0	0	0	112.55	220.08	321.8		٦
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	1587.04	(98)
Space	e heatir	ig requir	ement ir	n kWh/m²	/year								31.54	(99)
9a. En	ergy ree	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Sp <mark>ac</mark>	e heati	ng:												_
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)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ing from	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								93.5	(206)
Efficie	ency of	seconda	ary/suppl	ementar	y heatin	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatir	ig requir	ement (d	calculate	d above)								
	315.64	253.31	212.14	112.41	39.12	0	0	0	0	112.55	220.08	321.8		
(211)m	n = {[(98	8)m x (20	04)] } x ^	100 ÷ (20)6)									(211)
	337.58	270.92	226.89	120.23	41.84	0	0	0	0	120.37	235.38	344.17		
		-		-				Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	II.	1697.37	(211)
Space	e heatir	ng fuel (s	econdar	y), kWh/	month									
= {[(98])m x (2	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}	=	0	(215)
Water	heating	g												
Output	from w	ater hea	ter (calc	ulated a	bove)					r			l	
- //: .	168.23	148.47	156.37	140.8	138.43	124.34	120.03	130.86	130.36	145.97	153.57	164.39		
Efficier	ncy of w	ater nea	ater T							r			79.8	(216)
(217)m=	86.47	86.23	85.63	84.22	81.93	79.8	79.8	79.8	79.8	84.13	85.77	86.57		(217)
Fuel fo	r water $- (64)$	heating,	, kWh/m ∩ ∸ (217	onth)m										
(219)m=	194.55	172.18	182.62	167.18	168.95	155.81	150.41	163.98	163.36	173.5	179.04	189.88		
		I	1	I				Tota	I = Sum(2	19a) ₁₁₂ =			2061.46	(219)
Annua	l totals	5								k	Wh/vear		kWh/vear	י``∟
Space	heating	g fuel use	ed, main	system	1						.,		1697.37	1
	-													_

Water heating fuel used			I	2061.46	1
			ļ	2001.40	J
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	s	um of (230a)(230g) =		75	(231)
Electricity for lighting				241.56	(232)
12a. CO2 emissions - Individual heating systems	including micro-C	HP			-
	Energy kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	=	366.63	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	445.27	(264)
Space and water heating	(261) + (262) + (263)	+ (264) =		811.91	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.37	(268)
Total CO2, kg/year TER =		sum of (265)(271) =		976.2	(272)

User Details:														
Assessor Name:Stroma Number:Software Name:Stroma FSAP 2012Software Version:Version	n: 1.0.1.24													
Property Address: Flat 3														
Address :														
1. Overall dwelling dimensions:														
Area(m ²) Av. Height(m)	Volume(m ³)													
$\begin{array}{c} 66.88 \\ 66.88 \\ \hline \\ 12 \\ 2.5 \\ \hline \\ 2.1 \\ 2.5 \\ \hline \\ 2.5 \\ 2.5 \\ \hline \\ 2.5 \\ 2.5 \\ \hline \\ 2.5 $	167.2	(3a)												
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 66.88 (4)														
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$	167.2	(5)												
2. Ventilation rate:														
main secondary other total heating heating	m ³ per hour													
Number of chimneys $0 + 0 = 0 \times 40 =$	0	(6a)												
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	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)												
Number of flueless gas fires 0 $\times 40 = 0$ Air changes per Infiltration due to chimneys flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$														
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 20 \div (5) =$	0.12	(8)												
Number of storeys in the dwelling (ns) Additional infiltration	0	(9) (10)												
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	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		1.												
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)												
If no draught lobby, enter 0.05, else enter 0	0	(13)												
Percentage of windows and doors draught stripped	0	(14)												
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ (12) (12)	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 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ otherwise $(18) = (16)$	5	(17)												
If based on all permeability value, then $(10) = [(17) + 20]+(0)$, otherwise $(10) = (10)$	0.37	(18)												
Number of sides sheltered	3	(19)												
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78	(20)												
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.29	(21)												
Infiltration rate modified for monthly wind speed		-												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	L													
Monthly average wind speed from Table 7														
(22)m= 5.1 5 4.9 4.4 4.3 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 (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m	-		-	_	
	0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.26	0.29	0.31	0.32	0.34	ĺ	
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se							(220)
lf ovh			using App	andix N (2	(2b) = (23a)) × Emv (a	acuation (I		nuico (23h) - (23a)			0	
If bol	anood with				(200) = (200)	or in uno f	octor (fron	$r Toblo 4b^2$	1WI3C (200) – (238)			0	(23b)
			very. enic		anowing n) =			(00.)	0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a T	a)m = (22)	2b)m + (23b) × [1	1 - (23c)	÷ 100] I	(240)
(24a)m=		0	0	0	0	0	0	0	0	0	0	0	l	(24a)
b) If	balance	ed mecha	anical ve I	entilation	without	heat rec	covery (N	MV) (24b T)m = (22 I	2b)m + (2 I	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	İ	(240)
c) If	whole h if (22b)r	ouse ex n < 0.5 >	tract ver < (23b), 1	ntilation o then (24o	or positiv c) = (23b	ve input v o); otherv	ventilatio wise (24	on from c c) = (22b	outside o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	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 = (22ł	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	l	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. He	at losse	s and he	eat loss	oaramete	er:									
ELEN		Gros	ss	Openin	gs	Net Ar	rea	U-valu	Je	AXU		k-value	3	AXk
		area	(m²)	. m	2	A ,r	m²	W/m2	K	(W/I	K)	kJ/m²·l	K	kJ/K
Doors						2.1	x	1	=	2.1				(26)
Windo	<mark>ws</mark> Type	e 1				5.7	x1	/[1/(1.4)+	0.04] =	7.56				(27)
Win <mark>do</mark>	ws Type	2				2.81	x1	/[1/(1.4)+	0.04] =	3.73				(27)
Windo	ws Type	e 3				6.11	x1	/[1/(1.4)+	0.04] =	8.1	5			(27)
Walls		95.	5	16.7	2	78.78	3 x	0.18		14.18	Ξ Γ			(29)
Total a	area of e	lements	, m²			95.5			`					(31)
* for win	ndows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	lated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
** incluc	le the area	as on both	sides of ii	nternal wal	ls and part	titions								
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				35.66	(33)
Heat c	apacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	⁻ = Cm ÷	- TFA) in	∩ kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	constructi	ion are noi	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	K						2.25	(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) =			37.91	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	Y				(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.27	31.13	30.99	30.33	30.2	29.63	29.63	29.52	29.85	30.2	30.45	30.71	l	(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	69.18	69.04	68.9	68.24	68.12	67.54	67.54	67.44	67.76	68.12	68.37	68.63		
										Average =	Sum(39)1.		68.24	(39)

Heat lo	Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$															
(40)m=	1.03	1.03	1.03	1.02	1.02	1.01	1.01	1.01	1.01	1.02	1.02	1.03				
Ni yan ha		I	I			1	1	ļ	·	L Average =	Sum(40)1.	₁₂ /12=	1.02	(40)		
Numbe	r of day	/s in mo						A	0.00	0.4	Neur	Dee	l			
(11) m	Jan	Feb	Mar	Apr		Jun	Jui	Aug	Sep		NOV 20	Dec		(41)		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)		
4. Wa	4. Water heating energy requirement:kWh/year:															
Assum if TF/ if TF/	Assumed occupancy, N 2.17 (42 if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1															
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.69 (43) Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) (43)																
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Hot wate	r usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					L			
(44)m=	94.26	90.83	87.41	83.98	80.55	77.12	77.12	80.55	83.98	87.41	90.83	94.26		-		
Ener <mark>gy c</mark>	ontent of	hot water	used - ca	lculated mo	onthly $= 4$.	190 x Vd,r	m x nm x L	OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1028.3	(44)		
(45)m=	139.79	122.26	126.16	109.99	105.54	91.07	84.39	96.84	97.99	114.2	124.66	135.38		_		
lf instanta	aneous w	vater heati	ng at point	t of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1348.26	(45)		
(46)m=	20.97	18.34	18.92	16.5	15.83	13.66	12.66	14.53	14.7	17.13	18.7	20.31		(46)		
Storage volume (litres) including any solar or WWHRS storage within same vessel													(47)			
lf comn	If community beating and no tank in dwelling, enter 110 litres in (47)															
Otherw	Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)															
Water storage loss:																
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	39		(48)		
Tempe	rature f	actor fro	m Table	2b							0.	54		(49)		
Energy lost from water storage, kWh/year (48) x (49) = 0.75													(50)			
b) If manufacturer's declared cylinder loss factor is not known:														(54)		
If community heating see section 4.3														(51)		
Volume factor from Table 2a													(52)			
Temperature factor from Table 2b 0													(53)			
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$												0		(54)		
Enter (50) or (54) in (55)														(55)		
Water storage loss calculated for each month $((56)m = (55) \times (41)m$																
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)		
If cylinde	r contains	s dedicate	l d solar sto	nage, (57)	m = (56)m	x [(50) – (I [H11)] ÷ (5	i0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l lix H			
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)		
Primar	Primary circuit loss (annual) from Table 3													(58)		
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m							
(mod	lified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)					
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)		
Combi	loss ca	alculated	for ea	ach	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 rec	quired for	wate	r he	ating ca	alculated	l fo	r eacl	h month	(62)m =	0.85 ×	(45)m -	- (46)m +	(57)m +	- (59)m + (61)m	
(62)m=	186.38	164.34	172.7	75	155.08	152.13	13	36.16	130.98	143.43	143.09	160.8	169.75	181.97		(62)
Solar D	HW input	calculated	using A	Appe	endix 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	FGHF	RS a	and/or V	WHRS	ap	plies	, 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=	186.38	164.34	172.7	75	155.08	152.13	13	36.16	130.98	143.43	143.09	160.8	169.75	181.97		-
										Out	out from w	ater heat	er (annual)₁	12	1896.88	(64)
Heat g	ains fro	om water	heati	ng,	kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61)m	n] + 0.8 >	x [(46)n	n + (57)m	+ (59)m	<u>[</u>]	
(65)m=	83.75	74.32	79.2	2	72.64	72.37	6	6.35	65.34	69.47	68.66	75.25	77.52	82.29		(65)
inclu	ide (57)m in calo	culatio	on o	f (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	e Tabl	e 5	and 5a)):										
Metab	olic gai	ns (Table	e 5), V	Vatt	s		_								_	
	Jan	Feb	Ma	ar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	108.4	108.4	108.	4	108.4	108.4	1	08.4	108.4	108.4	108.4	108.4	108.4	108.4		(66)
Ligh <mark>tin</mark>	g gains	s (calcula	ted in	Ap	pendix	L, equat	ion	L9 oi	r L9a), <mark>a</mark>	lso see	Table 5					
(67)m=	17.35	15.41	12.5	3	9.49	7.09	5	5.99	6.47	8.41	11.29	14.33	16.73	17.83		(67)
Applia	nces ga	ains (ca <mark>lc</mark>	ulated	d in	Append	dix L, eq	uat	ion L'	13 or L1:	3a), also	see Ta	ble 5			-	
(68)m=	189.91	191.88	18 <mark>6.9</mark>	91	176.34	163	15	50.45	142.07	140.1	145.07	155.64	168.99	181.53		(68)
Cookir	ng gains	s (calcula	ited in	n Ap	pendix	L, equat	ion	1L15	or L15a)	, also se	e Table	5			-	
(69)m=	33.84	33.84	33.8	4	33.84	33.84	3	3.84	33.84	33.84	33.84	33.84	33.84	33.84		(69)
Pumps	and fa	ans gains	(Tabl	le 5	a)								•			
(70)m=	3	3	3		3	3		3	3	3	3	3	3	3]	(70)
Losses	s e.g. e	vaporatic	n (ne	gati	ve valu	es) (Tab	le :	5)							-	
(71)m=	-86.72	-86.72	-86.7	/2	-86.72	-86.72	-8	36.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72]	(71)
Water	heating	, g gains (T	able	5)							•		•	•	-	
(72)m=	112.57	110.59	106.4	48	100.9	97.27	9	2.16	87.82	93.38	95.36	101.14	107.67	110.6]	(72)
Total i	nterna	l gains =						(66)	m + (67)m	+ (68)m -	+ (69)m +	(70)m +	(71)m + (72)	m	-	
(73)m=	378.35	376.4	364.4	45	345.24	325.88	30	07.12	294.88	300.41	310.23	329.63	351.91	368.48]	(73)
6. So	lar gain	is:	-			_					•				-	
Solar g	ains are	calculated	using s	olar	flux from	Table 6a	and	associ	iated equa	tions to co	onvert to th	ne applica	able orientat	ion.		
Orienta	ation:	Access F	actor		Area			Flu	x	-	g	-	FF		Gains	
		l able 6d			m²			lat	ole 6a		able 6b		l able 6c		(VV)	_
East	0.9x	1		x	5.	7	x	1	9.64	x	0.63	x	0.7	=	23.99	(76)
East	0.9x	1		x	5.	7	x	3	8.42	x	0.63	x	0.7	=	46.94	(76)
East	0.9x	1		x	5.	7	x	6	3.27	x	0.63	x	0.7	=	77.3	(76)
East	0.9x	1		x	5.	7	x	9	2.28	x	0.63	x	0.7	=	112.73	(76)
East	0.9x	1		x	5.	7	x	1	13.09	x	0.63	x	0.7	=	138.16	(76)

East	0.9x	1		x	5.7	7	x	1	15.77	x		0.63	x	0.7		=	141.43	(76)
East	0.9x	1		x	5.7	7	x	1	10.22	x		0.63	×	0.7		=	134.65	(76)
East	0.9x	1		x	5.7	7	x	9	94.68	x		0.63	×	0.7		=	115.66	(76)
East	0.9x	1		x	5.7	7	x	7	'3.59	x		0.63	×	0.7		=	89.9	(76)
East	0.9x	1		x	5.7	7	x	4	5.59] ×		0.63		0.7		=	55.69	(76)
East	0.9x	1		x	5.7	7	x	2	24.49	x		0.63	×	0.7		=	29.92	(76)
East	0.9x	1		x	5.7	7	x	1	6.15	x		0.63	×	0.7		=	19.73	(76)
South	0.9x	0.54		x	2.8	1	x	4	6.75	x		0.63	x	0.7		=	28.16	(78)
South	0.9x	0.54		x	2.8	1	x	7	6.57	x		0.63	x	0.7		=	46.11	(78)
South	0.9x	0.54		x	2.8	1	x	ç	97.53	x		0.63	×	0.7		=	58.74	(78)
South	0.9x	0.54		x	2.8	1	x	1	10.23	x		0.63	x	0.7		=	66.39	(78)
South	0.9x	0.54		x	2.8	1	x	1	14.87	x		0.63	x	0.7		=	69.18	(78)
South	0.9x	0.54		x	2.8	1	x	1	10.55	x		0.63	x	0.7		=	66.58	(78)
South	0.9x	0.54		x	2.8	1	x	1	08.01	x		0.63	x	0.7		=	65.05	(78)
South	0.9x	0.54		x	2.8	1	x	1	04.89	x		0.63	x	0.7		=	63.17	(78)
South	0.9x	0.54		x	2.8	1	x	1	01.89	x		0.63	x	0.7		=	61.36	(78)
South	0.9x	0.54		x	2.8	1	x	8	32.59	x		0.63	x	0.7		=	49.74	(78)
South	0.9x	0.54		x	2.8	1	x	5	5.42	x		0.63	x	0.7		=	33.38	(78)
South	0.9x	0.54		x	2.8	1	х		40.4] x		0.63	x	0.7		=	24.33	(78)
West	0.9x	0.54		x	6.1	1	х	1	9.64] ×		0.63	x	0.7		=	25.72	(80)
West	0.9x	0.5 <mark>4</mark>		x	6.1	1	x	3	88.42	x		0.63	x	0.7		=	50.31	(80)
West	0.9x	0.54		x	6.1	1	x	6	63.27	x		0.63	x	0.7		=	82.86	(80)
West	0.9x	0.54		x	6.1	1	x	9	2.28	x		0.63	x	0.7		=	120.84	(80)
West	0.9x	0.54		x	6.1	1	x	1	13.09	x		0.63	x	0.7		=	148.1	(80)
West	0.9x	0.54		x	6.1	1	x	1	15.77	x		0.63	×	0.7		=	151.61	(80)
West	0.9x	0.54		x	6.1	1	x	1	10.22	x		0.63	x	0.7		=	144.33	(80)
West	0.9x	0.54		x	6.1	1	x	g	94.68	x		0.63	x	0.7		=	123.98	(80)
West	0.9x	0.54		x	6.1	1	x	7	'3.59	x		0.63	x	0.7		=	96.37	(80)
West	0.9x	0.54		x	6.1	1	x	4	5.59	x		0.63	x	0.7		=	59.7	(80)
West	0.9x	0.54		x	6.1	1	x	2	24.49	x		0.63	x	0.7		=	32.07	(80)
West	0.9x	0.54		x	6.1	1	x	1	6.15	x		0.63	x	0.7		=	21.15	(80)
Solar (gains in	watts, ca	alculat	ed	for eac	n mont	h			(83)m	n = Su	um(74)m	.(82)m					(00)
(83)m=	77.87	143.36	218.9		299.97	355.44	4 3	$\frac{359.62}{(92)m}$	344.03	302	2.82	247.63	165.13	95.36	65.2	21		(83)
10tal ((04)111 =	= (73)II	$\frac{1+1}{2}$			602		557.00	404.7	447.07	422.0	60		(84)
(04)111=	400.22	519.77	563.3	2	043.21	001.32	2 0	000.74	030.91	603	5.23	557.66	494.77	447.27	433.0	09		(04)
7. Me	ean inter	nal temp	eratur	e (heating	seaso	n)		· -		T I 4	(00)						
lemp	berature	during h	eating	pe	eriods ir	the In	/ing	area	from I al	ble 9	, 1h1	1 (°C)					21	(85)
Utilis	ation fac	ctor for g	ains to	r li	ving are	ea, h1,	m (s , T					S	0-+	Nav	D -		1	
(86)~-	Jan	red			Apr			Jun			ug 51	5ep				эC	1	(86)
	L	0.99	0.98		0.93	0.01		0.03	0.40	0.8		0.70	0.90	0.99				(00)
Mear	n interna	I temper	ature i	n I	iving are	ea T1 (ow ste	ps 3 to 7	7 in T		9c)	00.00	00.07	40.0		1	(07)
(87)m=	19.99	20.14	20.38		20.68	20.89		20.98	21	20.	.99	20.94	20.66	20.27	19.9	6		(07)

Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
=m(88)	20.05	20.06	20.06	20.07	20.07	20.08	20.08	20.08	20.07	20.07	20.06	20.06		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.97	0.91	0.76	0.55	0.37	0.41	0.69	0.93	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	18.72	18.94	19.28	19.7	19.96	20.06	20.07	20.07	20.03	19.68	19.13	18.68		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.56	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	19.43	19.61	19.9	20.24	20.48	20.58	20.59	20.59	20.54	20.23	19.77	19.4		(92)
Apply	adjustn	nent to t	he mear	n internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.43	19.61	19.9	20.24	20.48	20.58	20.59	20.59	20.54	20.23	19.77	19.4		(93)
8. Spa	ace hea	ting requ	uirement											
Set T	i to the r	nean int	ernal ter	mperatur	re obtair	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
ine ui	Jan	Feb	Mar	Anr	Mav	Jun	Jul	Αυσ	Sen	Oct	Nov	Dec		
Utilisa	ation fac	tor for a	ains, hm):	may	Udit	Uui	, tug	000	000	1101	200		
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.46	0.73	0.94	0.99	1		(94)
Us <mark>efu</mark>	Il gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	<mark>45</mark> 3.48	513. <mark>2</mark> 5	565.19	588.93	536.2 <mark>8</mark>	<mark>39</mark> 3.62	268.32	280.4	406.15	464.56	441.59	431.68		(95)
Mo <mark>nt</mark> ł	nly avera	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	los <mark>s rate</mark>	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				(07)
(97)m=	1046.98	1015.85	923.31	774.18	598.11	403.65	269.58	282.58	436.37	656.04	866.17	1043.15		(97)
Space		g require		r each m	nonth, K	/Vh/moni	$\ln = 0.02$	24 x [(97)m – (95 I)m] x (4')m 205 7	454.02		
(90)11=	441.30	337.74	200.44	133.30	40	0	0	Tota		142.40	300.7	404.95	2128.22	(98)
0								TOLA	ii pei yeai	(KWII/yeai) = Sum(90	0/15,912 =	2120.22	(00)
Space	e neatin	g require	ement in	KVVN/M ²	/year								31.82	(99)
9a. En	ergy rec	luiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ig:	t from o	ocondan	vleunnle	montory	evetom					1	0	(201)
Fracti	on of on				y/supple	mentary	System	(202) = 1	_ (201) _				0	(201)
Fracti	on or sp			iain syst	em(s)			$(202) = 1^{-1}$	- (201) -	(202)]			1	(202)
Fracti		tai neati	ng from	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g system	ı, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh	/year
Space	e heatin	g require	ement (c	alculate	d above)								
	441.56	337.74	266.44	133.38	46	0	0	0	0	142.46	305.7	454.93		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)	i								(211)
	472.26	361.22	284.96	142.66	49.2	0	0	0	0	152.37	326.95	486.56		
								Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2276.18	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									
$= \{[(98)]$)m x (20	ז א א <u>ווי</u> ן און איז איז איז איז איז איז איז איז איז איז	00 ÷ (20 		0	0	0	0	0	Ο	Ω	0		
(213)11=		0		- ⁰	0		0	Tota	l (kWh/ves	ar) = Sum(2)	215)		0	(215)
								1010		,	15,1012		0	(213)

Water heating

Output	from wa	ater hea	ter (calc	ulated al	oove)								_	
	186.38	164.34	172.75	155.08	152.13	136.16	130.98	143.43	143.09	160.8	169.75	181.97		
Efficier	ncy of w	ater hea	iter					-					79.8	(216)
(217)m=	87.04	86.7	85.97	84.41	82.05	79.8	79.8	79.8	79.8	84.49	86.37	87.16		(217)
Fuel fo	r water	heating,	kWh/mo	onth									-	
(219)m	= (64)	m x 100) ÷ (217)	m	195 /1	170.62	164.14	170 74	170.21	100.21	106 55	209 77	1	
(219)11=	214.14	169.00	200.90	103.71	100.41	170.03	104.14	Tota	l = Sum(2)	190.31 19a) =	190.55	200.11	2262.24	
Annua	l totolo							1010	ii – Gain(2	lou ₁₁₂ –	Mhhuon		2203.24	
Space	heating	fuel use	ed, main	system	1					ĸ	wii/yeai		2276.18	7
Water I	neating	fuel use	d										2263.24	Ī
Electric	ity for p	oumps, fa	ans and	electric	keep-ho	t								
centra	I heatin	g pump	:									30]	(230c)
boiler	with a f	an-assis	sted flue									45]	(230e)
Total e	lectricity	/ for the	above, ł	(Wh/yea	r			sum	of (230a).	(230g) =	:		75	(231)
Electric	ity for li	ghting											306.38	(232)
12a. (CO2 em	issions -	– Individ	ual heati	ng syste	ems inclu	uding mi	cro-CHF)					
				Г		En kW	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Em<mark>issio</mark>ns kg CO2/yea	ar
Spa <mark>ce</mark>	he <mark>ating</mark>	(main s	ystem 1))		(21)	1) x			0.2	16	=	491.65	(261)
Spa <mark>ce</mark>	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Wat <mark>er I</mark>	neating					(219	9) x			0.2	16	=	488.86	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + ((264) =				980.51	(265)
Electric	ity for p	oumps, f	ans and	electric	keep-ho	t (23 ⁻	1) x			0.5	19	=	38.93	(267)
Electric	ity for li	ghting				(232	2) x			0.5	19	=	159.01	(268)
Total C	;O2, kg/	'year							sum o	of (265)(271) =		1178.45	(272)

TER =

(273)

17.62

			User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012		Stroma Softwa	a Num are Ver	ber: sion:		Versio	on: 1.0.1.24	
		Р	roperty /	Address:	Flat 4					
Address :										
1. Overall dwelling dim	iensions:			()						
Cround floor			Area	a(m²)	(1 -)	Av. He	ight(m)		Volume(m ³)	
				1.18	(1a) x	2	2.5	(2a) =	177.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+((1d)+(1e)+(1r	1) 7	1.18	(4)					_
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	177.95	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m ³ per hour	
Number of chimneys	0	+ 0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent f	ans	_			- F	3	x ′	10 =	30	(7a)
Number of passive vent	ts					0	x ′	10 =	0	(7b)
Number of flueless gas	fires				Ē	0	× 4	40 =	0	(7c)
								Air ch	nanges per hou	ır
Infiltration due to chimn	eys, flues and fa	ans = (6a) + (6b) + (7)	(a)+(7b)+(7	7c) =		30	(16)	÷ (5) =	0.17	(8)
Number of storeys in	the dwelling (ns	s)	<i>u io (11),</i> c			0111 (0) 10 (10)		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration:	0.25 for steel or	timber frame or	0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are deducting areas of oper	present, use the va hings): if equal user	lue corresponding to 0.35	the great	er wall area	a (after					
If suspended wooder	floor, enter 0.2	(unsealed) or 0	1 (seale	d), else	enter 0				0	(12)
lf no draught lobby, e	nter 0.05, else e	enter 0							0	(13)
Percentage of window	ws and doors dr	aught stripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value	e, q50, expresse	ed in cubic metre	s per ho	our per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeat	ility value, then	$(18) = [(17) \div 20] + (8)$	3), otherwi	se (18) = (16)				0.42	(18)
Air permeability value appl	lies if a pressurisation	on test has been dor	e or a deg	gree air pei	rmeability	is being us	sed			
Shelter factor	leu			(20) = 1 - [0.075 x (1	9)] =			3 0.78	(19)
Infiltration rate incorpora	ating shelter fac	tor		(21) = (18)) x (20) =				0.32](=0)](21)
Infiltration rate modified	for monthly win	d speed							0.02](
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	peed 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 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		
		l l							1	

Adjust	ed infiltr	ation rat	e (allow	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m					
	0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38		
Calcul	ate ette	ctive air	change	rate for t	he appli	cable ca	se							(220)
lf exh	aust air h	eat nump i	using App	endix N (2	(3h) = (23a	i) x Fmv (e	equation (N	N5)) other	rwise (23h) = (23a)			0	(23a)
lf bal	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =) (200)			0	(230)
a) If	halance	n mech	anicalve	ntilation	with he	at recove	arv (MV/	-IR) (24a	(2)	2h)m ⊥ ('	23h) v [*	1 _ (23c)	0 .÷.1001	(230)
(24a)m=						0			0	0		$\frac{1}{0}$	÷ 100]	(24a)
(). b) If	halance		anical ve	l ntilation	without	hoat roc		1)/) (24h	m = (22)	$\frac{1}{2}$	23h)	ů		
(24b)m=					0				0	0	0	0		(24b)
c) If	whole h		tract ver	L				n from c		-				
0) 11	if (22b)r	n < 0.5 ×	(23b), 1	then (24	c) = (23b); otherv	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) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from l	oft					
,	if (22b)r	n = 1, th	en (24d)	m = (22	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN		Gros	SS	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	9	AXk
		area	(m²)	m	12	A ,r	m²	W/m2	K	(W/I	<)	kJ/m²·l	<	kJ/K
Doors						2.1	x	1	=	2.1				(26)
Windo	ws Type	e 1				5.4	x1.	/[1/(1.4)+	0.04] =	7.16				(27)
Windo	ws Type	92				10.29	x1	/[1/(1.4)+	0.04] =	13.64				(27)
Walls		91.	8	17.7	9	74.01	x	0.18	=	13.32				(29)
Roof		71.1	8	0		71.18	3 X	0.13	= [9.25				(30)
Total a	area of e	elements	, m²			162.9	8							(31)
* for win	idows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	e)+0.04] a	ns given in	paragraph	3.2	
** incluc	le the area	as on both	sides of in	nternal wal	ls and part	titions		(26) (20)	(22) -					(22)
Fabric	neat los	55, VV/K :	= 5 (A X	0)				(20)(30)	((20)	(20) . (20		(22-)	45.48	(33)
			(AXK)			1/m21/			((20)	(30) + (32)	2) + (328). Madium	(32e) =	0	(34)
For dog	iar nass	parame	eter (TIVI	= Cm +	- TFA) In	ion are not	t known nr	onicoly the	indicativo		TMP in T	oblo 1f	250	(35)
can be u	used inste	ad of a de	tailed calc	ulation.	constructi	on ale not	l known pi	ecisely life	; muicative	values of				
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						19.05	(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) =			64.53	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)	1	I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	34.38	34.19	34	33.1	32.93	32.15	32.15	32.01	32.45	32.93	33.27	33.63		(38)
Heat ti	ransfer o	coefficie	nt, W/K		-				(39)m	= (37) + (3	38)m			
(39)m=	98.91	98.72	98.52	97.63	97.46	96.68	96.68	96.53	96.98	97.46	97.8	98.15		
									/	Average =	Sum(39)1	12 /12=	97.63	(39)

Heat loss parameter (HLP), W/m ² K (40)m = $(39)m \div (4)$	
(40)m= 1.39 1.39 1.38 1.37 1.37 1.36 1.36 1.36 1.36 1.37 1.37 1.38	
Average = Sum(40) ₁₁₂ /12= 1.3	(40)
Number of days in month (Table 1a)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(41)m= 31 28 31 30 31 31 30 31 30 31	(41)
4. Water heating energy requirement: kWh/year:	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)	(43)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	
(44)m= 97.04 93.51 89.98 86.45 82.92 79.4 79.4 82.92 86.45 89.98 93.51 97.04	
$Total = Sum(44)_{112} = 1058$	61 (44)
(45)m = 142.01 125.86 120.88 112.22 108.65 02.75 86.88 00.60 100.88 117.57 128.24 120.27	
$(45) \Pi = \begin{bmatrix} 143.91 & 123.00 & 123.00 & 113.23 & 100.03 & 93.73 & 00.00 & 93.09 & 100.00 & 117.37 & 120.34 & 139.37 \\ \hline Total = Supp(45) = - 1288$	01 (45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	
(46)m= 21.59 18.88 19.48 16.98 16.3 14.06 13.03 14.95 15.13 17.64 19.25 20.9	(46)
Water storage loss:	
Storage volume (intes) including any solar or wwink's storage within same vesser 150	(47)
It community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored bot water (this includes instantaneous combi boilers) enter (0' in (47)	
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day):	(48)
Temperature factor from Table 2b	(49)
Energy lost from water storage, kWh/year $(48) \times (49) = 0.75$	(50)
b) If manufacturer's declared cylinder loss factor is not known:	
Hot water storage loss factor from Table 2 (kWh/litre/day)	(51)
If community heating see section 4.3	(50)
Temperature factor from Table 2b	(52) (53)
Energy lost from water storage kWb/y ar $(47) \times (51) \times (52) \times (53) =$	(50)
Enter (50) or (54) in (55) 0.75	(54)
Water storage loss calculated for each month $((56)m = (55) \times (41)m$	()
(56)m 22 22 21 07 22 22 22 22 58 22 22 58 22 22 58 22 22 22 22 22 22 22 22 22 22 22 22 22	(56)
$ \begin{array}{c} (30) \text{ In } = 23.33 & 21.07 & 23.33 & 22.38 & 23.33 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 & 22.38 & 23.33 &$	(00)
(57)m= 23.33 21.07 23.33 22.58 23.33 22.58 23.33 23.33 23.33 22.58 23.33 22.58 23.33	(57)
	(58)
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) \div 365 x (41)m	(00)
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	

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	uired for	water h	neating c	alculated	l for eac	h month	(62)m =	0.85 × 0	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96		(62)
Solar DI	-IW input	calculated	using Ap	pendix G c	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHR	S 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 v	vater hea	ter	_			i							
(64)m=	190.5	167.95	176.47	158.32	155.24	138.85	133.47	146.29	145.98	164.17	173.43	185.96		-
								Out	out from w	ater heate	r (annual)₁	12	1936.62	(64)
Heat g	ains fro	om water	heating	g, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 >	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	85.12	75.52	80.46	73.72	73.4	67.25	66.16	70.42	69.62	76.37	78.75	83.62		(65)
inclu	ide (57)m in calo	culation	of (65)m	n 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	ı):									
Metab	olic gai	ns (Table	e 5), Wa	atts		-		-	-	-	-	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72	113.72		(66)
Ligh <mark>tin</mark>	<mark>g g</mark> ains	(calcula	ted in A		L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	1 <mark>8.25</mark>	16.21	13.18	9.98	7.46	6.3	6.8	8.85	11.87	15.07	17.59	18.76		(67)
App <mark>lia</mark>	nces ga	ains (ca <mark>lc</mark>	ulated i	in Appen	dix L, eq	uation L	13 or L1	3a), also	o <mark>se</mark> e Ta	ble <mark>5</mark>				
(68)m=	200.04	202.11	19 <mark>6.88</mark>	185.74	171.69	158.48	149.65	147.57	152.81	163.94	178	191.21		(68)
Cookir	ng gains	s (calcula	ted in A	A <mark>ppen</mark> dix	L, equat	ion L15	or L15a)), also se	ee Table	5				
(69)m=	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.37		(69)
Pumps	and fa	ins gains	(Table	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. e	vaporatic	n (nega	ative valu	ies) (Tab	le 5)	•			•				
(71)m=	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98	-90.98		(71)
Water	heating	, g gains (T	able 5)		•					•				
(72)m=	114.42	112.38	108.15	102.39	98.66	93.4	88.93	94.66	96.69	102.65	109.37	112.39		(72)
Total i	nterna	I gains =			•	(66)m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	392.82	390.81	378.32	358.23	337.92	318.29	305.5	311.19	321.48	341.78	365.08	382.47		(73)
6. So	lar gain	IS:					•			•				
Solar g	ains are	calculated	using sol	ar flux from	n Table 6a a	and assoc	iated equa	itions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area	1	Flu		-	g	-	FF		Gains	
		l able 6d		m²		la	ble 6a		able 6b	I	able 6c		(VV)	_
North	0.9x	0.54	;	× 10	.29	x	10.63	x	0.63	x	0.7	=	23.45	(74)
North	0.9x	0.54	;	K 10	.29	x2	20.32	x	0.63	×	0.7	=	44.82	(74)
North	0.9x	0.54	;	× 10	.29	x;	34.53	x	0.63	x	0.7	=	76.15	(74)
North	0.9x	0.54	2	x 10	.29	×	55.46	x	0.63	x	0.7	=	122.32	(74)
North	0.9x	0.54	;	× 10	.29	x	74.72	x	0.63	×	0.7	=	164.78	(74)

North	0.9x	0.54	×		10.29	l x	7	0 00	1 x	0.63	×	0.7			176.4	(74)
North	0.9x	0.54	=		10.29			4.68	」 ^] _	0.03	╡ Û	0.7	=		164.69	$=^{(1,1)}_{(74)}$
North	0.9x	0.54	=	F	10.20		5	4.00 0.25	」 ^] _	0.63	٦Ŷ	0.7	=		130.66	(74)
North	0.9x	0.54			10.20	l ^ l x		1 52	」 ^ 】 ×	0.63		0.7	╡		91 56	-(74)
North		0.54	=	F	10.29			1.02] ^] _	0.03	٦Ŷ	0.7	=		53.35	
North	0.9x	0.54	=		10.29			2 12	」 ^] 、	0.03	۲Ŷ	0.7	\exists		28.03	(74)
North	0.9x	0.54		-	10.29	l ^ l x		3.12	」 ^] _	0.03	٦Ŷ	0.7	=		10.55	(74)
West		0.54	╡ Û	╞	5.4			0.64] ^] \	0.63	╡ Û	0.7	=		22.72	
West		0.54	╡ Û		5.4			9.04] ^] ↓	0.03	╡ Û	0.7	=		44.47	(00)
West		0.54	=		5.4			2 27	」 ^] ↓	0.63	٦Ŷ	0.7	\dashv		72.02	
West		0.54	╡ Û	╞	5.4			0.27] ^] \	0.03	╡ Û	0.7	=		106.9	
West	0.9	0.54	╡ Û		5.4		9	12.20] ^] ↓	0.63	╡Ĵ	0.7	=		100.8	
West	0.9	0.54			5.4			13.09	」^ 1	0.63	╡Û	0.7	=		130.89	
West	0.9X	0.54	╡ ゚	F	5.4			15.77	」 ^ 1 、	0.63	╡ Û	0.7	=		133.99	
West	0.9x	0.54			5.4	x x	1	10.22	」× 1 …	0.63	╡ .	0.7	⁼		127.56	
West	0.9X	0.54			5.4		9	4.68	」 ^ 1 _	0.63	╡ Û	0.7	= -		109.57	
West	0.9x	0.54			5.4	X 		3.59	」× 1 …	0.63	╡ .	0.7	⁼		85.17	
West	0.9x	0.54			5.4	×	4	5.59] ×]	0.63	╡^	0.7			52.76	(00)
West	0.9x	0.54			5.4	X		4.49	X	0.63		0.7			28.34	(00)
vvesi	0.9x	0.54	×		5.4	X	1	6.15] ×	0.63	X	0.7			18.69	(80)
Oalan									(00)	0 (74)	(00)					
Solar (83)m-	gains in	watts, cal	149 38		r each moni	$\frac{1}{7}$	10 30	202.25	(83)m	1 = Sum(74)m	(82)m	1 57 27	38.24			(83)
Total (nains – i	nternal ar	nd sola	r (84	4)m = (7.3)m	1 + (83)m	watts	240	.24 110.13	100.1	1 01.21	00.24			(00)
(84)m=	439	480.1	527.71	58	37.36 633.59	$\frac{1}{2}$	28.68	597.75	551	.43 498.21	447.8	9 422.35	420.71			(84)
				//									1			
7. Me	ean inter	nal tempe	erature	(he	eating seaso	on)									21	
rem	perature	auring ne	ating p		oas in the in	ving	area		ole 9	, INT (°C)					21	(85)
Utilis		tor for ga	Ins for	livin I	ng area, h1,	m (s		bie 9a)				h Nov	Dec			
(96)m-	Jan	Feb	Mar		Apr May	y		Jui						;		(86)
(00)11=	I		0.99	0	0.95		0.01	0.00	0.7	0.91	0.96					(00)
Mear	n interna	l tempera	ture in	livir T	ng area T1 ((follo	w ste	ps 3 to 7	7 in T	able 9c)	1		1	_		(07)
(87)m=	19.47	19.59	19.85	20	0.23 20.59	2	20.86	20.96	20.	94 20.73	20.27	7 19.81	19.44			(87)
Tem	perature	during he	eating p	perio	ods in rest o	of dw	/elling	from Ta	able	9, Th2 (°C)				_		
(88)m=	19.77	19.77	19.78	19	9.79 19.79		19.8	19.8	19	.8 19.79	19.79	9 19.78	19.78			(88)
Utilis	ation fac	tor for ga	ins for	rest	t of dwelling	j, h2	,m (se	e Table	9a)							
(89)m=	1	0.99	0.99	0	0.89 0.89		0.71	0.5	0.5	57 0.85	0.98	0.99	1			(89)
Mear	n interna	l tempera	ture in	the	rest of dwe	ellina	T2 (fo	ollow ste	eps 3	to 7 in Tab	le 9c)		-			
(90)m=	17.75	17.94	18.32	18	8.86 19.37		19.7	19.78	19.	77 19.56	18.94	1 18.26	17.72			(90)
	L	· ·		<u>I</u>	I					Į	fLA = Li	ving area ÷ (4	4) =		0.33	(91)
Mean	n interno	Itomporo	ture (fr	r th	ne whole dw	مالام	a) – fi	Δ 🗸 Τ1	⊥ (1	_ fl Δ) 🗸 Τα	,			L		
(92)m=	18.32	18.49	18.83		9.32 19.78		20.08	20.17	20	16 19.95	19.38	3 18.77	18.29	٦		(92)
<pre>=</pre>		, I		· · `		· · ^					1			1		x - 7

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

(93)m=	18.32	18.49	18.83	19.32	19.78	20.08	20.17	20.16	19.95	19.38	18.77	18.29		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set T the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	mperatui using Ta	re obtair Ible 9a	ned 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	n:										
(94)m=	1	0.99	0.98	0.96	0.89	0.74	0.55	0.62	0.86	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	436.93	476.51	519.64	563.65	564.28	465.01	331.58	340.98	430.07	434.97	418.88	419.07		(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	nal tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1386.55	1341.36	1214.62	1017	787.23	530.02	345.26	362.8	566.88	855.62	1141.74	1383.27		(97)
Space	e heatin	g require	ement fo	or each n	honth, k	Wh/mont	th = 0.02	24 x [(97])m – (95)m] x (4′	1)m			
(98)m=	706.52	581.18	517.07	326.41	165.88	0	0	0	0	312.96	520.46	717.36		_
								Tota	l per year	(kWh/year	.) = Sum(9	8)15,912 =	3847.83	(98)
Space	e heatin	g require	ement in	ı kWh/m²	/year								54.06	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Sp <mark>ac</mark>	e heatir	ng:												-
Fracti	on of sp	ace hea	at from s	econdar	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> i	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain s <mark>pa</mark>	ace heat	ing syste	em 1								93.5	(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)								
	706.52	581.18	517.07	326.41	165.88	0	0	0	0	312.96	520.46	717.36		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)								l	(211)
	755.63	621.58	553.01	349.1	177.41	0	0	0	0	334.72	556.64	767.23		-
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	-	4115.33	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									
= {[(98)m x (20	01)]}x 1	00 ÷ (20)8) 									I	
(215)m=	0	0	0	0	0	0	0	0 Tata	0	0	0	0		
								Tota	а (кууп/уеа	ar = 5urr(2	213) _{15,10} 12	-	0	(215)
Water	heating	J												
Output	100 5	ater hea	ter (calc	15922	00VE)	129.95	122 /7	146.20	145.09	164 17	172 / 2	195.06		
Efficier	130.3	ater hea		130.32	155.24	130.05	155.47	140.23	143.30	104.17	175.45	105.90	70.8	1 (216)
(017)m				96.7	84.00	70.0	70.0	70.0	70.0	00 54	07.57	00.07	79.8	(217)
(2 1) =	01.99	07.00		00./	04.99	19.0	19.0	19.0	19.0	16.00	01.01	00.07		(~ 1 /)
ruel 10	water = (64)	meating, m x 100	кууп/mi) <u>+</u> (217)	unin)m										
(219)m=	216.49	191.16	201.65	182.6	182.66	173.99	167.26	183.32	182.93	189.77	198.06	211.15		
			Į					Tota	I = Sum(2	19a) ₁₁₂ =			2281.04	(219)
Annua	I totals									k	Wh/year	,	kWh/year	J .
Space	heating	fuel use	ed, main	system	1						-		4115.33]
														-

Water heating fuel used			2281.04
Electricity for pumps, fans and electric keep-hot			
central heating pump:			30 (230c)
boiler with a fan-assisted flue			45 (230e)
Total electricity for the above, kWh/year	sui	m of (230a)(230g) =	75 (231)
Electricity for lighting			322.27 (232)
12a. CO2 emissions - Individual heating systems	including micro-CH	P	
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	888.91 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	492.7 (264)
Space and water heating	(261) + (262) + (263) +	- (264) =	1381.61 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	167.26 (268)
Total CO2, kg/year TER =		sum of (265)(271) =	22.31 (272)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2		Strom Softwa	a Num are Vei	ber: rsion:		Versic	on: 1.0.1.24	
		Р	roperty.	Address	: Flat 5					
Address :										
1. Overall dwelling dimension	ons:									
			Area	a(m²)	1	Av. Hei	ght(m)	-	Volume(m ³)	-
Ground floor			4	2.57	(1a) x	2	.5	(2a) =	106.42	(3a)
First floor			Э	32.51	(1b) x	2	.5	(2b) =	81.27	(3b)
Second floor			3	31.06	(1c) x	2	.5	(2c) =	77.65	(3c)
Total floor area TFA = (1a)+	(1b)+(1c)+(1d)+(1e	e)+(1r	1) <u>1</u>	06.14	(4)			_		-
Dwelling volume					(3a)+(3b)+(3c)+(3d))+(3e)+	.(3n) =	265.35	(5)
2. Ventilation rate:										-
	main so	econdar neating	у	other		total			m ³ per hour	
Number of chimneys		0] + [0] = [0	× 4	40 =	0	(6a)
Number of open flues	0 +	0	ī + Г	0	ī = [0	×	20 =	0	(6b)
Number of intermittent fans					Ī	4	×	10 =	40	(7a)
Number of passive vents					Γ	0	x '	10 =	0	(7b)
Number of flueless gas fires					Ē	0	X	40 =	0	(7c)
								Air ch	anges per hou	ır
Infiltration due to chimneys,	flues and fans = (6)	a)+(6b)+(7	a)+(7b)+(7c) =	Г	40		÷ (5) =	0.15](8)
If a pressurisation test has been	carried out or is intende	ed, procee	d to (17), d	otherwise of	continue fr	rom (9) to (16)	. (-)	0.10	
Number of storeys in the c	lwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.25	for steel or timber	frame or	0.35 fo	r masoni	y constr	ruction			0	(11)
if both types of wall are presended up to the second second second second second second second second second se	nt, use the value corres	ponding to	the great	er wall are	a (after					-
If suspended wooden floor	r, enter 0.2 (unseal	led) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, enter	0.05, else enter 0		,	,.					0	(13)
Percentage of windows ar	nd doors draught st	ripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13) +	(15) =		0	(16)
Air permeability value, q50), expressed in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	5	(17)
If based on air permeability	/alue, then (18) = [(1	7) ÷ 20]+(8	3), otherw	ise (18) = ((16)				0.4	(18)
Air permeability value applies if a	a pressurisation test ha	s been dor	e or a deg	gree air pe	rmeability	is being us	ed			-
Number of sides sheltered									2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporating	shelter factor			(21) = (18) x (20) =				0.34	(21)
Infiltration rate modified for n	nonthly wind speed			1.	-			_	1	
Jan Feb Ma	r Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	
Monthly average wind speed	from Table 7	1		i		,		i	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 (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4		
Calculate effec	ctive air	change i tion:	rate for t	he appli	cable ca	se						- 	0 (220)
If exhaust air he		using Anne	endix N (2	3h) - (23a	a) x Emv (e	auation (N	(5)) other	wise (23h) - (23a)				0 (238)
If balanced with	heat reco	overv: effici	iency in %	allowing f	or in-use f	actor (from	n Table 4h)) =) = (20u)				0 (230)
a) If balance	d mach	anical ve		with he	at recover	and (M)/F	- Pablo III)	(2)	2b)m ± ('	23h) v [*	1 _ (23c)	· 100]	
(24a)m = 0							0	0			$\frac{1}{0}$	 	(24a)
h) If halance	d mech:	anical ve	ntilation	without	heat rec	overv (N	 /\/) (24b)m – (2	2b)m + (;	23h)	-	l	· · · · ·
(24b)m = 0			0	0				0		0	0		(24b)
c) If whole h		tract ven	tilation o	n nositiv	l input v	/entilatic	n from c	utside				J	· · · ·
if (22b)n	n < 0.5 ×	(23b), t	hen (24d	c) = (23b); otherv	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	on or wh	ole hous	e positiv	ve input	ventilatio	on from l	oft				1	
íf (22b)n	n = 1, th	en (24d)	m = (22k	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]	-		-	
(24d)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(24d)
E <mark>ffectiv</mark> e air	change	rate - er	n <mark>ter (</mark> 24a) or (2 <mark>4</mark> k	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(25)
3. Heat losse	s and he	eat loss r	paramete	er:									
												_	
ELEMENT	Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e	AXk
ELEMENT	Gros	ss (m²)	Openin m	gs I ²	Net Ar A ,r	ea n²	U-valı W/m2	le K	A X U (W/ł	<)	k-value kJ/m²·I	€ K	A X k kJ/K
ELEMENT Doors	Gros area	ss (m²)	Openin m	gs I ²	Net Ar A ,r 2.1	ea n² x	U-valu W/m2	Je K =	A X U (W/ł 2.1	<)	k-value kJ/m²∙I	e K	A X k kJ/K (26)
ELEMENT Doors Windows Type	Gros area	ss (m²)	Openin m	gs ₁ 2	Net Ar A ,r 2.1 2.23	ea n ² x x	U-valu W/m2 1 /[1/(1.4)+	ue K 0.04] =	A X U (W/ł 2.1 2.96	<)	k-value kJ/m²·I	e K	A X k kJ/K (26) (27)
ELEMENT Doors Windows Type Windows Type	Gros area e 1 e 2	ss (m²)	Openin m	gs 1 ²	Net Ar A ,r 2.1 2.23 3.44	ea n ² x x ¹ / x ¹ /	U-valu W/m2 [ue K 0.04] = 0.04] =	A X U (W/ł 2.1 2.96 4.56	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27)
ELEMENT Doors Windows Type Windows Type	Gros area e 1 e 2 e 3	ss (m²)	Openin m	gs ₁₂	Net Ar A ,r 2.1 2.23 3.44 3.53	ea n ² x x ^{1,} x ^{1,} x ^{1,}	U-valu W/m2 [ue K 0.04] = 0.04] = 0.04] =	A X U (W/ł 2.1 2.96 4.56 4.68		k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	Gros area 2 1 2 2 2 3 2 4	ss (m²)	Openin m	gs 2	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08	ea n ² x x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾	U-valu W/m2 [Je	A X U (W/ł 2.1 2.96 4.56 4.68 2.76	$\langle \rangle$	k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	Gros area 2 2 3 2 4 2 5	ss (m²)	Openin m	gs ₂ 2	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 [1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04]	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56		k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 2 1 2 2 3 3 4 4 5 5 6	ss (m²)	Openin m	gs 2	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34	ea n ² x x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾ x ¹⁾	U-valu W/m2 [1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04]	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56 3.1		k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 2 1 2 2 3 4 4 5 5 6 6 7	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89	ea n ² x x1, x1, x1, x1, x1, x1, x1, x1,	U-valu W/m2 [1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] = 0.04] = 0.04]	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51	\diamond	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 2 2 3 4 4 5 6 6 7 8 8	ss (m²)	Openin m	gs ₁ 2	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2	ea n ² x x ¹ / x ^{1}/ x¹/ x^{1}/ x^{1}/ x¹/ x^{1}/ x^{1}/ x^{1}/ x^{1}/}}}}}}}	U-valu W/m2 [1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65		k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 2 1 2 2 3 3 4 4 5 5 6 6 7 2 8 8 9 9	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46	ea n ² x x1. x1. x1. x1. x1. x1. x1. x1.	U-valu W/m2 [1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	Je 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94	$\langle $	k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 2 1 2 2 2 3 2 4 2 5 2 6 2 7 2 8 2 9 2 9 2 10	ss (m²)	Openin m	gs ²	Net Ar A,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02	ea n ² x x1, x1, x1, x1, x1, x1, x1, x1,	$\frac{\text{U-valu}}{\text{W/m2}}$ $\frac{1}{(1/(1.4)+}$ $/(1/(1.4)+)$	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04]	A X U (W/ł 2.1 2.96 4.56 4.56 4.56 3.1 2.51 2.65 1.94 2.68	\diamond	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 2 1 2 2 3 4 2 5 2 6 2 7 2 8 9 9 2 10	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02 31.02	ea n ² x x1, x1, x1, x1, x1, x1, x1, x1,	U-valu W/m2 1 (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58		k-value kJ/m²-I	÷ K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type	Gros area 2 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 2 10 <u>40.2</u>	22 7	Openin m 9.2	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02 31.02	ea n ² x x ¹ / x ^{1}/ x¹/ x^{1}/ x¹/ x^{1}/ x^{1}/ x^{1}/ x^{1}/}}}}}}	U-valu W/m2 1 (1/(1.4)+)+ (1/(1.4)+ (1/(1.4)+)+ (1/(1.4)+ (1/(1.4)+)+ (1/(1.4)+ (1/(1.4)+)+ (1	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] = 0.04] = 0.04] = 0.04]	A X U (W/ł 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Walls Type2	Gros area 2 1 2 2 2 3 2 4 2 5 2 6 2 7 2 8 2 9 2 10 2 40.2 3 9.1 1 0 2 0 0 1 0 2 0 0 1 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 2	22 7	Openin m 9.2 7.86	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02 31.02 31.31	ea n ² x x1 x1) x1) x1) x1) x1) x1) x1) x	U-valuW/m2 1 $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ $(1/(1.4)+)+$ 0.18 0.18	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	A X U (W/ł 2.1 2.96 4.56 4.56 4.56 3.1 2.51 2.65 1.94 2.68 5.58 5.58		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Walls Type1 Walls Type3 Roof	Gros area 2 1 2 2 3 4 2 5 2 6 2 7 2 8 2 9 2 10 40.2 39.1 39.1	22 7 7	Openin m 9.2 7.86 7.37 2	gs 2	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02 31.02 31.02 31.02	ea n ² x x1, x1, x1, x1, x1, x1, x1, x1,	U-valu W/m2 1 (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ (1/(1.4)+ 0.18 0.18 0.18	Je K 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/) 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58 5.58 5.58		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Walls Type1 Walls Type3 Roof	Gros area 2 1 2 2 3 3 4 4 2 5 4 6 2 7 2 8 2 9 2 10 40.2 39.1 39.1 31.0	22 7 7 7 96 m ²	Openin m 9.2 7.86 7.37 0	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 2.34 1.89 2 1.46 2.02 31.02 31.02 31.31 31.8 31.06	ea n ² x x1, x1, x1, x1, x1, x1, x1, x1,	U-valu W/m2 1 (1/(1.4)+ (1/(1.4)+ (1/(1.4)+)+ (1/(1.4)+)+ (1/(1.4)+)+ (1/(1.4)+)+ (1/(1.4)+)+ (1/(1.4)+)+ (1/(1.4)+)+ (1/(1.4)+)+ 0.18 0.18 0.13	$\begin{bmatrix} \mathbf{K} \\ 0.04 \end{bmatrix} = \\ $	A X U (W/) 2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58 5.58 5.64 5.72 4.04		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Walls Type1 Walls Type2 Walls Type3 Roof Total area of e	Gros area 2 1 2 2 3 3 4 4 2 5 4 6 2 7 8 8 9 9 2 10 40.2 39.1 39.1 31.0 embedded and a second secon	22 7 7 96 , m ²	Openin m 9.2 7.86 7.37 0	gs ²	Net Ar A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02 31.02 31.31 31.8 31.06 151.7	ea n^2 x11 x11	U-valu W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.18 0.18 0.13	$\begin{bmatrix} k \\ 0.04 \end{bmatrix} = \\ 0.0$	A X U (W/ł 2.1 2.96 4.56 4.56 3.1 2.51 2.65 1.94 2.68 5.58 5.64 5.72 4.04		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27

* for win ** inclua	idows and le the area	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	ie)+0.04] a	as given in	paragrap	h 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				55.47	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (3	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	- = Cm -	÷ TFA) ir	ו kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Te	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	K						19.05	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			74.52	(37)
Ventila	ation hea	at loss ca	alculated	monthl	у	-	-		(38)m	= 0.33 × ((25)m x (5)		_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	52.04	51.72	51.41	49.93	49.65	48.37	48.37	48.13	48.86	49.65	50.21	50.8		(38)
Heat tr	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m		-	
(39)m=	126.56	126.24	125.92	124.45	124.17	122.89	122.89	122.65	123.38	124.17	124.73	125.32]	
									/	Average =	Sum(39)1.	12 /12=	124.45	(39)
Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)		7	
(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.16	1.16	1.17	1.18	1.18		_
Nhunda	or of dou		ath (Tah						1	Average =	Sum(40)1.	12 /12=	1.17	(40)
NUMD	er of day	s in moi	nth (Tab						0		- NL	D	1	
	Jan	Feb	Mar	Apr	May	Jun	Jui	Aug	Sep	Oct	NOV	Dec	-	(44)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ting ener	rgy <mark>requ</mark>	irement:								kWh/y	ear:	
Assum	ned occi	inancy I	N								2	70	1	(42)
if TF if TF	A > 13.9 A £ 13.9	9, N = 1 9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	00 <mark>13 x (</mark>	TF <mark>A -13</mark>	.9)	79		(72)
Annua	l averag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		100).45]	(43)
Reduce	the annua	al average	hot water	usage by	5% if the c	lwelling is	designed i	to achieve	a water us	se target o	of		-	
		nites per j					1			-			1	
11-4	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	r day for ea	acn montn I	va,m = 1a			(43)		r			-	
(44)m=	110.5	106.48	102.46	98.44	94.42	90.41	90.41	94.42	98.44	102.46	106.48	110.5		
Enerav	content of	hot water	used - cal	culated m	onthly = 4	190 x Vd r	т х пт х Г)Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b_1	= c. 1d)	1205.42	(44)
(45)		4 4 2 2 2	447.00	400.00	400.70	400.70		442.50	444.07	400.00		450.00	1	
(45)m=	163.86	143.32	147.89	128.93	123.72	106.76	98.93	113.52	114.87	133.88	146.14	158.69	4500.5	(45)
lf instan	taneous w	ater heatii	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	i otal = Su	m(45) ₁₁₂ =	-	1580.5	(43)
(46)m=	24.58	21.5	22.18	19.34	18.56	16.01	14.84	17.03	17.23	20.08	21.92	23.8		(46)
vvater Storog	storage	IOSS:	ingludir		olor or M		otorogo	within or					1	(47)
Sioray				ig any so			Slorage		ame ves	501		150		(47)
II COMI	munity h vise if pr	eating a	niu no ta	uik IN OW ar (this is	vening, e veludee i	nstantar		(47) mbi boil	are) ante	ar '()' in <i>(</i>	(17)			
Water	storade	loss:	not wate	21 (UIIS II	1010069	nətarildi				, U III ((11)			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	39	1	(48)
Tempe	erature f	actor fro	m Table	2b			- /				0.	54	ĺ	(49)
•														

Energy lost fr b) If manufac Hot water sto	om wate cturer's d rage loss	r storage eclared c factor fr	, kWh/ye cylinder l com Tabl	ear oss facto e 2 (kWl	or is not h/litre/da	known: iy)	(48) x (49)) =		0.	75 0		(50) (51)
If community	heating s	ee sectio	on 4.3										
Temperature	f from Ta	.bie ∠a om Table	2h								0		(52)
Energy lost fr	om wate	r storage	_~ kWh/v∈	ar			(47) x (51) x (52) x (53) =		0		(54)
Enter (50) or	(54) in (55)	,				(47) X (01)	/ X (02) X (00) -	0	75		(55)
Water storage	e loss cal	culated f	for each	month			((56)m = (55) × (41)	m				. ,
(56)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If cylinder contai	ns dedicate	d solar sto	rage, (57)r	n = (56)m	x [(50) – (L H11)] ÷ (5	0), else (5	l 7)m = (56)	n where (L H11) is fro	m Appendi	хH	
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circu	it loss (ar	nual) fre	m Table	3							0		(58)
Primary circu	it loss (al	Iculated f	for each	month (59)m = ((58) ÷ 36	65 x (41)	m			<u> </u>		()
(modified b	y factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss c	alculated	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 heat red	uired for	water h	eating ca	lculated	for eacl	h month	(62)m =	0.85 × ((45) <mark>m +</mark>	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 210.46	185.4	194.48	174.03	170.31	151.85	145.52	160.11	159.97	18 <mark>0.47</mark>	191.23	205.29		(62)
Solar DHW input	calculated	using App	<mark>endix</mark> G or	Appendix	H (negativ	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add addition	al lines <mark>if</mark>	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 v	vater hea	iter											
(64)m= 210.46	185.4	194.48	174.03	170.31	151.85	145.52	160.11	159.97	180.47	191.23	205.29		
							Outp	out from w	ater heate	r (annual)₁	12	2129.12	(64)
Heat gains fro	om water	heating,	kWh/ma	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	1 + 0 8 1	([(4 G) m				
(65)m= 91.76	81.32				-	(-)	(ij i 0.07	(40)m	+ (57)m	+ (59)m]	
include (F7		86.45	78.94	78.41	71.57	70.17	75.02	74.27	81.79	+ (57)m 84.66	+ (59)m 90.04]	(65)
include (57)m in cal	86.45	78.94 of (65)m	78.41 only if c	71.57 ylinder is	70.17 s in the c	75.02 dwelling	74.27 or hot w	81.79 ater is fr	+ (57)m 84.66 rom com	+ (59)m 90.04 munity h] eating	(65)
5. Internal g)m in cale jains (see	86.45 culation (Table 5	78.94 of (65)m and 5a)	78.41 only if c :	71.57 ylinder is	70.17 s in the c	75.02 dwelling	74.27 or hot w	81.79 ater is fr	+ (57)m 84.66 rom com	+ (59)m 90.04 munity h] eating	(65)
5. Internal g)m in cale jains (see ns (Table	86.45 culation (Table 5 3 5), Wat	78.94 of (65)m and 5a) ts	78.41 only if c	71.57 ylinder is	70.17 s in the c	75.02 dwelling	74.27 or hot w	81.79 ater is fr	+ (57)m 84.66 rom com	+ (59)m 90.04 munity h] eating	(65)
5. Internal g Metabolic gai)m in cale jains (see ns (Table Feb	86.45 culation (Table 5 5), Wat Mar	78.94 of (65)m and 5a) ts Apr	78.41 only if c : May	71.57 ylinder is Jun	70.17 s in the c	75.02 dwelling Aug	74.27 or hot w	ater is fr	+ (57)m 84.66 om com	+ (59)m 90.04 munity h Dec] eating	(65)
5. Internal of Metabolic gai (66)m= 139.48)m in cal jains (see ns (Table Feb 139.48	86.45 culation (Table 5 5), Wat Mar 139.48	78.94 of (65)m and 5a) ts Apr 139.48	78.41 only if c : May 139.48	71.57 ylinder is Jun 139.48	70.17 s in the c Jul 139.48	Aug 139.48	74.27 or hot w Sep 139.48	81.79 ater is fr Oct 139.48	+ (57)m 84.66 rom com Nov 139.48	+ (59)m 90.04 munity h Dec 139.48] eating	(65)
5. Internal g Metabolic gai (66)m= 139.48 Lighting gains)m in cale ains (see ns (Table Feb 139.48 s (calcula	86.45 culation (Table 5 ≥ 5), Wat Mar 139.48 ted in Ap	78.94 of (65)m and 5a) ts Apr 139.48 opendix I	78.41 only if c : May 139.48 _, equati	71.57 ylinder is Jun 139.48 ion L9 ol	70.17 s in the c Jul 139.48 r L9a), a	Aug 139.48 Iso see	74.27 or hot w Sep 139.48 Table 5	0ct 139.48	+ (57)m 84.66 rom com Nov 139.48	+ (59)m 90.04 munity h Dec 139.48] eating	(65)
5. Internal g Metabolic gai (66)m= 139.48 Lighting gains (67)m= 24.09)m in cale pains (see ns (Table Feb 139.48 s (calcula 21.4	86.45 culation (Table 5 5), Wat Mar 139.48 ted in Ap 17.4	78.94 of (65)m and 5a) ts Apr 139.48 >pendix I 13.18	78.41 only if c : May 139.48 _, equati 9.85	71.57 ylinder is Jun 139.48 ion L9 oi 8.31	70.17 s in the c Jul 139.48 r L9a), a 8.98	75.02 dwelling Aug 139.48 Iso see 11.68	74.27 or hot w Sep 139.48 Table 5 15.67	81.79 ater is fr Oct 139.48	+ (57)m 84.66 rom com Nov 139.48 23.23	+ (59)m 90.04 munity h Dec 139.48 24.76] eating	(65) (66) (67)
5. Internal (Metabolic gain (66)m= 139.48 Lighting gains (67)m= 24.09 Appliances ga)m in cale pains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc	86.45 culation (Table 5 5), Wat Mar 139.48 ted in Ap 17.4 :ulated in	78.94 of (65)m and 5a) ts Apr 139.48 opendix I 13.18	78.41 only if c : May 139.48 _, equati 9.85 lix L, eq	71.57 ylinder is Jun 139.48 on L9 of 8.31 uation L	70.17 s in the c 139.48 r L9a), a 8.98 13 or L1	Aug 139.48 Iso see 11.68 3a), also	74.27 or hot w Sep 139.48 Table 5 15.67 o see Ta	0ct 139.48	+ (57)m 84.66 rom com Nov 139.48 23.23	+ (59)m 90.04 munity h Dec 139.48 24.76] eating	(65) (66) (67)
Include (575. Internal gMetabolic gaiJan(66)m=139.48Lighting gains(67)m=24.09Appliances gai(68)m=265.89)m in cale ains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc	86.45 culation (Table 5 5), Wat 139.48 ted in Ap 17.4 :ulated in 261.7	78.94 of (65)m and 5a) ts Apr 139.48 opendix I 13.18 Appence 246.89	78.41 only if c : May 139.48 _, equati 9.85 lix L, eq 228.21	71.57 ylinder is Jun 139.48 ion L9 of 8.31 uation L 210.65	70.17 s in the c Jul 139.48 r L9a), a 8.98 13 or L1 198.92	75.02 dwelling 139.48 Iso see 11.68 3a), also 196.16	74.27 or hot w Sep 139.48 Table 5 15.67 o see Ta 203.11	Oct 139.48 19.9 ble 5 217.91	+ (57)m 84.66 rom com 139.48 23.23 236.6	+ (59)m 90.04 munity h Dec 139.48 24.76] eating	(65)(66)(67)(68)
1000000000000000000000000000000000000)m in cale ains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc 268.65 s (calcula	86.45 culation (Table 5 5), Wat 139.48 ted in Ap 17.4 :ulated in 261.7 ated in Ap	78.94 of (65)m of and 5a) ts Apr 139.48 opendix I 13.18 Appendix 246.89 opendix	78.41 only if c : May 139.48 _, equati 9.85 lix L, eq 228.21 L, equat	71.57 ylinder is Jun 139.48 on L9 of 8.31 uation L 210.65 ion L15	70.17 s in the c Jul 139.48 r L9a), a 8.98 13 or L1 198.92 or L15a)	75.02 dwelling Jayelling 139.48 Iso see 11.68 3a), also 196.16), also see	74.27 or hot w Sep 139.48 Table 5 15.67 o see Ta 203.11 ce Table	0ct 139.48 19.9 ble 5 217.91 5	+ (57)m 84.66 rom com Nov 139.48 23.23 236.6	+ (59)m 90.04 munity h Dec 139.48 24.76 254.16] eating	(65) (66) (67) (68)
Include (575. Internal gMetabolic gaiJan(66)m=139.48Lighting gains(67)m=24.09Appliances gai(68)m=265.89Cooking gain(69)m=36.95)m in cale ains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc 268.65 s (calcula 36.95	86.45 culation (Table 5 5), Wat Mar 139.48 ted in Ap 17.4 :ulated in 261.7 ated in Ap 36.95	78.94 of (65)m and 5a) ts Apr 139.48 ppendix I 13.18 Appendix 246.89 cpendix 36.95	78.41 only if c : 139.48 _, equati 9.85 lix L, equati 228.21 L, equat 36.95	71.57 ylinder is Jun 139.48 on L9 or 8.31 uation L 210.65 ion L15 36.95	70.17 s in the c 139.48 r L9a), a 8.98 13 or L13 198.92 or L15a) 36.95	75.02 dwelling 139.48 Iso see 11.68 3a), also 196.16), also se 36.95	74.27 or hot w Sep 139.48 Table 5 15.67 o see Ta 203.11 ee Table 36.95	81.79 ater is fr Oct 139.48 19.9 ble 5 217.91 5 36.95	+ (57)m 84.66 rom com 139.48 23.23 236.6 36.95	+ (59)m 90.04 munity h Dec 139.48 24.76 254.16 36.95] eating	 (65) (66) (67) (68) (69)
5. Internal gMetabolic gaiJan(66)m=139.48Lighting gains(67)m=24.09Appliances gi(68)m=265.89Cooking gain(69)m=36.95Pumps and fa)m in cale ains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc 268.65 s (calcula 36.95 ans gains	86.45 culation (Table 5 5), Wat 139.48 ited in Ap 17.4 :ulated in 261.7 ated in Ap 36.95 (Table 5	78.94 of (65)m and 5a) ts Apr 139.48 opendix I 13.18 Appenci 246.89 opendix 36.95 ja)	78.41 only if c : May 139.48 ., equati 9.85 dix L, equati 228.21 L, equat 36.95	71.57 ylinder is Jun 139.48 ion L9 of 8.31 uation L 210.65 ion L15 36.95	70.17 s in the c Jul 139.48 r L9a), a 8.98 13 or L1: 198.92 or L15a) 36.95	75.02 dwelling 139.48 Iso see 11.68 3a), also 196.16), also se 36.95	Sep 139.48 Table 5 15.67 > see Ta 203.11 >> Table 36.95	81.79 ater is fr Oct 139.48 19.9 ble 5 217.91 5 36.95	+ (57)m 84.66 rom com 139.48 23.23 236.6 36.95	+ (59)m 90.04 munity h Dec 139.48 24.76 254.16 36.95] eating	 (65) (66) (67) (68) (69)
Include (575. Internal gMetabolic gaiJan(66)m=139.48Lighting gains(67)m=24.09Appliances gai(68)m=265.89Cooking gain(69)m=36.95Pumps and fa(70)m=3)m in cale pains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc 268.65 s (calcula 36.95 ans gains 3	86.45 culation (5), Wat Mar 139.48 ited in Ap 17.4 culated in 261.7 ated in Ap 36.95 (Table 5	78.94 of (65)m of and 5a) ts Apr 139.48 opendix I 13.18 Appendix 246.89 opendix 246.89 opendix 36.95 5a) 3	78.41 only if c : 139.48 _, equati 9.85 lix L, equati 228.21 L, equat 36.95	71.57 ylinder is Jun 139.48 on L9 of 8.31 uation L 210.65 ion L15 36.95	70.17 s in the c Jul 139.48 r L9a), a 8.98 13 or L13 198.92 or L15a) 36.95	75.02 dwelling Jayelling 139.48 Iso see 11.68 3a), also 196.16), also se 36.95	74.27 or hot w Sep 139.48 Table 5 15.67 o see Ta 203.11 ee Table 36.95	81.79 ater is fr Oct 139.48 19.9 ble 5 217.91 5 36.95	+ (57)m 84.66 rom com Nov 139.48 23.23 236.6 36.95	+ (59)m 90.04 munity h Dec 139.48 24.76 254.16 36.95] eating	 (65) (66) (67) (68) (69) (70)
Include (575. Internal gMetabolic gaiJan(66)m=139.48Lighting gains(67)m=24.09Appliances gai(68)m=265.89Cooking gain(69)m=36.95Pumps and fa(70)m=3Losses e.g. e)m in cale ains (see ns (Table Feb 139.48 s (calcula 21.4 ains (calc 268.65 s (calcula 36.95 ans gains 3 vaporatio	86.45 culation (Table 5 5), Wat Mar 139.48 ited in Ap 17.4 :ulated in 261.7 ated in Ap 36.95 (Table 5 3 on (negat	78.94 of (65)m and 5a) band 5a) and 5a) and 5a) band 5a) and 5a) and 5a) and 5a) and 5a) appendix and 5a) and 5a) appendix and 5a) and 5a)	78.41 only if c : 139.48 _, equati 9.85 dix L, equati 228.21 L, equat 36.95 3 es) (Tab	71.57 ylinder is Jun 139.48 on L9 or 8.31 uation L 210.65 ion L15 36.95 3 le 5)	70.17 s in the c 139.48 r L9a), a 8.98 13 or L12 198.92 or L15a) 36.95	75.02 dwelling 139.48 Iso see 11.68 3a), also 196.16), also se 36.95	74.27 or hot w Sep 139.48 Table 5 15.67 o see Ta 203.11 see Table 36.95	81.79 ater is fr Oct 139.48 19.9 ble 5 217.91 5 36.95	+ (57)m 84.66 rom com Nov 139.48 23.23 236.6 36.95 3	+ (59)m 90.04 munity h Dec 139.48 24.76 254.16 36.95 3] eating	 (65) (66) (67) (68) (69) (70)

Water	heating	gains (T	able 5)											_	
(72)m=	123.33	121.01	116.2	109.64	105.3	9	99.4	94.31	100	.83 103.15	109.9	3 117.59	121.02		(72)
Total	interna	l gains =					(66))m + (67)m	n <mark>+ (6</mark> 8	3)m + (69)m +	(70)m +	(71)m + (72)	m		
(73)m=	481.16	478.91	463.14	437.56	6 411.2	9 3	86.21	370.06	376	.51 389.78	415.5	9 445.26	467.79		(73)
6. Sc	olar gain	s:													
Solar	gains are	calculated	using sola	r flux fro	m Table 6	a and	d assoc	iated equa	tions	to convert to th	ne applic	able orientat	ion.		
Orient	ation:	Access F Table 6d	actor	Are	a 2		Flu Tal	IX hla 6a		<u>g_</u> Table 6b		FF Table 6c		Gains	
Feet						1			1		_			(**)	
East	0.9x	1	×	2	2.23	X		9.64	X	0.63	×	0.7	=	9.39	(76)
East	0.9x	1	×		3.53) × 1		9.64	X	0.63	X	0.7	=	14.86	
East	0.9x	1	×		2.34] × 1		9.64	X	0.63		0.7	=	9.85	
Fast	0.9x	1			2.02] × 1		9.64	x	0.63		0.7	=	8.5	
Fast	0.9x	1			2.23] ^		38.42		0.63		0.7		18.36	
Fast	0.9x	1	╡ Û		0.03] ^] ↓		08.42		0.63	╡ Û	0.7	=	29.07	
Fast	0.9x	1	╡ Û		2.34] ^] ↓		08.42		0.63	╡Ĵ	0.7	=	19.27	
East	0.0x	1			2.02			2 27		0.63	╡ Û	0.7		20.24	
East	0.0	1			2.23			3 27	×	0.63		0.7	\exists	17.97	(76)
East	0.9x	1			2 34	l x		3 27	x	0.63		0.7		31.73	
East	0.9x	1			2.02] ^]		3 27	×	0.63		0.7		27 39	
East	0.9x	1			23	x		2 28	×	0.63	×	0.7	-	44 1	(76)
East	0.9x	1	× T		3.53			2.28	x	0.63	x	0.7		69.82	(76)
East	0.9x	1	×		2.34	x		2.28	x	0.63	x	0.7	=	46.28	(76)
East	0.9x	1	×		2.02	×)2.28	x	0.63		0.7	=	39.95	(76)
East	0.9x	1	x	2	2.23	×	1	13.09	x	0.63	x	0.7	=	54.05	(76)
East	0.9x	1	×		3.53	İ x	1	13.09	x	0.63	×	0.7	=	85.56	(76)
East	0.9x	1	×	2	2.34	×	1	13.09	x	0.63	×	0.7	=	56.72	(76)
East	0.9x	1	x	2	2.02	×	1	13.09	×	0.63	x	0.7	=	48.96	(76)
East	0.9x	1	x	2	2.23	×	1	15.77	x	0.63	x	0.7	=	55.33	(76)
East	0.9x	1	x	3	3.53	×	1	15.77	x	0.63	x	0.7	=	87.59	(76)
East	0.9x	1	x	2	2.34	×	1	15.77	x	0.63	x	0.7	=	58.06	(76)
East	0.9x	1	x	2	2.02	×	1	15.77	x	0.63	x	0.7	=	50.12	(76)
East	0.9x	1	x	2	2.23	×	1	10.22	x	0.63	x	0.7	=	52.68	(76)
East	0.9x	1	x	3	3.53	×	1	10.22	x	0.63	x	0.7	=	83.39	(76)
East	0.9x	1	x	2	2.34	×	1	10.22	x	0.63	x	0.7	=	55.28	(76)
East	0.9x	1	x	2	2.02	x	1	10.22	×	0.63	×	0.7	=	47.72	(76)
East	0.9x	1	x	2	2.23	x	9	94.68	×	0.63	×	0.7	=	45.25	(76)
East	0.9x	1	x	3	3.53	x	9	94.68	×	0.63	x	0.7	=	71.63	(76)
East	0.9x	1	x	2	2.34	x	9	94.68	×	0.63	x	0.7	=	47.48	(76)
East	0.9x	1	x	2	2.02	x	9	94.68	x	0.63	x	0.7	=	40.99	(76)

East	0.9x	1	x	2.23	x	73.59	x	0.63	x	0.7] =	35.17	(76)
East	0.9x	1	x	3.53	x	73.59	x	0.63	x	0.7	=	55.68	(76)
East	0.9x	1	x	2.34	x	73.59	x	0.63	x	0.7	=	36.91	(76)
East	0.9x	1	x	2.02	x	73.59	x	0.63	x	0.7	=	31.86	(76)
East	0.9x	1	x	2.23	x	45.59	x	0.63	x	0.7	=	21.79	(76)
East	0.9x	1	x	3.53	x	45.59	x	0.63	x	0.7	=	34.49	(76)
East	0.9x	1	x	2.34	x	45.59	x	0.63	x	0.7	=	22.86	(76)
East	0.9x	1	x	2.02	x	45.59	x	0.63	x	0.7	=	19.74	(76)
East	0.9x	1	x	2.23	x	24.49	x	0.63	x	0.7	=	11.7	(76)
East	0.9x	1	×	3.53	×	24.49	×	0.63	x	0.7] =	18.53	(76)
East	0.9x	1	x	2.34	x	24.49	x	0.63	x	0.7	=	12.28	(76)
East	0.9x	1	x	2.02	x	24.49	x	0.63	x	0.7	=	10.6	(76)
East	0.9x	1	x	2.23	x	16.15	x	0.63	x	0.7] =	7.72	(76)
East	0.9x	1	x	3.53	x	16.15	x	0.63	x	0.7] =	12.22	(76)
East	0.9x	1	x	2.34	x	16.15	x	0.63	x	0.7	=	8.1	(76)
East	0.9x	1	x	2.02	x	16.15	x	0.63	x	0.7	=	6.99	(76)
South	0.9x	0.54	x	3.44	x	46.75	x	0.63	x	0.7	=	34.47	(78)
South	0.9x	0.54	x	3.44	×	46.75	х	0.63	х	0.7] =	34.47	(78)
South	0.9x	0.54	x	2	x	46.75	x	0.63	x	0.7] =	20.04	(78)
South	0.9x	0.54	x	1.46	х	46.75] ×	0.63	x	0.7] =	14.63	(78)
South	0.9x	0.54	x	3.44	x	76.57	x	0.63	x	0.7] =	56.45	(78)
South	0.9x	0.54	x	3.44	×	76.5 <mark>7</mark>	х	0.63	x	0.7	=	56.45	(78)
South	0.9x	0.54	x	2	x	76.57	×	0.63	x	0.7	=	32.82	(78)
South	0.9x	0.54	x	1.46	x	76.57	×	0.63	x	0.7	=	23.96	(78)
South	0.9x	0.54	x	3.44	x	97.53	x	0.63	x	0.7	=	71.91	(78)
South	0.9x	0.54	x	3.44	x	97.53	x	0.63	x	0.7	=	71.91	(78)
South	0.9x	0.54	x	2	x	97.53	x	0.63	x	0.7	=	41.81	(78)
South	0.9x	0.54	x	1.46	x	97.53	x	0.63	x	0.7	=	30.52	(78)
South	0.9x	0.54	x	3.44	x	110.23	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.54	x	3.44	×	110.23	x	0.63	x	0.7] =	81.27	(78)
South	0.9x	0.54	x	2	x	110.23	x	0.63	x	0.7	=	47.25	(78)
South	0.9x	0.54	x	1.46	x	110.23	x	0.63	x	0.7] =	34.49	(78)
South	0.9x	0.54	x	3.44	x	114.87	×	0.63	x	0.7] =	84.69	(78)
South	0.9x	0.54	x	3.44	x	114.87	x	0.63	x	0.7	=	84.69	(78)
South	0.9x	0.54	x	2	x	114.87	x	0.63	x	0.7	=	49.24	(78)
South	0.9x	0.54	x	1.46	x	114.87	x	0.63	x	0.7	=	35.95	(78)
South	0.9x	0.54	x	3.44	x	110.55	×	0.63	x	0.7	=	81.5	(78)
South	0.9x	0.54	x	3.44	x	110.55	×	0.63	x	0.7	=	81.5	(78)
South	0.9x	0.54	×	2	×	110.55	×	0.63	x	0.7] =	47.39	(78)
South	0.9x	0.54	×	1.46	×	110.55	×	0.63	x	0.7	=	34.59	(78)
South	0.9x	0.54	x	3.44	x	108.01	x	0.63	x	0.7	=	79.64	(78)

South	0.9x	0 54	x	3.44	x	108.01	1 x	0.63	x	0.7] =	79.64	7(78)
South	0.9x	0.54	l ^ l x	2	l ^ l x	108.01] ^] x	0.63	x	0.7]] _	46.3](^{, , ,}] ₍₇₈₎
South	0.9x	0.54	l x	1.46	l x	108.01] ~	0.63	x	0.7	」 _	33.8](78)
South	0.9x	0.54	l x	3.44	l x	104.89] ~] x	0.63	x	0.7	」 _	77 34](78)
South	0.9x	0.54		3.44		104.89] ~] _	0.63	×	0.7	」 1 _	77.34](78)
South	0.9x	0.54	l x	2	l ^ l x	104.89] ^] x	0.63	x	0.7	」 _	44.96](⁷ 8)
South	0.9x	0.54	l x	1 46	l x	104.89] x	0.63	x	0.7	」] =	32.82](78)
South	0.9x	0.54	ı İx	3 44	l I x	101.89	」 】 x	0.63	x	0.7	」] _	75.12](78)
South	0.9x	0.54	l x	3.44	x	101.89] x	0.63	x	0.7	」] _	75.12](78)
South	0.9x	0.54	l X	2	l x	101.89	」 】 ×	0.63	x	0.7	」 】 =	43.67](78)
South	0.9x	0.54	x	1.46	x	101.89	」 】 ×	0.63	x	0.7	, =	31.88](78)
South	0.9x	0.54	x	3.44	x	82.59	」 】 ×	0.63	x	0.7	, =	60.89](78)
South	0.9x	0.54	x	3.44	x	82.59	x	0.63	x	0.7	=	60.89](78)
South	0.9x	0.54	x	2	x	82.59	x	0.63	x	0.7	1 =	35.4](78)
South	0.9x	0.54	x	1.46	x	82.59	x	0.63	x	0.7	=	25.84](78)
South	0.9x	0.54	x	3.44	x	55.42	x	0.63	x	0.7	=	40.86](78)
South	0.9x	0.54	x	3.44	x	55.42	x	0.63	x	0.7	1 =	40.86](78)
Sout <mark>h</mark>	0.9x	0.54	x	2	X	55.42	x	0.63	x	0.7		23.75	(78)
South	0.9x	0.54	×	1.46	x	55.42	x	0.63	x	0.7	i -	17.34	- (78)
South	0.9x	0.54	x	3.44	x	40.4	i 🖌	0.63	x	0.7	i =	29.78] (78)
South	0.9x	0.54	×	3.44	x	40.4	x	0.63	x	0.7	1 =	29.78] (78)
South	0.9x	0.54	×	2	x	40.4	x	0.63	x	0.7	i =	17.32] (78)
South	0.9x	0.54	x	1.46	x	40.4	×	0.63	x	0.7	i =	12.64] (78)
West	0.9x	0.54	×	2.08	х	19.64	x	0.63	x	0.7	i =	8.76] (80)
West	0.9x	0.54	×	1.89	×	19.64	×	0.63	x	0.7	i =	7.96	- (80)
West	0.9x	0.54	x	2.08	x	38.42	×	0.63	x	0.7	i =	17.13	(80)
West	0.9x	0.54	x	1.89	x	38.42	x	0.63	x	0.7] =	15.56	(80)
West	0.9x	0.54	x	2.08	x	63.27	x	0.63	x	0.7	=	28.21	- (80)
West	0.9x	0.54	×	1.89	x	63.27	x	0.63	x	0.7] =	25.63	(80)
West	0.9x	0.54	x	2.08	x	92.28	x	0.63	x	0.7	=	41.14	(80)
West	0.9x	0.54	×	1.89	x	92.28	x	0.63	x	0.7	=	37.38	(80)
West	0.9x	0.54	x	2.08	x	113.09	x	0.63	x	0.7	=	50.42	(80)
West	0.9x	0.54	×	1.89	x	113.09	x	0.63	x	0.7] =	45.81	(80)
West	0.9x	0.54	x	2.08	x	115.77	x	0.63	x	0.7	=	51.61	(80)
West	0.9x	0.54	×	1.89	x	115.77	x	0.63	x	0.7] =	46.9	(80)
West	0.9x	0.54	x	2.08	x	110.22	x	0.63	x	0.7] =	49.14	(80)
West	0.9x	0.54	×	1.89	x	110.22	x	0.63	x	0.7	=	44.65	(80)
West	0.9x	0.54	×	2.08	x	94.68	x	0.63	x	0.7	=	42.21	(80)
West	0.9x	0.54	×	1.89	×	94.68	x	0.63	x	0.7	=	38.35	(80)
West	0.9x	0.54	×	2.08	×	73.59	×	0.63	x	0.7] =	32.81	(80)
West	0.9x	0.54	×	1.89	x	73.59	x	0.63	x	0.7	=	29.81	(80)

West	0.9x	0.54	>	2.	08	x	4	15.59	x		0.63	x	0.7		=	20.32	(80)
West	0.9x	0.54)	1.	89	x	4	15.59	x		0.63	x	0.7		=	18.47	(80)
West	0.9x	0.54)	2.	08	x	2	24.49	x		0.63	×	0.7		=	10.92	(80)
West	0.9x	0.54)	1.	89	x	2	24.49	x		0.63	×	0.7		=	9.92	(80)
West	0.9x	0.54)	2.	08	x	1	6.15	x		0.63	×	0.7		=	7.2	(80)
West	0.9x	0.54)	: 1.	89	x	1	6.15	x		0.63	×	0.7		=	6.54	(80)
	-								-								
Solar (gains in	watts, ca	alculate	d for eac	h mont	h			(83)m	ו = S	um(74)m .	(82)m					
(83)m=	162.92	285.71	407.22	522.97	596.09	ł	594.6	572.21	518	.37	448.02	320.69	9 196.77	138.3	3	I	(83)
Total g	gains – i	nternal a	and sola	ır (84)m	= (73)m	1+(83)m	, watts									
(84)m=	644.08	764.61	870.36	960.52	1007.3	9 9	80.81	942.27	894	.88	837.8	736.28	642.02	606.0	9		(84)
7. Me	an inter	nal temp	perature	(heating	g seaso	n)											
Temp	perature	during h	eating	periods i	n the liv	ving	area	from Tab	ble 9	, Th	1 (°C)					21	(85)
Utilisa	ation fac	ctor for g	ains for	living ar	ea, h1,r	n (s	ee Ta	ble 9a)							1		
	Jan	Feb	Mar	Apr	May	,	Jun	Jul	A	ug	Sep	Oct	Nov	De	с	l	
(86)m=	1	0.99	0.99	0.96	0.88		0.73	0.56	0.6	61	0.84	0.97	1	1		l	(86)
Mear	interna	I temper	ature in	living a	· ·ea T1 (follo	w ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	19.71	19.88	20.15	20.48	20.77		20.94	20.99	20.	98	20.87	20.49	20.04	19.68	8		(87)
`		l					- II:	і (пала Т					_				
remt										9, 11 06	12 (°C)	10.04	10.04	10.0	4		(88)
(00)11=	19.93	19.93	19.95	19.94	19.94	<u> </u>	9.95	19.95	19.	90	19.95	19.94	19.94	19.94	+		(00)
Utilis	ation fac	tor for g	ains for	rest of c	lwelling	, h2	,m (se	e Table	9a)				_				()
(89)m=	1	0.99	0.98	0.94	0.84		0.64	0.43	0.4	18	0.77	0.96	0.99	1			(89)
Me <mark>ar</mark>	interna	l temper	ature in	the rest	of dwe	lling	T2 (f	ollow ste	eps 3	to 7	<mark>7 in Ta</mark> bl	e 9 <mark>c)</mark>					
(90)m=	18.21	18.46	18.85	19. <mark>34</mark>	19.71		9.91	19.95	19.	95	19.85	1 <mark>9.36</mark>	18.7	18.17	7		(90)
											f	LA = Liv	ving area ÷ (4) =		0.19	(91)
Mear	n interna	l temper	ature (f	or the wl	nole dw	ellin	g) = f	LA x T1	+ (1	– fL	.A) × T2						
(92)m=	18.5	18.74	19.1	19.56	19.91	12	20.11	20.15	20.	14	20.04	19.57	18.95	18.46	6	l	(92)
Apply	v adjustr	nent to t	he mea	n interna	l tempe	eratu	ure fro	m Table	e 4e,	whe	ere appro	opriate	•				
(93)m=	18.5	18.74	19.1	19.56	19.91	1	20.11	20.15	20.	14	20.04	19.57	18.95	18.46	6	l	(93)
8. Sp	ace hea	ting requ	uiremer	it													
Set T	i to the	mean int	ernal te	mperatu	ire obta	inec	l at st	ep 11 of	Tabl	le 9t	o, so tha	t Ti,m=	=(76)m an	d re-c	alc	ulate	
the u	tilisation	factor fo	or gains	using T	able 9a	-			. .		-		—			l	
1.1411	Jan	Feb	Mar	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov	De	С		
Utilisa (04)m-		$\frac{1}{1}$	ains, nr	n:	0.84		0.65	0.46		5	0.77	0.05	0.00	1		I	(94)
		bmGm	$\frac{0.90}{100}$	$\frac{0.95}{100 \text{ y}}$	0.04		0.05	0.40	0.	5	0.77	0.95	0.99				(34)
(95)m-	641 31	757	, VV = (8 849.05	897.6	843.46	6	40.02	430.89	451	23	647 44	701 3	1 636.08	604 1	3	I	(95)
Mont	hlv aver		rnal ter	nperatur	e from	Гарі Гарі	e 8	400.00	-01	.20	011.11	701.0	000.00	004.1	0		(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	an inter	nal temp	erature	Ln, Ln	1.W=	I =[(39)m	x [(9:	3)m	– (96)m	1					
(97)m=	1796.54	1746.54	1586.69	1326.04	1020.0	, <u> </u>	76.85	435.91	459	.31	733.06	1114.3	7 1478.36	1787.	16		(97)
Spac	e heatin	g require	ement f	or each i	nonth, l	۲ Wt	/mon	th = 0.02	<u>2</u> 4 x [[(97])m – (95)m] x (41)m	1			
(98)m=	859.49	664.97	548.8	308.48	131.35		0	0)	0	307.32	2 606.44	880.1	7		
	L					-											

			Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	4307.02	(98)
Space heating requirement in kWh/m²/year								40.58	(99)
9a. Energy requirements – Individual heating	g systems i	ncluding	micro-C	HP)					
Space heating:	-								
Fraction of space neat from secondary/sup	plementary	system	(202) = 1	(201) -				0	
Fraction of space heat from main system(s)	1		(202) = 1 - (202)	-(201) =	(202)1 -			1	
Efficiency of main space besting system	1		(204) = (20	52) x [1 -	(203)] =			1	
Efficiency of main space heating system 1	ting overlage	o 0/						93.5	
Enciency of secondary/supplementary rea		1, %						0	(208)
Jan Feb Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
859.49 664.97 548.8 308.48 131.3	35 0	0	0	0	307.32	606.44	880.17		
$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$									(211)
919.24 711.2 586.95 329.92 140.4	18 0	0	0	0	328.68	648.6	941.36		()
	I		Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	4606.44	(211)
Space heating fuel (secondary), kWh/month	า								_
= {[(<mark>98)m x (201)] } x 100 ÷ (20</mark> 8)		-							
(215)m= 0 0 0 0 0	0	0		0	0	0	0		
			Tota	r (Kvvii/yea	ar) =Sum(2	13) _{15,1012}		0	(215)
water neating Output from water heater (calculated above)									
210.46 185.4 194.48 174.03 170.3	31 151.85	145.52	160.11	159.97	180.47	191.23	205.29		
Efficiency of water heater								79.8	(216)
(217) <mark>m= 88.17 87.93 87.43 86.33 84.1</mark>	3 79.8	79.8	79.8	79.8	8 <mark>6.22</mark>	87.68	88.26		(217)
Fuel for water heating, kWh/month $(210)m = (64)m \times 100 \div (217)m$									
(219) m = (34) m \times 100 \div (217) m (219) m = 238.69 210.85 222.44 201.59 202.4	13 190.29	182.36	200.64	200.46	209.31	218.09	232.59		
	I	ļ	Tota	I = Sum(2 ⁻	19a) ₁₁₂ =			2509.74	(219)
Annual totals					k	Wh/year	,	kWh/yea	 r
Space heating fuel used, main system 1								4606.44	
Water heating fuel used								2509.74	
Electricity for pumps, fans and electric keep-	hot								
central heating pump:							30		(230c)
boiler with a fan-assisted flue							45		(230e)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting								425.5	(232)
12a. CO2 emissions – Individual heating sy	stems inclu	uding mi	cro-CHP						
	En kW	ergy /h/year			Emiss kg CO2	ion fac 2/kWh	tor	Emissions	s ar
Space heating (main system 1)	(21	1) x			0.2	16	=	994.99	(261)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	542.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1537.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	220.83	(268)
Total CO2, kg/year	sum	of (265)(271) =		1796.85	(272)
					_

TER =

16.93 (273)



BRUKL Output Document

Compliance with England Building Regulations Part L 2013

Project name

Retail Lean

Date: Wed Jul 20 07:11:53 2016

Administrative information

Building Details

Address: Retail Unit, 317 Finchley Road, London, NW3 6EP

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3.3

BRUKL compliance check version: v5.2.d.2

Owner Details Name:

Telephone number: Address: , ,

Certifier details Name: Audley Franklin Telephone number: Address: MLM, ,

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	38.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	38.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	34.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.13	0.13	External Wall
Floor	0.25	-	-	No floors in project
Roof	0.25	-	-	No roofs in project
Windows***, roof windows, and rooflights	2.2	1.4	1.4	New Window
Personnel doors	2.2	1.39	1.39	Sliding Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
Lighting area-weighted average Lightles M	//(m ² K)]			

 $U_{a-\text{Limit}} = \text{Limiting area-weighted average U-values [W/(m⁻K)]}$ $U_{a-\text{Calc}} = \text{Calculated area-weighted average U-values [W/(m²K)]}$

Ui-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	7

As designed

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values			
Whole building electric power factor achieved by power factor correction	0.9 to 0.95		

1- New HVAC System (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR	efficiency	
This system	0.91	2.6	-	-	0.7		
Standard value	0.91*	2.6	N/A	N/A	N/A		
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES							
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.							

1- New DHW Circuit

Water heating efficiency Storage loss factor [kWh/litre per					
This building	1	0			
Standard value	0.9*	N/A			
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.					

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
A1A2_Sales 1	-	85	30	894
A1A2_Sales 2	-	85	30	1220
A1A2_Sales 3	-	85	30	390

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
A1A2_Sales 1	NO (-33%)	NO
A1A2_Sales 2	NO (-84%)	NO
A1A2_Sales 3	NO (-99%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional	% A
Area [m ²]	236	236	100
External area [m ²]	165	165	-
Weather	LON	LON	71
Infiltration [m ³ /hm ² @ 50Pa]	7	5	
Average conductance [W/K]	89	130	74 N
Average U-value [W/m ² K]	0.54	0.78	
Alpha value* [%]	8.81	8.81	_

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.4	1.57
Cooling	17.44	17.4
Auxiliary	8.47	4.15
Lighting	39.01	52.35
Hot water	1.61	1.86
Equipment*	20.26	20.26
TOTAL**	67.93	77.33

* Energy used by equipment does not count towards the total for calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	176.44	242.28
Primary energy* [kWh/m ²]	203.94	225.15
Total emissions [kg/m ²]	34.5	38.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services	
A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways	
B1 Offices and Workshop businesses	
B2 to B7 General Industrial and Special Industrial Groups	
B8 Storage or Distribution	
C1 Hotels	
C2 Residential Inst.: Hospitals and Care Homes	
C2 Residential Inst.: Residential schools	
C2 Residential Inst.: Universities and colleges	
C2A Secure Residential Inst.	
Residential spaces	
D1 Non-residential Inst.: Community/Day Centre	
D1 Non-residential Inst.: Libraries, Museums, and Galleries	
D1 Non-residential Inst.: Education	
D1 Non-residential Inst.: Primary Health Care Building	
D1 Non-residential Inst.: Crown and County Courts	
D2 General Assembly and Leisure, Night Clubs and Theatres	
Others: Passenger terminals	
Others: Emergency services	
Others: Miscellaneous 24hr activities	
Others: Car Parks 24 hrs	
Others - Stand alone utility block	

ŀ	HVAC Systems Performance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[\$1	[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	4.5	171.9	1.4	18.4	8.9	0.86	2.6	0.91	2.6
	Notional	4.9	237.4	1.7	18.3	4.4	0.82	3.6		And the second s

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*
Wall	0.23	0.13	External Wall
Floor	0.2	-	No floors in project
Roof	0.15	-	No roofs in project
Windows, roof windows, and rooflights	1.5	1.4	New Window
Personnel doors	1.5	1.39	Sliding Door
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{I-Typ} = Typical individual element U-values [W/(m ² K)]		UI-Min = Minimum individual element U-values [W/(m ² K)]
* There might be more than one surface where the n	ninimum U	l-value oc	curs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Appendix B - Step Two – 'Be Lean' Output Document and Energy Report Figures

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	2		Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.1.24	
			Р	roperty <i>i</i>	Address	flat 1					
Address :											
1. Overall dwelling dime	nsions:			Aro	o(m ²)			iaht(m)		Volumo(m ³)	
Ground floor					a(III-) 57.7	(1a) x		1911(11) 25	(2a) =	144 25](3a)
First floor					5.67	(1b) x](2b) -	444.47](3b)
	-) · (4 -) · (4 -) ·	(1 -1) + (1 -)	. (4	4 ب	·0.07	(10) X	2		(20) -	114.17	
10tal floor area IFA = (13)	a)+(1D)+(1C)+	(1d)+(1e))+(1r	1) 1(03.37	(4)					_
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	258.42	(5)
2. Ventilation rate:	_									<u>, ,</u>	
	main heating	se h	condar eating	у	other		total			m ³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0	+	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns					- F	0	x 1	10 =	0	(7a)
Number of passive vents							0	x 1	10 =	0	(7b)
Number of flueless gas fi	res					Ē	0	x 4	40 =	0](7c)
Infiltration due to obimpo	in fluor and f) . (6b) . (7	(2) (7b) (7)	70) -		_				" "~~
If a pressurisation test has b	een carried out o	r is intended	d. procee	d to (17).	otherwise o	continue fre	0 om (9) to (16)	÷ (5) =	0	(8)
Number of storeys in th	ne dw <mark>elling</mark> (na	5)					- (-) - (-/		0	(9)
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	.25 for steel o	r timber f	rame or	0.35 foi	r masonr	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openir	resent, use the va nas): if equal user	lue corresp 0.35	oonding to	the great	er wall are	a (after					
If suspended wooden f	loor, enter 0.2	(unseale	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else	enter 0								0	(13)
Percentage of windows	s and doors dr	aught str	ripped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				_	(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cubi	ic metre	s per ho	our per so	quare m	etre of e	nvelope	area	3	(17)
IT Dased on air permeabili Air permeability value applie	ity value, then	(10) = [(17)	been don	o, onerwi	se (10) = (rmeahility	is haina us	ad		0.15	(18)
Number of sides sheltere	d	511 1031 1103	been don			Theability	is being ut	500		3](19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wir	nd speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tab	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	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 infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcula	ate effec	ctive air	change i	rate for t	he appli	cable ca	se	-				-		
IT ME				andia NL (O	0h) (00-	·) · · · · · · / ·	······································			(00-)			0.5	(23a)
If exh	aust air ne	eat pump	using Appe	enaix IN, (2	3D) = (238	a) × Fmv (e		v5)), otne	rwise (23b) = (23a)			0.5	(23b)
	inced with	n neat reco	overy: effic	iency in %	allowing f	or in-use to			$) = (2)^{2}$	2b)m i (ʻ	22h) v [1	1 (22c)	77.3	5 (23c)
a) II (24a)m-	0.26	0.26		0.24	0.24			0.22		0.24	0.24	0.25	- 100j	(24a)
(2-10)117 b) If	bolonoo	d moob		ntilation	without	boot roc		1)/) (24h	1 = 0.20		0.24 02h)	0.20	l	(,)
(24b)m	Dalance				without			1 v) (240 0	D = (22)	20)III + (2	230)		1	(24b)
(240)m=	0	0					0	0		0	0	0		(240)
c) If v	whole h	ouse ex	tract ven	itilation o	or positiv	e input v	ventilatio	on from ($22k$		E v (22h)			
(240)m	0	1< 0.5 >) = (23L			c) = (22)	$\frac{1}{1}$	5 × (230)		1	(24c)
(240)11=	0				0					0	0	0	l	(240)
a) ir i	naturai f (22b)n	ventilation = 1 th	on or wn en (24d)	ole nous $m = (22h)$	e positiv	ve input v erwise (2	(4d)m = 0	on from 1 0 5 + [(2	0ft 2b)m ² x	0.51				
(24d)m=	0	0			0	0				0.0]	0	0		(24d)
Effec	tive air	change	rate - er	ter (24a) or (24h	(24)	c) or (24	d) in hor	(25)					, , , , , , , , , , , , , , , , , , ,
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25	1	(25)
(0.20	0120					<u> </u>				0.2.1			
2 Hay	et lesses													
з. неа	at losse	s and he	eat loss p	paramete	er:									
ELEN		s and he Gros area	eat loss p ss (m²)	oaramete Openin m	er: gs 2	Net Ar A ,r	ea n²	U-valı W/m2	ue :K	A X U (W/ł	<)	k-value kJ/m²-l	e K	A X k kJ/K
ELEN Doors	IE <mark>NT</mark>	s and he Gros area	eat loss p ss (m²)	Openin Openin m	er: gs ,2	Net Ar A ,r 2.1	ea n² ×	U-valı W/m2	ue K =	A X U (W/ł 4.2	<)	k-value kJ/m²·I	e K	A X k kJ/K (26)
ELEN Doors Windov	IENT	s and he Gros area	eat loss p ss (m²)	Openin Openin m	er: gs 2	Net Ar A ,r 2.1 3.69	ea n² x x ^{1/}	U-valı W/m2 2 /[1/(0.8)+	ue 2K 0.04] = [A X U (W/ł 4.2 2.86	<)	k-value kJ/m²-l	e K	A X k kJ/K (26) (27)
Doors Window	IENT ws Type ws Type	S and he Gros area e 1 e 2	eat loss p ss (m²)	Openin M	er: gs ²	Net Ar A ,r 2.1 3.69 4.83	ea n ² x x x ¹ / x ¹ /	U-valu W/m2 2 /[1/(0.8)+	ue 2K 0.04] = [0.04] = [A X U (W/ł 4.2 2.86 3.74	<) 	k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27)
Doors Windov Windov	IENT ws Type ws Type ws Type	Gros area area 2 2 3	eat loss ; ss (m²)	Openin M	er: gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01	ea n ² x x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	ue K 0.04] = [0.04] = [0.04] = [A X U (W/ł 2.86 3.74 2.33	<) 	k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27)
S. Here ELEN Doors Window Window Window	IENT ws Type ws Type ws Type ws Type	Gros area 9 1 9 2 9 3 9 4	eat loss ; ss (m²)	Openin M	er: gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	ue K 0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/ł 2.86 3.74 2.33 3.88		k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27)
S. Here ELEN Doors Window Window Window Floor	IENT ws Type ws Type ws Type ws Type	Gros area 4 2 3 4	eat loss ; ss (m²)	oaramete Openin m	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7	ea m ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13	ue K = 0.04] = [0.04] = [0.04] = [0.04] = [= =	A X U (W/ł 2.86 3.74 2.33 3.88 7.501		k-value kJ/m²·l	× K	A X k kJ/K (26) (27) (27) (27) (27) (28)
S. Here ELEN Doors Window Window Window Floor Walls T	IENT ws Type ws Type ws Type ws Type	s and he Gros area 9 1 9 2 9 3 9 4	of (m ²)	Openin m	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92		k-value kJ/m²+l		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
S. Here ELEN Doors Window Window Window Floor Walls T Walls T	IENT ws Type ws Type ws Type ws Type Type1	s and he Gros area 4 54.0 48.7	96 74	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= [= = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29)
S. Here ELEN Doors Window Window Window Window Floor Walls T Walls T Total a	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e	s and he Gros area 2 3 4 54.0 48.7 lements	06 74 , m ²	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31)
S. Here ELEN Doors Window Window Window Floor Walls T Walls T Total a Party w	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall	s and he Gros area 2 3 4 54.0 48.7 lements	206 74 5, m ²	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05	ea m ² x x 1/ x	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13 0.13	ue 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = =	A X U (W/k 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)
S. Here ELEN Doors Window Window Window Window Floor Walls T Walls T Total a Party w * for window ** include	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area	s and has Gross area 4 4 48.7 lements roof wind as on both	06 74 ows, use e sides of in	Darameta Openin m 8.52 8.02 effective will internal wall	ndow U-va	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calcul titions	ea n ² x 1/ x 1	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13 0.13 0.13	$\begin{bmatrix} 2 \\ - \\ - \\ 0 \\ - \\ 0 \\ - \\ 0 \\ - \\ 0 \\ - \\ -$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)
S. Here ELEN Doors Window Window Window Window Floor Walls 1 Walls 1 Total a Party w * for window * include Fabric	IENT ws Type ws Type ws Type ws Type ype1 Type2 rea of e vall dows and e the area heat los	s and has $Gross area Gross wind as on both$	p_{1}^{0} p_{2}^{0} p_{3}^{0} p_{4}^{0} p_{4}^{0} p_{5}^{0} p_{6}^{0} p_{4}^{0} p_{5}^{0} p_{6}^{0} p_{4}^{0} p_{5}^{0} $p_{$	Darameta Openin m 8.52 8.02 affective will affective will uternal walk U)	ndow U-va	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x ^{1/} x ^{1/}	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$\begin{array}{c} ue \\ K \\ 0.04] = [\\ 0.$	A X U (W/k 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32)
S. Free Boors Window Window Window Window Floor Walls T Walls T Total a Party w * for wind * for wind * for wind * fabric Heat ca	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los	s and he Gros area 4 1 2 3 4 1 48.7 1 48.7 1 1 1 1 1 1 1 1 1 1	$\frac{1000}{100}$ $\frac{1000}{100}$	effective winternal walk	er: gs 2 2 ndow U-va Is and part	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x ^{1/} x	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+)/[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+)/[1/	$\begin{array}{c} ue \\ K \\ 0.04] = \\ $	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 e)+0.04] a	<)	k-value kJ/m²-l	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32) 4 (33)
S. Heat ca Therma	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los apacity al mass	s and has Gross area 4 54.0 48.7 48.7 48.7 48.7 48.7 10000 wind as on both as on both 55, W/K = Cm = S0 parameters	$\frac{1000}{100}$ $\frac{1000}{1000}$ $\frac{1000}{100}$ $\frac{1000}{100}$ $\frac{1000}{100$	Definition of the second seco	er: gs 2 2 ndow U-va ls and part - TFA) ir	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea m ² x x 1/ x	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+ 0.13 0.13 0.13 0.13 0.13 (0.13 (0.13) (0.13) (1) (2)((0,0))	$\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a .(30) + (32 tive Value:	() () </td <td>k-value kJ/m²-I</td> <td>e K] [] [] [] []] []] []] []]] []]] []]] []]]]</td> <td>A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (31) (32) 4 (33) (34) (34)</td>	k-value kJ/m²-I	e K] [] [] [] []] []] []] []]] []]] []]] []]]]	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (31) (32) 4 (33) (34) (34)
S. Herman BLEN Doors Window Window Window Window Floor Walls T Walls T Total a Party w * for wind ** include Fabric Heat ca Therma For desig	IENT ws Type ws Type ws Type ws Type ys Type Type Type rea of e vall dows and e the area heat los apacity al mass gn assess	s and he Gros area 4 54.0 48.7 48.7 lements <i>roof wind</i> as on both as on both 55, W/K = Cm = Signaments	p_{1}^{06} (m^2) p_{2}^{06} (m^2) p_{3}^{06} (m^2) p_{4}^{06} (m^2)	$\begin{bmatrix} 8.52 \\ \hline 8.02 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ $	er: gs 2 2 ndow U-va ls and part - TFA) ir construct	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x 1/ x	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$\begin{array}{c} ue \\ K \\ = \\ 0.04] $	A X U (W/k 4.2 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a .(30) + (32 tive Value: 9 values of	<) () () () () () () ()	k-value kJ/m²-l	x x 35.7 0 250	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (31) (32) (31) (32) (32)
S. Field Doors Window Window Window Window Window Floor Walls T Walls T Walls T Total a Party w * for wind * for wind * for wind Total a Party w * for wind Total a Party w * for wind * for design can be wind * for wind * for wind * for wind * for wind * for wind * for wind * for design can be wind * for wind	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los apacity al mass gn assess sed inste	s and has Gross area 4 54.0 48.7 48.7 48.7 48.7 48.7 1000000000000000000000000000000000000	26 (m^2) 26 (m^2) 26 (m^2) 74 (m^2) 74 (m^2)	$\begin{bmatrix} 8.52 \\ 8.02 \end{bmatrix}$	er: gs 2 ² ndow U-va ds and pan - TFA) ir construct	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 5.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$ \begin{array}{c} $	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 e)+0.04] a .(30) + (32 tive Value: values of	<) () () () () () () ()	k-value kJ/m²-l paragraph (32e) = able 1f	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32) (31) (32)

if detail	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			48.94	(37)
Ventila	ation hea	at loss ca	alculated	monthl	у	-	_		(38)m	= 0.33 × (25)m x (5)	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	22.3	22.05	21.8	20.56	20.32	19.08	19.08	18.83	19.57	20.32	20.81	21.31		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	71.24	70.99	70.74	69.5	69.25	68.01	68.01	67.77	68.51	69.25	69.75	70.24		
									/	Average =	Sum(39)1	12 /12=	69.44	(39)
Heat I	oss para	meter (H	HLP), W	/m²K	r	r	i		(40)m	= (39)m ÷	(4)	r	I	
(40)m=	0.69	0.69	0.68	0.67	0.67	0.66	0.66	0.66	0.66	0.67	0.67	0.68		
Numb	er of day	/s in mo	nth (Tab	le 1a)	-	-				Average =	Sum(40)1	12 /12=	0.67	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. W	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
		Ŭ											1	
Assun if TF	ned occu =A ⇒ 13 (Ipancy, I 9 N – 1	N + 1.76 x	[1 - exp	(-0 000?	849 x (TF	-13 Q)2)] + 0 ()013 x (⁻	TFA -13	2.	77		(42)
if TF	A £ 13.	9, N = 1	1 1.70 %		(0.0000	, , , , , , , , , , , , , , , , , , ,	10.0) <u>_</u>)] + 0.0		117(10.	.0)			
Ann <mark>ua</mark>	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.22		(43)
Reduce	e the annua re that 125	al average litres per	hot water	usage by a r day (all w	5% if the c	lwelling is hot and co	designed t Id)	to achieve	a water us	se target o	t			
not mor									0					
Hot wa	Jan	Feb	Mar Mar	Apr	May	Jun	Jul Table 1c x	(43)	Sep	Oct	Nov	Dec		
									100.11	407.00	444.50	445 74		
(44)m=	115.74	111.53	107.32	103.11	98.9	94.69	94.69	98.9	103.11	107.32	111.53	115.74	1000 50	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	1262.58	(44)
(45)m=	171.63	150.11	154.9	135.05	129.58	111.82	103.62	118.9	120.32	140.22	153.06	166.22		
16 :				- f		(· · · · · · · · · · · ·	h	-	Total = Su	m(45) ₁₁₂ =	=	1655.45	(45)
it instar	itaneous v	ater neati.	ng at point T	t of use (no	not watel	r storage), I	enter 0 in	boxes (46)) tO (61)	r		r	I	
(46)m=	25.75	22.52	23.24	20.26	19.44	16.77	15.54	17.84	18.05	21.03	22.96	24.93		(46)
Storad	siorage ne volum	iuss. ie (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	and no te	nk in dw	vellina e	nter 110) litres in	(47)				0		()
Other	wise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	(47) 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	10		(50)
b) If n	nanufact	urer's de	eclared	cylinder l	loss fact	or is not	known:							
Hot wa	ater stor	age loss	factor fi	om I abl	le 2 (kW	h/litre/da	ay)				0.	02		(51)
Volum	nunity f	from Ta	hle 22	011 4.3							4	02		(52)
Temp	erature f	actor fro	m Table	2b								.6		(53)
Energ	v lost fro	m water	storage	. kWh/v	ear			(47) x (51)	x (52) x (53) =		03		(54)
Enter	(50) or ((54) in (5	55)	, ,				、 , (- ·)	(-) (,	1.	03		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Prima	ry circuit	loss (ar	nnual) 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 wa	ter heati	ng and a	cylinde	r thermo	ostat)		_	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	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	neat req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	226.91	200.04	210.18	188.54	184.86	165.31	158.89	174.18	173.82	195.5	206.56	221.5		(62)
Solar D	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHRS	and/or \	WHRS	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=	226.91	200.04	210.18	188.54	184.86	165.31	158.89	174.18	173.82	195.5	206.56	221.5		-
								Outp	out from wa	ater heate	r (annual)₁	12	2306.29	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5	× (45)m	n + (61)n	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (59)m	1	
(65)m=	101.29	89.85	95.73	87.7	87.31	79.97	78.67	83.76	82.8	90.85	93.69	99.49		(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	rom com	<mark>mu</mark> nity h	neating	
5. In	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	s (Table	<mark>5), Wa</mark> t	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43		(66)
Lightir	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	25.03	22.23	18.08	13.69	10.23	8.64	9.33	12.13	16.28	20.67	24.13	25.72		(67)
Applia	nces ga	ins (calc	ulated in	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	i			
(68)m=	261.66	264.38	257.54	242.97	224.58	207.3	195.76	193.04	199.88	214.45	232.84	250.12		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equa	tion L15	or L15a), also se	ee Table	5				
(69)m=	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)	-	-	_	-	-	_	_	
(71)m=	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74		(71)
Water	haating	nains (T	Table 5)											
	neating	gains (1												
(72)m=	136.14	133.71	128.66	121.8	117.35	111.08	105.74	112.58	115	122.1	130.12	133.72		(72)
(72)m= Total i	136.14	133.71 gains =	128.66	121.8	117.35	111.08 (66)	105.74)m + (67)m	112.58 n + (68)m -	115 + (69)m + (122.1 (70)m + (7	130.12 (1)m + (72)	133.72 m]	(72)
(72)m= Total (73)m=	136.14 internal 487.36	gains (1 133.71 gains = 484.85	128.66 468.81	121.8 442.99	117.35 416.69	111.08 (66) 391.54	105.74)m + (67)m 375.36	112.58 n + (68)m - 382.27	115 + (69)m + (395.7	122.1 (70)m + (7 421.76	130.12 (1)m + (72) 451.62	133.72 m 474.09]	(72)

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	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.69	x	10.63	x	0.4	x	0.7] =	7.61	(74)
North	0.9x	0.77	x	4.83	x	10.63	x	0.4	x	0.7	i =	9.97	(74)
North	0.9x	0.77	x	3.01	x	10.63	x	0.4	x	0.7	=	6.21	(74)
North	0.9x	0.77	x	5.01	×	10.63	x	0.4	×	0.7] =	10.34	(74)
North	0.9x	0.77	x	3.69	x	20.32	x	0.4	x	0.7] =	14.55	(74)
North	0.9x	0.77	x	4.83	x	20.32	x	0.4	x	0.7	=	19.05	(74)
North	0.9x	0.77	x	3.01	x	20.32	x	0.4	x	0.7	=	11.87	(74)
North	0.9x	0.77	x	5.01	x	20.32	x	0.4	x	0.7	=	19.75	(74)
North	0.9x	0.77	x	3.69	x	34.53	x	0.4	x	0.7] =	24.72	(74)
North	0.9x	0.77	x	4.83	x	34.53	x	0.4	x	0.7] =	32.36	(74)
North	0.9x	0.77	x	3.01	x	34.53	x	0.4	x	0.7	=	20.17	(74)
North	0.9x	0.77	x	5.01	x	34.53	x	0.4	x	0.7] =	33.57	(74)
North	0.9x	0.77	x	3.69	x	55.46	x	0.4	x	0.7] =	39.71	(74)
North	0.9x	0.77	x	4.83	x	55.46	x	0.4	x	0.7] =	51.98	(74)
North	0.9x	0.77	x	3.01	×	55.46	x	0.4	×	0.7] =	32.39	(74)
North	0.9x	0.77	x	5.01	×	55.46	x	0.4	х	0.7		53.92	(74)
North	0.9x	0.77	x	3.69	x	74.72	x	0.4	x	0.7] =	53.5	(74)
North	0.9x	0.77	x	4.83	x	74.72] ×	0.4	x	0.7] =	70.02	(74)
North	0.9x	0.77	x	3.01	x	74.72	x	0.4	x	0.7] =	43.64	(74)
North	0.9x	0.77	x	5.01	x	74.72	x	0.4	x	0.7	=	72.63	(74)
North	0.9x	0.77	x	3.69	x	79.99	×	0.4	x	0.7] =	57.27	(74)
North	0.9x	0.77	x	4.83	x	79.99	x	0.4	x	0.7] =	74.96	(74)
North	0.9x	0.77	x	3.01	×	79.99	x	0.4	x	0.7	=	46.72	(74)
North	0.9x	0.77	x	5.01	x	79.99	x	0.4	x	0.7	=	77.76	(74)
North	0.9x	0.77	x	3.69	x	74.68	x	0.4	x	0.7	=	53.47	(74)
North	0.9x	0.77	x	4.83	x	74.68	x	0.4	x	0.7	=	69.99	(74)
North	0.9x	0.77	x	3.01	x	74.68	x	0.4	x	0.7	=	43.62	(74)
North	0.9x	0.77	x	5.01	x	74.68	x	0.4	x	0.7	=	72.6	(74)
North	0.9x	0.77	x	3.69	x	59.25	x	0.4	x	0.7	=	42.42	(74)
North	0.9x	0.77	x	4.83	x	59.25	x	0.4	x	0.7	=	55.53	(74)
North	0.9x	0.77	x	3.01	x	59.25	x	0.4	x	0.7	=	34.6	(74)
North	0.9x	0.77	x	5.01	x	59.25	x	0.4	x	0.7	=	57.6	(74)
North	0.9x	0.77	x	3.69	x	41.52	x	0.4	x	0.7	=	29.73	(74)
North	0.9x	0.77	x	4.83	x	41.52	x	0.4	x	0.7	=	38.91	(74)
North	0.9x	0.77	x	3.01	x	41.52	x	0.4	x	0.7	=	24.25	(74)
North	0.9x	0.77	x	5.01	×	41.52	x	0.4	×	0.7	=	40.36	(74)
North	0.9x	0.77	x	3.69	×	24.19	x	0.4	x	0.7	=	17.32	(74)
North	0.9x	0.77	x	4.83	×	24.19	x	0.4	×	0.7] =	22.67	(74)
North	0.9x	0.77	x	3.01	x	24.19	x	0.4	x	0.7] =	14.13	(74)

North	0.9x	0.77	x	5.0)1	×	2	4.19	x		0.4	x	0.7	=	23.52	(74)
North	0.9x	0.77	×	3.6	69	×	1	3.12	×		0.4	×	0.7	=	9.39	(74)
North	0.9x	0.77	x	4.8	3	×	1	3.12	x		0.4	×	0.7	=	12.29	(74)
North	0.9x	0.77	x	3.0)1	×	1	3.12	x		0.4	×	0.7	= =	7.66	(74)
North	0.9x	0.77	x	5.0)1	×	1	3.12	×		0.4	- x	0.7		12.75	(74)
North	0.9x	0.77	x	3.6	69	×	8	3.86	x		0.4	×	0.7	=	6.35	(74)
North	0.9x	0.77	×	4.8	33	×	8	3.86	x		0.4	×	0.7	=	8.31	(74)
North	0.9x	0.77	x	3.0)1	×	8	3.86	x		0.4	×	0.7	=	5.18	(74)
North	0.9x	0.77	×	5.0)1	×	8	3.86	×		0.4	×	0.7	=	8.62	(74)
	-					L										
Solar	gains in	watts, ca	alculated	for eac	h month				(83)m	ı = Sı	um(74)m .	(82)m				
(83)m=	34.13	65.22	110.82	178.01	239.79	25	56.71	239.67	190	.15	133.24	77.63	42.1	28.45		(83)
Total (gains – i	nternal a	and solar	r (84)m =	= (73)m ·	+ (8	33)m	, watts						i		
(84)m=	521.49	550.07	579.63	621	656.48	64	8.25	615.03	572	.42	528.94	499.39	493.72	502.54		(84)
7. Me	ean inter	nal temp	perature	(heating	season)										
Temp	perature	during h	neating p	eriods ir	n the livi	ng a	area f	from Tab	ole 9	, Th1	1 (°C)				21	(85)
Utilis	ation fac	tor for g	ains for	living are	ea, h1,m	i (se	e Ta	ble 9a)	-				_			
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.88	0	.66	0.49	0.5	54	0.83	0.98	1	1		(86)
Me <mark>ar</mark>	n interna	l temper	ature in	living are	ea T1 <mark>(fo</mark>	ollov	w ste	ps 3 to 7	' in T	able	9c)					
(87)m=	20.34	20.41	20.55	20.77	20.93	20	0.99	21	2	1	20.97	20.77	20.53	20.33		(87)
Tem	oerature	during h	neating p	eriods ir	n rest of	dwe	elling	from Ta	able S	9, Th	n2 (°C)					
(88)m=	20.35	20.35	20.35	20.37	20.37	20	0.38	20.38	20.	38	20.37	20.37	20.36	20.36		(88)
Utilis	ation fac	tor for a	ains for	rest of d	welling	h2 i	m (se	e Table	9a)							
(89)m=	1	1	0.99	0.97	0.84	(D.6	0.42	0.4	17	0.78	0.97	1	1		(89)
Moor		l tompor	i aturo in	the rest	of dwalli	ing '	T2 (f			to 7	in Tabl					
(90)m=	19.45	19.56	19.77	20.08	20.3		0.37	20.38	20.	38	20.35	20.09	19.73	19.44		(90)
()											f	LA = Liv	ing area ÷ (4	4) =	0.29	(91)
				and a f) (I	л т 4			A) TO					
			ature (to 20) = TL 0.56	_A × 11	+ (1	- TL/	A) X IZ	20.20	10.06	10.7		(92)
	/ adjustr	nent to t	he mear	internal	temper	 atu	re fro	m Table	<u></u>	whe	re appro	priate	19.90	13.7		(02)
(93)m=	19.71	19.81	20	20.28	20.49	20	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(93)
8. Sp	ace hea	ting reg	uirement			<u> </u>										
Set T	i to the	mean int	ernal ter	mperatu	re obtair	ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=	⊧(76)m an	d re-calo	ulate	
the u	tilisation	factor fo	or gains	using Ta	ble 9a									i		
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilis	ation fac	tor for g	ains, hm I): I		-			1						I	
(94)m=	1	1	0.99	0.96	0.85	0).62	0.44	0.4	19	0.79	0.97	1	1		(94)
	u gains,	nmGm	, VV = (94)	4)m x (84	+)M	40	1 52	260 11	201	40	110 27	186.00	101 69	501.0	l	(05)
Mont	hly aver				$\int_{-5000}^{5000} T$	⁴⁰ able	,1.02 2 8	203.11	201	.49	713.21	400.08	491.00	501.9		(33)
(96)m=	4.3	4.9	6.5	8.9	11.7	1	4.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempo	erature	L Lm	, W =	[(39)m	x [(9:	<u>]</u> 3)m–	- (96)m	1	1		l	. ,
(97)m=	1097.49	1058.13	954.76	790.83	608.41	40)5.04	269.31	281	.96	440.43	- 671.04	897.26	1088.61		(97)

Space	heating	g require	ment fo	r each m	onth, k	Wh/mor	th = 0.02	24 x [(97	')m – (95	j)m] x (4	11)m	-			
(98)m=	429.2	342.54	282.66	138.43	36.9	0	0	0	0	137.6	292.02	436.	51		_
								Tota	al per year	(kWh/yea	ar) = Sum(9	1 5,91	2 =	2095.88	(98)
Space	heating	g require	ment in	kWh/m ²	/year								L	20.28	(99)
9b. Ene	ergy req	uiremen	ts – Cor	nmunity	heating	schem	e								
This pa Fraction	rt is use 1 of spa	ed for sp ce heat	ace hea from se	ting, spa condary/	ice cool suppler	ling or w mentary	ater hea heating	ting prov (Table 1	/ided by 1) '0' if n	a comn one	nunity scl	neme	Г	0	(301)
Fraction	n of spa	ce heat	from co	mmunity	system	n 1 – (30	1) =							1	(302)
The com	munity sc	heme may	[,] obtain he	eat from se	veral sou	rces. The	procedure	allows for	CHP and	up to foui	other heat	source	es; the	latter	
includes Fraction	boilers, he	eat pumps it from C	, geothern	nal and wa ity boiler	ste heat : s	from powe	er stations.	See Appe	ndix C.				Г	1	(303a)
Fraction	n of tota	l space	heat fro	m Comr	o nunity b	oilers				(302) x (303	a) =		1	(304a)
Factor	for cont	rol and c	harging	method	(Table	4c(3)) fo	or comm	unitv hea	atina svs	tem	, (1	(305)
Distribu	ition los	s factor	(Table 1	2c) for c	ommur	nity heat	ing syste	m	5-9-					1.1	(306)
Space	heating	1	(-,		· ,	5 -)							kWh/vear	`´´
Annual	space h	, neating r	equirem	nent										2095.88	7
Spa <mark>ce I</mark>	heat fro	m Comn	nunity b	oilers					(98) x (30	04a) x (30	05) x (306)	=		2305.47	(307a)
Efficien	cy of se	condary	/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	pp <mark>endi</mark>	x E)			0	(308
Spa <mark>ce I</mark>	neating	requirer	nent froi	m secon	dary/su	pplemer	ntary sys	tem	(98) x (30	01) x 100	÷ (308) =			0	(309)
Water I	neating														
Annual	water h	eating re	equirem	ent										2306.29	
If DHW Water h	from co neat fror	ommunit n Comm	y schen nunity bo	ne: pilers					(64) x (30	03a) x (30	05) x (306)	=	Г	2536.91	(310a)
Electric	ity used	l for hea	t distribu	ution				0.01	l × [(307a).	(307e)	+ (310a)	(310e)]	=	48.42	(313)
Cooling	Systen	n Energy	/ Efficiei	ncy Ratio	þ									0	(314)
Space	cooling	(if there	is a fixe	d cooling	g syster	n, if not	enter 0)		= (107) ÷	- (314) =				0	(315)
Electric	ity for p	umps ar	nd fans v	within dw	velling (Table 4f):								_
mechar	nical ver	ntilation	- balanc	ed, extra	act or po	ositive ir	put from	outside					Ľ	315.28	(330a)
warm a	ir heatir	ng syster	m fans										Ľ	0	(330b)
pump fo	or solar	water he	eating										Ľ	0	(330g)
Total el	ectricity	for the a	above, k	(Wh/yea	r				=(330a) ·	+ (330b)	+ (330g) =		Ľ	315.28	(331)
Energy	for light	ting (calo	culated i	in Appen	dix L)									441.96	(332)
12b. C0	D2 Emis	ssions –	Commu	inity hea	ting sch	ieme		F .							
								En kW	ergy /h/year	E k	-missior (g CO2/k	Wh	or Er kç	missions g CO2/year	
CO2 fro	om othe	r source	s of spa	ce and v	vater he	eating (n	ot CHP)						-		
Efficien	cy of he	eat sourc	e 1 (%)			If there is	s CHP usin	g two fuel	s repeat (3	63) to (36	66) for the s	second	fuel	96	(367a)
CO2 as	sociate	d with he	eat sour	ce 1			[(307b)+	-(310b)] x	100 ÷ (367	'b) x	0		=	1089.54	(367)
Electric	al energ	gy for he	at distril	bution				[(313) x		[0.52		=	25.13	(372)

Total CO2 associated with community s	systems	(363)(366) + (368)(372)	1	=	1114.67	(373)
CO2 associated with space heating (se	condary)	(309) x	0	=	0	(374)
CO2 associated with water from immer	sion heater or instanta	aneous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and w	vater heating	(373) + (374) + (375) =			1114.67	(376)
CO2 associated with electricity for pum	ps and fans within dw	elling (331)) x	0.52	=	163.63	(378)
CO2 associated with electricity for light	ing	(332))) x	0.52	=	229.38	(379)
Total CO2, kg/year	sum of (376)(382) =				1507.68	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.59	(384)
El rating (section 14)					86.38	(385)



User Details:														
Assessor Name: Software Name: Stroma FSAP 2012		Stroma Softwa	a Num re Ver	ber: sion:		Versio	n: 1.0.1.24							
	Property A	Address:	Flat 2											
Address :														
1. Overall dwelling dimensions:	.	()			• • • •									
Ground floor	Area	i(m²)	(10)	Av. Hei	ght(m)		Volume(m ³)							
	50	0.32	(ia) x	2	.5	(2a) =	125.8	(38)						
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+$	(1n) 50	0.32	(4)			(0)		-						
Dwelling volume			(3a)+(3b)	+(3C)+(30))+(3e)+	.(3n) =	125.8	(5)						
2. Ventilation rate:							<u>,</u> ,							
main sec heating heating	ating	other		total			m ³ per hour							
Number of chimneys 0 +	0 +	0	=	0	X 4	40 =	0	(6a)						
Number of open flues 0 +	0 +	0] = [0	x 2	20 =	0	(6b)						
Number of intermittent fans			Ē	0	x ′	10 =	0	(7a)						
Number of passive vents			Γ	0	x ^	10 =	0	(7b)						
Number of flueless gas fires			Γ	0	x 4	40 =	0	(7c)						
			_			Air ch	anges per ho	ur						
Infiltration due to chimneys, flues and fans = (6a)-	+(6b)+(7a)+(7b)+(7	7c) =		0		÷ (5) =	0	(8)						
If a pressurisation test has been carried out or is intended,	proceed to (17), o	otherwise c	ontinue fre	om (9) to (16)	1								
Additional infiltration					[(9)-	-11x0 1 =	0	(9)						
Structural infiltration: 0.25 for steel or timber fra	ame or 0.35 for	masonr	constr	uction	[(0)	1,00.1 -	0	(10)						
if both types of wall are present, use the value correspo	onding to the greate	er wall area	a (after				0							
deducting areas of openings); if equal user 0.35	d or 0.1 (acala	d) alaa (ntor 0				_							
If no draught lobby enter 0.05 else enter 0	u) 01 0.1 (Seale	u), eise e					0	(12)						
Percentage of windows and doors draught strir	ned						0	[(13)] (14)]						
Window infiltration	opeu	0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)						
Infiltration rate		- (8) + (10) +	- (11) + (1	- 2) + (13) +	- (15) =		0	(16) (16)						
Air permeability value, q50, expressed in cubic	metres per ho	ur per sc	uare m	etre of e	nvelope	area	3](17)						
If based on air permeability value, then $(18) = [(17)]$	÷ 20]+(8), otherwis	se (18) = (1	6)				0.15	(18)						
Air permeability value applies if a pressurisation test has b	een done or a deg	ree air per	meability i	is being us	sed									
Number of sides sheltered		(00) (1		0.1			3	(19)						
Shelter factor		(20) = 1 - [(J.075 x (1	9)] =			0.78	(20)						
Infiltration rate incorporating shelter factor		(21) = (18)	x (20) =				0.12	(21)						
Infiltration rate modified for monthly wind speed			-											
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec								
Monthly average wind speed from Table 7		1					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 \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 (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
----------------------	-------------	------------------	----------------------	--------------	--------------	-------------	-------------	--------------	---------------	----------------	-------------	-----------	-------	-------
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul	ate ette	ctive air	change	rate for t	he appli	cable ca	se						0.5	(220)
lf exh	aust air h	eat pump	using App	endix N. (2	(23a) = (23a	a) x Fmv (e	equation (I	N5)), othe	rwise (23b) = (23a)			0.5	(23a)
If bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =) (200)			0.5	(230)
a) If	halance	nd mech	anical ve	ntilation	with he	at recove	orv (M\/I	HR) (24s	(2)m – (2)	2h)m + (23h) 🗸 [ʻ	l _ (23c)	1001	(230)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25]	(24a)
(,). b) If	halance	d mech	anical ve	Intilation	without	heat rec		(1)/(24h)	1 - (2)	$\frac{1}{2}$	23h)		J	
(24b)m=					0				0		0	0	1	(24b)
c) If	whole h		tract ver		n nositiv		ventilatio	n from c	<u>utside</u>				J	
0) 11	if (22b)r	n < 0.5 >	(23b), t	then (24	c) = (23b); other	vise (24	c) = (22t	b) m + 0.	.5 × (23b))			
(24c)m=	= 0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	n from l	oft					
	if (22b)r	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(25)
3. He	at losse	s and he	eat loss	paramete	er:									
		Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e .	AXk
		area	(m²)	m	²	A ,r	n²	W/m2	K	(W/I	K)	kJ/m²·l	K	kJ/K
Doors						2.1	X	2	=	4.2				(26)
Windo	ws Type	€1				3.33	x1	/[1/(0.8)+	0.04] =	2.58				(27)
Windo	ws Type	e 2				5.01	x1	/[1/(0.8)+	0.04] =	3.88				(27)
Walls		59.4	19	10.4	4	49.05	5 X	0.13	=	6.38				(29)
Total a	area of e	elements	, m²			59.49	9							(31)
Party v	wall					17.5	x	0	=	0				(32)
* for win	idows and	l roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	n 3.2	
^{~^} includ	he the area	as on both N/K		nternal wal	is and pari	titions		(26) (30)	+ (32) -				47.04	(22)
Heat o		55, W/N	= 3 (A X (A v k)	0)				(20)(00)	((28)	$(30) \pm (3)$	2) ± (32a)	(320) -	17.04	(33)
Thorm	apacity	narame	(TAR) Mar (TMI	- Cm -	TEA) ir	k l/m²k			((20)	tive Value	· Medium	(526) –	0	(34)
For desi	ian asses:	sments wh	ere the de	- On -	construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f	250	(33)
can be u	used inste	ad of a de	tailed calc	ulation.	00110110101				maioaire					
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	<						6.85	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			23.89	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y 			i .	(38)m	= 0.33 × (25)m x (5)		1	
(0.5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	10.85	10.73	10.61	10.01	9.89	9.29	9.29	9.17	9.53	9.89	10.13	10.37	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		1	
(39)m=	34.75	34.63	34.5	33.9	33.78	33.18	33.18	33.06	33.42	33.78	34.02	34.26		
									1	Average =	Sum(39)1	12 /12=	33.87	(39)

Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.69	0.69	0.69	0.67	0.67	0.66	0.66	0.66	0.66	0.67	0.68	0.68		
L	r of do		l					I	,	Average =	Sum(40)1	12 /12=	0.67	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
, , T														
4. Wat	ter heat	ting enei	rgy requ	irement:								kWh/ye	ear:	
Assume if TF/ if TF/	ed occu A > 13.9 A £ 13.9	upancy, l 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)	.7		(42)
Annual Reduce t not more	averag the annua that 125	e hot wa al average litres per j	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the a 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	78 f	.49		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per I	r day for ea I	ach month I	Vd,m = fa	ctor from	Table 1c x I	(43) T			<u> </u>		I	
(44)m=	86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34	0.44.00	
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600) kWh/mor	total = Su with (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	941.86	(44)
(45)m=	128.04	111.98	115.55	100.74	96.66	83.41	77.3	88.7	89.76	104.6	114.18	124		—
lf instanta	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1234.92	(45)
(46)m=	19.21	16.8	17.33	15.11	14.5	12.51	11.59	13.3	13.46	15.69	17.13	18.6		(46)
Storage	e volum	loss. le (litres)	includir	ng any so	olar or M	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comm	nunity h	eating a	and no ta	ink in dw	velling, e	nter 110	litres in	(47)						
Otherw	ise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in ((47)			
Water s	storage	loss:				. /1 \ \ //	(1-1						I	
a) If ma	anufact	urer's de	eclared I	oss facto	or is kno	wn (kvvi	n/day):					0		(48)
Tempe	rature to	actor fro	m lable	20								0		(49)
Energy	lost fro apufact	m water	storage	e, KVVh/ye sylinder l	ear	or is not	known:	(48) x (49)) =		1	10		(50)
Hot wat	ter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)				0.	02		(51)
Volume	e factor	from Ta	ble 2a	011 4.5							1	03		(52)
Tempe	rature fa	actor fro	m Table	2b							0	.6		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter ((50) or ((54) in (5	55)								1.	03		(55)
Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(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	ix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	infled by	ractor fi			nere is s	solar wat	ter heati	ng and a			ostat)	00.00	l	(50)
(59)II)=	23.20	21.01	23.20	22.51	23.20	22.51	23.20	23.20	22.51	23.20	22.51	23.20		(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=	183.31	161.91	170.83	154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		(62)
Solar DH	- IW input	calculated	using App	bendix G o	r Appendix	H (negat	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=	183.31	161.91	170.83	154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		
				-	-		-	Out	out from w	ater heate	r (annual)₁	12	1885.76	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	86.79	77.18	82.64	76.29	76.36	70.53	69.92	73.71	72.64	79	80.76	85.45		(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 fi	rom com	munity h	leating	
5. Int	ernal a	ains (see	e Table :	5 and 5a):	-		-				-	-	
Metab	olic dai	ns (Table	5) Wa	tte										
metab	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(66)m=	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	8 <mark>4.98</mark>	84.98	84.98		(66)
Lightin	d dains	(calcula	ted in A	ppendix	L equati	ion I 9 o	riga) a	lso see	Table 5		I			
(67)m=	14.05	12.48	10.15	7.69	5.74	4.85	5.24	6.81	9.14	11.61	13.55	14.44		(67)
Applia		aine (cale	ulated i			uation I	13 or L 1	32) 2/20		blo 5				
Appilai	148 07		145 73	137 49	127.08	1173		109 23		121 35	131 75	141 53		(68)
				nondiv						E	101.70	141.00		(00)
(60)m-	ig gains					21.5	01 L 15a	, also se		21.5	21.5	21.5		(69)
(09)11=	51.5	51.5	(Table	5 .5	31.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5		(00)
Pumps	and fa	ins gains		5a)		0							I	(70)
(70)m=	0	0	, U	0		0	0	0	0	0	0	0		(70)
Losses	s e.g. e	vaporatio	on (nega I	itive valu	es) (Tab T	le 5)			r	1	I		I	
(71)m=	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98		(71)
Water	heating) gains (T	able 5)									r		
(72)m=	116.66	114.84	111.08	105.96	102.64	97.96	93.98	99.08	100.89	106.19	112.17	114.85		(72)
Total i	nterna	l gains =	:	i		(66)m + (67)m	ı + (68)m ·	+ (69)m +	(70)m + (7	'1)m + (72) +	m		
(73)m=	327.27	325.42	315.45	299.63	283.96	268.6	258.49	263.62	271.63	287.64	305.96	319.32		(73)
6. So	lar gain	s:												
Solar g	ains are	calculated	using sola -	ar flux from	Table 6a a	and assoc	iated equa	tions to co	onvert to th	e applicat	ole orientat	ion.		
Orienta	ation:	Access F Table 6d	actor	Area		Flu Ta	IX hle 6a	т	g_ able 6b	т	FF able 6c		Gains	
								, L		, , ,			(**)	-
North	0.9x	0.77	X	3.3	33	×	10.63	×	0.4		0.7	=	6.87	(74)
North	0.9x	0.77	X	5.0	01	×	10.63	×	0.4		0.7	=	10.34	(74)
North	0.9x	0.77	X	3.3	33	×	20.32	×	0.4		0.7	=	13.13	(74)
North	0.9x	0.77	x	5.0	01	×:	20.32	x	0.4	×	0.7	=	19.75	(74)
North	0.9x	0.77	x	3.3	33	x :	34.53	x	0.4	x	0.7	=	22.31	(74)

North	0.9x	0.77		x	5.0	1	x	3	34.53	x	0.4		x	0.7		= [33.57	(74)
North	0.9x	0.77		x	3.3	3	x	5	5.46	x	0.4		x	0.7		= [35.84	(74)
North	0.9x	0.77		x	5.0	1	x	5	5.46	×	0.4		x	0.7		= [53.92	(74)
North	0.9x	0.77		x	3.3	3	x	7	4.72	×	0.4		x	0.7		= [48.28	(74)
North	0.9x	0.77		x	5.0	1	x	7	4.72	x	0.4		x	0.7		= [72.63	(74)
North	0.9x	0.77		x	3.3	3	x	7	9.99	x	0.4		x	0.7		= [51.68	(74)
North	0.9x	0.77		x	5.0	1	x	7	' 9.99	x	0.4		x	0.7		= [77.76	(74)
North	0.9x	0.77		x	3.3	3	x	7	4.68	x	0.4		x	0.7		= [48.25	(74)
North	0.9x	0.77		x	5.0	1	x	7	4.68	x	0.4		x	0.7		= [72.6	(74)
North	0.9x	0.77		x	3.3	3	x	5	59.25	x	0.4		x	0.7		= [38.28	(74)
North	0.9x	0.77		x	5.0	1	x	5	59.25	x	0.4		x	0.7		= [57.6	(74)
North	0.9x	0.77		x	3.3	3	x	4	1.52	×	0.4		x	0.7		= [26.83	(74)
North	0.9x	0.77		x	5.0	1	x	4	1.52	x	0.4		x	0.7		= [40.36	(74)
North	0.9x	0.77		x	3.3	3	x	2	24.19	x	0.4		x	0.7		= [15.63	(74)
North	0.9x	0.77		x	5.0	1	x	2	24.19	×	0.4		x	0.7		= [23.52	(74)
North	0.9x	0.77		x	3.3	3	x	1	3.12	×	0.4		x	0.7		= [8.48	(74)
North	0.9x	0.77		x	5.0	1	x	1	3.12	x	0.4		x	0.7		= [12.75	(74)
North	0.9x	0.77		x	3.3	3	x		8.86	х	0.4		х	0.7		= [5.73	(74)
North	0.9x	0.77		x	5.0	1	х	8	8.86	x	0.4		x	0.7		- [8.62	(74)
Sola <mark>r</mark>	gains in	watts, <mark>ca</mark>	alculat	ted	for each	mont	h			(83)m	n = Sum(74	l)m(<mark>8</mark> 2)m			_		
(83)m=	17.21	32.89	55.8	в	89.76	120.91	1	29.44	120.85	95.	88 67.1	19 :	39.15	21.23	14.3	5		(83)
Total	gains – i	nternal a	ind so	lar	(84)m =	(73)m) + (83)m	, watts							_ 1		(2.4)
(84)m=	344.48	358.31	371.3	3	389.38	404.8		98.04	379.33	359	.49 338.	.82 3	26.78	3 327.19	333.6	57		(84)
7. Me	ean inter	nal temp	eratu	re (heating	seaso	n)											
Tem	perature	during h	eating	g pe	eriods in	the liv	/ing	area	from Tab	ole 9	, Th1 (°C	;)					21	(85)
Utilis	ation fac	tor for g	ains fo	or li	ving are	a, h1,	m (s	ee Ta	ble 9a)					_	r	_		
	Jan	Feb	Ma	r	Apr	May	′	Jun	Jul	A	ug Se	эр	Oct	Nov	De	С		
(86)m=	0.99	0.99	0.97	,	0.91	0.75		0.53	0.38	0.4	12 0.6	7	0.92	0.98	0.99			(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=	20.51	20.59	20.7	2	20.89	20.98		21	21	2	1 20.9	99 2	20.89	20.69	20.5			(87)
Tem	oerature	during h	eating	g pe	eriods in	rest c	f dv	elling	from Ta	able 9	9, Th2 (° (C)						
(88)m=	20.35	20.35	20.3	5	20.36	20.37	1	20.38	20.38	20.	38 20.3	37 2	20.37	20.36	20.30	6		(88)
Utilis	ation fac	tor for g	ains fo	or r	est of dv	velling	, h2	,m (se	e Table	9a)								
(89)m=	0.99	0.98	0.96	;	0.89	0.71	T	0.48	0.33	0.3	37 0.6	1	0.89	0.98	0.99)		(89)
Mear	n interna	l temper	ature	in t	he rest o	of dwe	llina	T2 (f	ollow ste	eps 3	to 7 in T	able	9c)					
(90)m=	19.7	19.81	20		20.23	20.35		20.38	20.38	20.	38 20.3	37 2	20.25	19.97	19.69	9		(90)
	L				I		_!				!	fLA	= Liv	ving area ÷ (4	4) =	╡	0.48	(91)
Mear	n interna	l temper	ature	(for	the who	le dw	ellin	a) – fl	A 🗙 T1	+ (1	– fI A) ∽	Т2				L		
(92)m=	20.09	20.18	20.34	4 T	20.55	20.65		<u>97 – 11</u> 20.68	20.68	20.	68 20.6	67	20.56	20.32	20.08	в		(92)

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

(93)m=	20.09	20.18	20.34	20.55	20.65	20.68	20.68	20.68	20.67	20.56	20.32	20.08		(93)
8. Sp	ace hea	ting requ	uirement											
Set T the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of	Table 9t	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	:										
(94)m=	0.99	0.98	0.96	0.89	0.73	0.51	0.36	0.39	0.64	0.9	0.98	0.99		(94)
Usefu	I gains,	hmGm ,	, W = (94	4)m x (84	4)m									
(95)m=	340.87	352.42	358.13	347.86	294.1	201.14	135.22	141.35	217.01	294.14	319.37	330.78		(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	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m∙	– (96)m]				
(97)m=	548.76	529.12	477.61	394.85	302.34	201.56	135.24	141.4	219.49	336.46	449.61	544.16		(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=	154.67	118.74	88.89	33.83	6.13	0	0	0	0	31.49	93.78	158.75		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	686.29	(98)
Space	e heating	g require	ement in	kWh/m²	/year								13.64	(99)
9b. En	ergy req	luiremer	nts – Cor	nmunity	heating	scheme)							-
This pa	art is use	ed for sp	ace hea	ting, spa	ice cooli	ng or wa	ater heat	ing prov	ided by	a c <mark>omm</mark>	unity sch	neme.		1/22.43
Fractio	n of spa	ace neat	trom se	condary/	suppien	nentary r	neating	Table 1	1) 'U' IT N	one			0	(301)
Fractio	<mark>n o</mark> f spa	ace heat	from co	<mark>mmu</mark> nity	system	1 - (301	1) =						1	(302)
The com	n <mark>mu</mark> nity so	heme may	y obtain he	eat from se	everal sour	ces. The p	procedure	allows for	CHP and u	up to four o	other heat	sources; tl	ne latter	
<i>includes</i> Fractio	<i>bo</i> ilers, h n of hea	eat pumps at from C	s, ge ^{otherr} Commun	nal and wa ity boiler	aste heat fi S	rom powei	r stations.	See Apper	ndix C.				1	(303a)
Fractio	n of tota	al space	heat fro	m Comm	nunity bo	oilers				(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commu	unity hea	ting sys	tem			1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	ommuni	ity heatir	ng syste	m					1.1	(306)
Space	heating	3										-	kWh/year	-
Annua	space	heating	requirem	nent									686.29]
Space	heat fro	m Comr	munity b	oilers					(98) x (30	04a) x (30	5) x (306) :	=	754.92	(307a)
Efficier	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water Annua	heating water h	l neating r	equirem	ent								I	1885.76]
If DHW Water	/ from co heat fro	ommunit m Comn	ty schem nunity bo	ne: pilers					(64) x (30)3a) x (30	5) x (306) :	= [2074.34) (310a)
Electric	city used	d for hea	t distribu	ution				0.01	× [(307a).	(307e) +	· (310a)([310e)] =	28.29	(313)
Cooling	g Syster	n Energ	y Efficie	ncy Ratio	C								0	(314)
Space	cooling	(if there	is a fixe	d cooling	g system	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electric mecha	city for p nical ve	oumps aintilation	nd fans v - balanc	within dw ed, extra	velling (1 act or po	able 4f) sitive inp	: put from	outside					136.21	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	136.21	(331)
Energy for lighting (calculated in Appendix L)			248.2	(332)
12b. CO2 Emissions – Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using t	wo fuels repeat (363) to (366) for the second fue	96	(367a)
CO2 associated with heat source 1 [(307b)+(3	10b)] x 100 ÷ (367b) x	0	= 636.58	(367)
Electrical energy for heat distribution [(313) x	0.52	= 14.68	(372)
Total CO2 associated with community systems (3	63)(366) + (368)(372)	:	651.27	(373)
CO2 associated with space heating (secondary) (3	09) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantaneo	us heater (312) x	0.22	= 0	(375)
Total CO2 associated with space and water heating (3	73) + (374) + (375) =		651.27	(376)
CO2 associated with electricity for pumps and fans within dwelling	g (331)) x	0.52	70.69	(378)
CO2 associated with electricity for lighting (3	32))) x	0.52	128.81	(379)
Total CO2, kg/year sum of (376)(382) =			850.77	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			16.91	(384)
El rating (section 14)			88.04](385)

		ι	Jser De	etails:										
Assessor Name: Software Name:	Stroma FSAP 20	12	:	Stroma Softwa	a Numi ire Ver	ber: sion:		Versio	n: 1.0.1.24					
		Pro	perty A	Address:	Flat 3									
Address :														
1. Overall dwelling dim	ensions:													
			Area	(m²)		Av. Hei	ight(m)		Volume(m ³	') 				
Ground floor			66	6.88	(1a) x	2	2.5	(2a) =	167.2	(3a)				
Total floor area TFA = (la)+(1b)+(1c)+(1d)+(1	e)+(1n)	66	5.88	(4)									
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	167.2	(5)				
2. Ventilation rate:														
	main s heating	secondary heating	(other		total			m ³ per hou	r				
Number of chimneys	0 +	0	+	0	=	0	X 4	40 =	0	(6a)				
Number of open flues	0 +	0	+	0] = [0	x	20 =	0	(6b)				
Number of intermittent fa	ans				- 	0	x ′	10 =	0	(7a)				
Number of passive vents	s				Ē	0	x ′	10 =	0	(7b)				
Number of flueless gas	fires				Γ	0	X 4	40 =	0	(7c)				
Number of intermittent fans 0 $x 10 =$ 0 Number of passive vents 0 $x 10 =$ 0 Number of flueless gas fires 0 $x 40 =$ 0 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 \div (5) = 0 Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 \div (5) = 0														
Infiltration due to chimne	eys, flues and fans = (6a)+(6b)+(7a)	+(7b)+(7	(c) =		0		÷ (5) =	0	(8)				
If a pressurisation test has	been carried out or is intend	led, proceed t	o (17), o	therwise c	ontinue fro	om (9) to ((16)			–				
Additional infiltration	ne dwelling (ns)						[(0)]	11v0 1 -	0	(9)				
Structural infiltration: () 25 for steel or timber	frame or 0	35 for	masonr	v constru	uction	[(3)	-1]x0.1 =	0	$=_{(11)}^{(10)}$				
if both types of wall are p deducting areas of open	present, use the value corre ings); if equal user 0.35	sponding to th	ne greate	er wall area	a (after				0					
If suspended wooden	floor, enter 0.2 (unsea	aled) or 0.1	(seale	d), else	enter 0				0	(12)				
lf no draught lobby, er	nter 0.05, else enter 0								0	(13)				
Percentage of window	vs and doors draught s	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	, q50, expressed in cu	bic metres	per ho	ur per so	quare me	etre of e	nvelope	area	3	(17)				
If based on air permeab	ility value, then (18) = [(17) ÷ 20]+(8),	otherwis	se (18) = (*	16)				0.15	(18)				
Air permeability value appli	es it a pressurisation test ha	as been done	or a degi	ree air per	meability i	s being us	sed		2					
Shelter factor	eu		((20) = 1 - [0.075 x (1	9)] =			3 0.78	(19)				
Infiltration rate incorpora	ating shelter factor		((21) = (18)	x (20) =				0.12	– (21)				
Infiltration rate modified	for monthly wind spee	d							-					
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Monthly average wind s	peed 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 Eactor $(22a)m = (2a)m =$	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						
	ļ ļ	<u> </u>					I	I	I					

Adjust	ed infiltr	ation rat	e (allow	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
~ ' '	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If me	ate etter	<i>ctive air</i> al ventila	change	rate for t	ne appli	cable ca	se						0.5	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	N5)), othei	wise (23b) = (23a)			0.5	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =	, (,			77.25	(23c)
a) If	balance	d mech	anical ve	ntilation	with he	at recove	erv (MV/	- - - - - - - - - - - - - - - - - - -	n)m = (2)	2h)m + (23h) x [1	l – (23c)	<u> </u>	(200)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(24a)
b) If	balance	l d mech	i anical ve	entilation	without	heat rec	L Coverv (N	I //V) (24b)m = (22	I 2b)m + (;	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	tract ver	ntilation of	or positiv	e input v	ventilatio	n from c	outside	1				
	if (22b)n	n < 0.5 ×	(23b), t	hen (24	c) = (23b); other	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	se positiv	/e input	ventilatio	on from I	oft				-	
i	if (22b)n	n = 1, th	en (24d) I	m = (22t	o)m othe	erwise (2	24d)m = 0	0.5 + [(2	2b)m² x	0.5]			I	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				I	(05)
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	-0.22	0.23	0.24	0.24	0.25		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	/IENT	Gros	SS (m 2)	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value		A X k
Doore		area	(m²)	m	12	A,r	n²	vv/m2		(VV/I	K)	KJ/M ² ·I	1	KJ/K
Mindo		.1				2.1		2	=	4.2	H			(20)
		;]				19.23		/[1/(0.0)+	0.04] =	14.91	H			(27)
windo	ws type	2				9.5		/[1/(0.8)+	0.04] =	7.36	L.			(27)
	ws type	93 				20.61	x1/	/[1/(0.8)+	0.04] =	15.98	╡,			(27)
Walls		95.	5	51.4	4	44.06	3 X	0.13	=	5.73				(29)
Total a	area of e	elements	, m²			95.5								(31)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	formula 1,	/[(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) =				48.18	(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	: Medium		250	(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 noi	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	<						8.1	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			56.28	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	14.43	14.27	14.11	13.3	13.14	12.34	12.34	12.18	12.66	13.14	13.46	13.79		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	70.7	70.54	70.38	69.58	69.42	68.62	68.62	68.46	68.94	69.42	69.74	70.06		
										Average =	Sum(39)1.	12 /12=	69.54	(39)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05		
L	r of dov		u oth (Toh						,	Average =	Sum(40) _{1.}	12 /12=	1.04	(40)
	lan	Feb	Mar		May	lun	6.1	Διια	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ener	rgy requi	irement:								kWh/ye	ear:	
Assum 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	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	17		(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 ^r day (all w	es per da 5% if the a 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	90 f).2		(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=	99.22	95.61	92.01	88.4	84.79	81.18	81.18	84.79	88.4	92.01	95.61	99.22		_
Ener <mark>gy c</mark>	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1082.42	(44)
(45)m=	147.14	128.69	132.8	115.78	111.09	95.86	88.83	101.94	103.15	12 <mark>0.21</mark>	131.22	142.5		_
lf instanta	aneous w	ater heatii	na at point	of use (no	o hot water	storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1419.22	(45)
(46)m=	22.07	19.3	19.92	17 37	16 66	14.38	13.32	15 29	15.47	18.03	19.68	21.38		(46)
Water s	storage	loss:										2.100		
Storage	e volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	a <mark>me ve</mark> s	sel		0		(47)
If comn	nunity h	eating a	ind no ta	ınk in dw	elling, e	nter 110	litres in	(47)		(()			
Otherw Water e	ise if no	o stored	hot wate	er (this ir	ICludes I	nstantar	neous co	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/dav):					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	10		(50)
b) If m	anufact	urer's de	eclared o	cylinder 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.	02		(51)
Volume	e factor	from Tal	ble 2a	011 4.3							1	03		(52)
Tempe	rature fa	actor fro	m Table	2b							0	.6		(53)
Enerav	lost fro	m water	storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =	1	03		(54)
Enter ((50) or ((54) in (5	55)	, ,							1.	03		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinde	r contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (L H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (an	nual) fro	om Table	e 3							0		(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	ter heati	ng and a	cylinde	r thermo	stat)		I	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(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 h	neating c	alculated	d fo	r eacl	n month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	202.42	178.62	188.08	169.27	166.37	14	49.36	144.11	157.21	156.65	175.49	184.72	197.78]	(62)
Solar DI	HW input	calculated	using Ap	pendix G c	r Appendix	<н((negativ	ve quantity	/) (enter	0' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHRS	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 v	vater hea	ter												
(64)m=	202.42	178.62	188.08	169.27	166.37	14	49.36	144.11	157.21	156.65	175.49	184.72	197.78		
			-						Ou	tput from w	ater heate	er (annual)	112	2070.06	(64)
Heat g	jains fro	om water	heating	, kWh/m	onth 0.2	5 ′	[0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	93.15	82.73	88.38	81.29	81.16	7	4.67	73.76	78.11	77.09	84.19	86.43	91.6		(65)
inclu	ude (57)m in calo	ulation	of (65)m	n only if c	ylir	nder is	s in the c	dwelling	g or hot w	vater is f	rom com	munity h	neating	
5. In	ternal g	ains (see	Table	5 and 5a	ı):										
Metab	olic dai	ns (Table	5) Wa	utts	,										
motab	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	108.4	108.4	108.4	108.4	108.4	1	08.4	108.4	108.4	108.4	108.4	108.4	108.4		(66)
Liahtin		(calcula	ted in A		L. equat	ion	L9 oi	r L9a), a	lso see	Table 5					
(67)m=	16.93	15.04	12.23	9.26	6.92	1	5.84	6.31	8.21	11.01	13.99	16.32	17.4	1	(67)
Annlia	nces da	ains (calc	ulated i	n Appen	dix Lea	Lat	tion L	13 or L 1:	l 3a) als	o see Ta	ble 5	1		1	
(68)m=	189.91	191.88	186.91	176.34	163	1	50.45	142.07	140.1	145.07	155.64	168,99	181.53	1	(68)
Cookir			tod in /	honondiv		tion	1 15	or 150)			5	100.00	101.00	J	()
(69)m-	19 yana	33.84	33.84	33.84			3.84	33.84	33.84	33.84	33.84	33.84	33.84	1	(69)
000)11-	00.04	00.04	(Table	50.04	00.04		0.04	00.04	00.04	55.04	00.04	00.04	00.04		(00)
Pumps	s and fa	ins gains		5a)		<u> </u>	0	0						1	(70)
(70)m=	0					Ļ	0	0	0	0	0	0	0	J	(70)
Losse	s e.g. e		on (nega		ies) (Tab	ble :	5)							1	(74)
(71)m=	-86.72	-86.72	-86.72	-86.72	-86.72		36.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	J	(71)
Water	heating	g gains (T	Table 5)	1		-						1		1	(70)
(72)m=	125.2	123.11	118.79	112.9	109.08	10	03.71	99.14	104.99	107.07	113.16	120.04	123.12	J	(72)
Total i	interna	l gains =	:			-	(66)	m + (67)m	n + (68)m r	+ (69)m +	(70)m + (1 1	71)m + (72))m 1	1	
(73)m=	387.56	385.55	373.45	354.02	334.52	3	15.52	303.05	308.82	318.68	338.31	360.87	377.57		(73)
6. So	lar gain	IS:													
Solar (jains are	calculated	using sol	ar flux from	1 able 6a	and	associ	ated equa	tions to a	convert to th	ne applica	ble orienta	tion.		
Orient	ation:	Access F Table 6d	actor	Area m ²	1		Flu Tab	x ble 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
Feet								510 OU	. –					(**)	٦
⊏ast	0.9x	1	`	(19	.23	x	1	9.64		0.4	_ × Ļ	0.7	=	51.4	_(76)
⊏ast	0.9x	1	`	(19	.23	x	3	8.42		0.4	_ × L	0.7	=	100.54	_(76)
⊨ast –	0.9x	1)	(19	.23	x	6	3.27		0.4		0.7	=	165.57	(76)
East	0.9x	1)	(19	.23	x	9	2.28	×	0.4	× [0.7	=	241.48	(76)
East	0.9x	1	>	<mark>(</mark> 19	.23	x	1'	13.09	x	0.4	×	0.7	=	295.94	(76)

East	0.9x	1		x	19.	23	x	1	15.77	x		0.4	x	0.7		=	302.95	(76)
East	0.9x	1		x	19.3	23	j ×	1	10.22	x		0.4	×	0.7		=	288.42	(76)
East	0.9x	1		x	19.	23	x	9	94.68	x		0.4	×	0.7		=	247.75	(76)
East	0.9x	1		x	19.3	23	j ×	7	73.59	x		0.4	×	0.7		=	192.57	(76)
East	0.9x	1		x	19.:	23	j ×	4	15.59	x		0.4	- X	0.7		=	119.3	(76)
East	0.9x	1		x	19.:	23] ×	2	24.49	x		0.4	×	0.7		=	64.08	(76)
East	0.9x	1		x	19.:	23	x	1	6.15	x		0.4	×	0.7		= [42.26	(76)
South	0.9x	0.54		x	9.	5	x	4	16.75	x		0.4	×	0.7		= [60.44	(78)
South	0.9x	0.54		x	9.	5	x	7	76.57	x		0.4	×	0.7	:	=	98.98	(78)
South	0.9x	0.54		x	9.	5	x	9	97.53	x		0.4	×	0.7	:	=	126.09	(78)
South	0.9x	0.54		x	9.5	5	×	1	10.23	x		0.4	x	0.7	:	=	142.51	(78)
South	0.9x	0.54		x	9.9	5	x	1	14.87	x		0.4	×	0.7	:	=	148.5	(78)
South	0.9x	0.54		x	9.	5	x	1	10.55	x		0.4	×	0.7		=	142.91	(78)
South	0.9x	0.54		x	9.	5	x	1	08.01	x		0.4	×	0.7		=	139.63	(78)
South	0.9x	0.54		x	9.	5	x	1	04.89	x		0.4	×	0.7	:	=	135.6	(78)
South	0.9x	0.54		x	9.	5	x	1	01.89	x		0.4	×	0.7	:	=	131.71	(78)
South	0.9x	0.54		x	9.	5	x	8	32.59	x		0.4	×	0.7		=	106.76	(78)
South	0.9x	0.54		x	9.	5	X	5	55.42	x		0.4	×	0.7		=	71.64	(78)
South	0.9x	0.54		x	9.	5	x		40.4) x		0.4	x	0.7		-	52.23	(78)
West	0.9x	0.54		x	20.	61	×		9.64] ×		0.4	×	0.7		=	55.08	(80)
West	0.9x	0.5 <mark>4</mark>		x	20.	61	x		38.42	x		0.4	×	0.7		= [107.75	(80)
West	0.9x	0.54		x	20.	61	x	6	63.27	x		0.4	×	0.7		=	177.46	(80)
West	0.9x	0.54		x	20.	61	x	Ę	92.28	x		0.4	×	0.7	:	=	258.81	(80)
West	0.9x	0.54		x	20.	61	×	1	13.09	x		0.4	×	0.7		=	3 <mark>17.18</mark>	(80)
West	0.9x	0.54		x	20.	61	x	1	15.77	x		0.4	×	0.7	:	=	324.69	(80)
West	0.9x	0.54		x	20.	61	x	1	10.22	x		0.4	×	0.7	:	=	309.12	(80)
West	0.9x	0.54		x	20.	61	x	ę	94.68	x		0.4	×	0.7	:	=	265.53	(80)
West	0.9x	0.54		x	20.	61	×	7	73.59	x		0.4	×	0.7	:	=	206.39	(80)
West	0.9x	0.54		x	20.	61	×	4	15.59	x		0.4	×	0.7	:	=	127.86	(80)
West	0.9x	0.54		x	20.	61	x	2	24.49	x		0.4	×	0.7	:	=	68.68	(80)
West	0.9x	0.54		x	20.	61	x	1	6.15	x		0.4	×	0.7	:	=	45.3	(80)
Solar (gains in	watts, ca	alculat	ed	for eac	n mon	th		1	(83)m	ו = Su	ım(74)m	.(82)m					(00)
(83)m=	166.92	307.28	469.1	2	642.8	761.6	2	770.55	737.17	648	.88	530.67	353.92	2 204.41	139.7	'9		(83)
				аі - Т	(04)111 =	= (73)		(03)11		057	74	0.40.05	<u> </u>	505.07	5470			(94)
(04)11=	554.47	092.03	642.5	<u> </u>	990.82	1096.1		086.08	1040.22	957	./ 1	649.35	692.23	5 565.27	517.3	00		(04)
7. Me	ean inter	nal temp	peratur	e (heating	seaso	on)		· -		-					- 1		1
Temp	berature	during h	ieating	pe	eriods ir	n the li	ving	area	trom lat	ole 9	, I h 1	l (°C)					21	(85)
Utilis	ation fac	tor for g	ains to	r li	ving are	ea, h1,	m (9					600 I	0~*	Nov				
(86)m-					Apr		y I	Jun			ug	0.55	OCt			C		(86)
(00)11=		0.97	0.91		0.11	0.58		0.4	0.29			0.00	0.00	0.90	0.99	'		(00)
Mear	interna	I temper	ature i	n li T	iving are	ea T1	(foll)	ow ste	ps 3 to 7	7 in T	able	9c)	00.00	00.4	00.07			(97)
(ŏ1)m=	20.1	20.34	20.64		20.89	20.98	<u>`</u>	21	21	2	1	20.99	20.82	20.4	20.05	С		(07)

Temp	perature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04		(88)
Utilis	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.96	0.89	0.72	0.52	0.34	0.23	0.26	0.48	0.82	0.97	0.99		(89)
Mear	n interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	18.85	19.2	19.62	19.93	20.03	20.06	20.06	20.06	20.05	19.87	19.3	18.79		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.56	(91)
Mear	n interna	l temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	_A) × T2					
(92)m=	19.55	19.84	20.19	20.47	20.56	20.59	20.59	20.59	20.58	20.4	19.92	19.5		(92)
Apply	/ adjustr	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.55	19.84	20.19	20.47	20.56	20.59	20.59	20.59	20.58	20.4	19.92	19.5		(93)
8. Sp	ace hea	ting requ	uirement											
Set T	i to the i	mean int	ternal ter	nperatur	re obtain	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the u		Tactor Id	Mor			lun	lul	Δυα	Son	Oct	Nov	Dec		
Utilis	ation fac	tor for a	ains hm		iviay	Jun	Jui	Aug	Sep	001	NUV	Dec		
(94)m=	0.99	0.96	0.89	0.74	0.55	0.38	0.26	0.3	0.52	0.84	0.97	0.99		(94)
Usef	L ul gains,	hmGm	. W = (9	1)m x (84	4)m				1			II		
(95)m=	546.84	666.24	753.59	740.37	603.47	409.52	273.48	286.45	440.1	58 <mark>0.01</mark>	547.16	512.14		(95)
Mo <mark>nt</mark>	hly avera	age exte	ernal tem	perature	e from Ta	able 8		7						
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1078.33	1053.8	963.52	804.96	615.28	410.72	273.61	286.71	446.39	680.48	894.03	1071.8		(97)
Sp <mark>ac</mark>	e heatin	g require	ement fo	<mark>r eac</mark> h m	honth, <mark>k</mark>	Nh/mon ⁺	th = 0.02	24 x [(97) <mark>m – (9</mark> 5)m] x (4	1)m			
(98)m=	395.43	260.44	156.19	46.51	8.79	0	0	0	0	74.75	249.75	416.38		-
								Tota	al per year	(kWh/yeai	[.]) = Sum(9	8)15,912 =	1608.23	(98)
Spac	e heatin	g require	ement in	kWh/m ²	/year								24.05	(99)
9b. Er	ergy rec	quiremer	nts – Cor	nmunity	heating	scheme	•							
This p	art is us	ed for sp	bace hea	ting, spa	ace cooli	ing or wa	ater heat	ting prov	vided by	a comm	unity scł	neme.		
Fractio	on of spa	ace neat	from se	condary/	suppien	nentary i	neating	(Table 1	1) 'U' if n	one			0	(301)
Fractio	on of spa	ace heat	from co	mmunity	system	1 – (30′	1) =						1	(302)
The cor	nmunity so	cheme ma	y obtain he	eat from se	everal sour	rces. The p	procedure	allows for	CHP and u	up to four	other heat	sources; ti	he latter	
Fractio	s boilers, h on of hea	eat pump: at from (s, geotheri Commun	nal and wa ity hoiler	aste heat f 's	rom powei	r stations.	See Appe	ndix C.				1	(303a)
Fractio	on of tot		heat fro	m Comn	ounity be	nilore				(3	02) v (303	a) –	1	$\frac{304a}{304a}$
Factor			oborging	mothod		4o(2)) fo	r	unity has	ting over	()	02) X (000	α) –	1	
Distrib					(Table 4	40(3)) 10		unity nea	aing sys	lem			1	
Distric		s factor	(Table 1	2C) for C	commun	ity neatil	ng syste	m					1.1	(306)
Space	heating	g heating	requirem	nent									kWh/yea	ir
Snace	heat fro	m Com	munity h	oilers					(98) x (3()4a) x (304	5) x (306) ·	_	1760.20	(307a)
Efficia	nov of o			montory	haating	evetor	in % /fre	m Table	12 or ^	nnendiv	F)		0	
Lucie		Scondar	ysuppie	mentary	neating	system	111 /o (11 C		, 4 a UI A	ppenuix	L)		U	(300

Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0 (30)	9)
Water heating Annual water heating requirement		2070.06	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) :	= 2277.07 (31)	0a)
Electricity used for heat distribution 0.0	01 × [(307a)(307e) + (310a)((310e)] = 40.46 (313	3)
Cooling System Energy Efficiency Ratio		0 (314	4)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0 (31	5)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside	e	234.58 (33)	0a)
warm air heating system fans		0 (33)	0b)
pump for solar water heating		0 (33)	0g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	234.58 (33	1)
Energy for lighting (calculated in Appendix L)		299 (33)	2)
12h CO2 Emissions – Community heating scheme			
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	hergy Emission Wh/year kg CO2/k als repeat (363) to (366) for the s	econd fuel 96 (36	7a)
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using two fue CO2 associated with heat source 1 [(307b)+(310b)] >	Dergy Emission Wh/year kg CO2/k els repeat (363) to (366) for the s < 100 ÷ (367b) x	econd fuel 96 (36)	7a) 7)
End Er KV CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using two fue CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution [(313) x	Dergy Wh/year Emission kg CO2/k els repeat (363) to (366) for the s < 100 ÷ (367b) x	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37)	7a) 7) 2)
Example 2 End of the end of the	Dergy Wh/year Emission kg CO2/k els repeat (363) to (366) for the s < 100 ÷ (367b) x	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37)	7a) 7) 2) 3)
Example 2 Consistence Er KV CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using two fue CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution [(313) x Total CO2 associated with space heating (secondary) (363)(Dergy Vh/year Emission kg CO2/k els repeat (363) to (366) for the s < 100 ÷ (367b) x	factor Emissions kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37) = 0 (37)	7a) 7) 2) 3) 4)
Example 2012 Emissions Community neuting scheme Er KV CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution Total CO2 associated with space heating (secondary) (309) x CO2 associated with water from immersion heater or instantaneous heater	Dergy Wh/year Emission kg CO2/k els repeat (363) to (366) for the s (100 ÷ (367b) x 0 366) + (368)(372) 0	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37) = 0 (37) = 0 (37)	77a) 77) 2) 3) 4) 5)
Example 2012 Emissions Community netating scheme Err CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution Total CO2 associated with space heating (secondary) CO2 associated with space heating (secondary) CO2 associated with space and water heating (373) +	Dergy Wh/year Emission kg CO2/k els repeat (363) to (366) for the s (100 ÷ (367b) x 0 366) + (368)(372) 0	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37)	77a) 77) 2) 3) 4) 5) 6)
Example 2012 Emissions Community netating scheme Figure 2012 Emissions Community netating scheme Err CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution [(313) x Total CO2 associated with community systems CO2 associated with space heating (secondary) CO2 associated with water from immersion heater or instantaneous heater Total CO2 associated with space and water heating CO2 associated with space and water heating CO2 associated with space and water heating (373) + (CO2 associated with electricity for pumps and fans within dwelling	Dergy Wh/year Emission kg CO2/k els repeat (363) to (366) for the s $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (367b) \times$ $x = 100 \div (368) \dots (372)$ $x = 100 \div (368) \dots (372)$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (372) \div$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \times$ $x = 100 \div (312) \div (312) \div (312) \div (312) \div$	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 121.75 (37)	77a) 77) 72) 3) 4) 5) 6) 8)
Explore Co2 Enhabities Continuity netating scheme Freind CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution Total CO2 associated with community systems CO2 associated with space heating (secondary) CO2 associated with water from immersion heater or instantaneous heater Total CO2 associated with space and water heating CO2 associated with electricity for pumps and fans within dwelling (332))) x	nergy Emission Vh/year Emission kg CO2/k kg CO2/k els repeat (363) to (366) for the s 0 $(100 \div (367b) \times 0)$ 0 $(366) + (368)(372)$ 0 eater $(312) \times 0.22$ $(374) + (375) =$ 0.52 $(31)) \times 0.52$ 0.52	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37) = 0 (37) = 0 (37) = 0 (37) = 121.75 (37) = 121.75 (37) = 155.18 (37)	77a) 77) 72) 33) 4) 55) 6) 8) 8) 9)
Explored control of the sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using two fue CO2 associated with heat source 1 [(307b)+(310b)] Electrical energy for heat distribution [(313) × Total CO2 associated with space heating (secondary) (309) × CO2 associated with water from immersion heater or instantaneous heater (373) + (CO2 associated with electricity for pumps and fans within dwelling (332))) × Total CO2, kg/year sum of (376)(382) =	Dergy Vh/year Emission kg CO2/k els repeat (363) to (366) for the s $x (100 \div (367b) \times 0)$ $x (100 \div (367b) \times 0)$ $x (366) + (368)(372)$ $x (366) + (368)(372)$ $x (312) \times 0.22$ $x (374) + (375) =$ $x (312) \times 0.52$ $x (312) \times 0.52$	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 931.38 (37) = 0 (37) = 0 (37) = 0 (37) = 121.75 (37) = 121.75 (37) = 1208.3 (38)	77a) 77) 72) 73) 4) 5) 6) 8) 9) 3)
Explored CO2 Links on S Continuity neuting scheme Freind CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) CO2 associated with heat source 1 [(307b)+(310b)] > Electrical energy for heat distribution [(313) x Total CO2 associated with community systems CO2 associated with space heating (secondary) CO2 associated with space heating (secondary) CO2 associated with space and water heating Total CO2 associated with space and water heating CO2 associated with electricity for pumps and fans within dwelling CO2 associated with electricity for lighting CO3 associated with electricity for lighting CO3 associated with electricity for lighting <td< td=""><td>hergy Emission Wh/year Emission kg CO2/k kg CO2/k els repeat (363) to (366) for the s 0 $(100 \div (367b) \times 0)$ 0 $(366) + (368)(372)$ 0 eater $(312) \times 0.22$ $(374) + (375) =$ 0.52 $(311) \times 0.52$ 0.52</td><td>factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 121.75 (37) = 121.75 (37) = 155.18 (37) 1208.3 (38) 18.07 (38)</td><td>77a) 77) 72) 73) 4) 5) 6) 8) 9) 3) 4)</td></td<>	hergy Emission Wh/year Emission kg CO2/k kg CO2/k els repeat (363) to (366) for the s 0 $(100 \div (367b) \times 0)$ 0 $(366) + (368)(372)$ 0 eater $(312) \times 0.22$ $(374) + (375) =$ 0.52 $(311) \times 0.52$ 0.52	factor Emissions Wh kg CO2/year second fuel 96 (36) = 910.38 (36) = 21 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 0 (37) = 121.75 (37) = 121.75 (37) = 155.18 (37) 1208.3 (38) 18.07 (38)	77a) 77) 72) 73) 4) 5) 6) 8) 9) 3) 4)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSA	P 2012		Stroma Softwa	a Num Ire Ver	ber: sion:		Versio	on: 1.0.1.24	
		Р	roperty /	Address:	Flat 4					
Address :										
1. Overall dwelling dim	iensions:		-	()						
Cround floor			Area	a(m²)	(4)	Av. He	ight(m)		Volume(m ³)	
				1.18	(1a) x	2	2.5	(2a) =	177.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1	d)+(1e)+(1r	1) 7	1.18	(4)					_
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	177.95	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m ³ per hour	
Number of chimneys	0	+ 0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	¯ + ¯	0] = [0	x	20 =	0	(6b)
Number of intermittent f	ans				Ē	0	x ′	10 =	0	(7a)
Number of passive vent	S					0	x ′	10 =	0	(7b)
Number of flueless gas	fires				Г	0	X 4	40 =	0	(7c)
								Air ch	anges per hou	ır
Infiltration due to chimne	eys, flues and fan	S = (6a) + (6b) + (7)	(a)+(7b)+(7	7c) =		0	(16)	÷ (5) =	0	(8)
Number of storeys in	the dwelling (ns)	intended, proceed	<i>a io</i> (<i>17)</i> , c		onunue no	5m (9) to (10)		0	7(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration:	0.25 for steel or ti	mber frame or	0.35 for	masonr	y constr	uction			0	 (11)
if both types of wall are deducting areas of oper	present, use the value nings); if equal user 0.	e corresponding to 35	the greate	er wall area	a (after					-
If suspended wooden	floor, enter 0.2 (u	unsealed) or 0.	1 (seale	d), else	enter 0				0	(12)
lf no draught lobby, e	nter 0.05, else en	ter 0							0	(13)
Percentage of window	vs and doors drau	ught 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	, q50, expressed	in cubic metre	s per ho	our per so	quare m	etre of e	envelope	area	3	(17)
If based on air permeab	bility value, then ($(8) = [(17) \div 20] + (8)$	s), otherwi	se(18) = (io) moobility	ia haina w	and		0.15	(18)
Number of sides shelter	ed	lesi nas been don	le of a deg	liee all pei	Πεαριπτγ	is being us	seu		3	7(19)
Shelter factor	00			(20) = 1 - [0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorpora	ating shelter facto	r		(21) = (18)	x (20) =				0.12] (21)
Infiltration rate modified	for monthly wind	speed								-
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	peed 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 $(22a)m = 0$	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		
	I			•			•	•		

Adjust	ed infiltr	ation rat	e (allow	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
<u> </u>	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If me	ate etter	ctive air al ventila	change	rate for t	he appli	cable ca	se						0.5	(23a)
lf exh	aust air h	eat pump (usina App	endix N. (2	3b) = (23a	a) × Fmv (e	equation (1	N5)) . othei	wise (23b) = (23a)			0.5	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use fa	actor (from	n Table 4h) =	, (,			77.25	(23c)
a) If	balance	d mech:	anical ve	ntilation	with he	at recove	erv (MVI	- - - - - - - - - - - - - - - - - - -	n)m = (22)	2h)m + (23h) x [1	l – (23c)	<u> </u>	(200)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(24a)
b) If	balance	d mecha	ı anical ve	entilation	without	heat rec	L Coverv (N	I //V) (24b)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	use ex	ract ver	ntilation of	n pripositiv	re input v	ventilatio	n from c	outside					
,	if (22b)n	n < 0.5 ×	(23 b), 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					
i 	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]		-	I	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in boy	(25)			0.05	l	(05)
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	-0.22	0.23	0.24	0.24	0.25		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	<mark>/IE</mark> NT	Gros	SS (mr 2)	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value		A X k
Doore		area	(m²)	II	12	A,r		vv/m2		(\vv)	n)	KJ/M2+I		KJ/K
Windo		.1				2.1			=	4.2	H			(20)
Windo	ws Type					8.25		/[1/(0.0)+	0.04] =	6.4	H			(27)
Walla	ws type	; 2				15.71		/[1/(0.8)+	0.04] =	12.18	닏,			(27)
vvalis		91.8	8	26.0	6	65.74	1 ×	0.13		8.55	╡╞		\dashv	(29)
Roof	,	71.1	8	0		71.18	3 ×	0.12	= [8.54				(30)
Total a	area of e	lements	, m²			162.9	8		<i></i>					(31)
* for win ** inclua	dows and le the area	roof winde as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and pari	alue calcul titions	ated using	formula 1.	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)	,			(26)(30)	+ (32) =				39.86	(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	: Medium		250	(35)
For desi can be ı	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	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						13.8	(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) =			53.66	(37)
Ventila	ation hea	at loss ca	alculated	monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	15.35	15.18	15.01	14.16	13.99	13.14	13.14	12.97	13.48	13.99	14.33	14.67		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	69.02	68.85	68.67	67.82	67.65	66.8	66.8	66.63	67.14	67.65	67.99	68.33		
										Average =	Sum(39)1.	12 /12=	67.78	(39)

Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.96	0.96		
								ļ	,	Average =	Sum(40)1.	12 /12=	0.95	(40)
Numbe	r of day	/s in moi	nth (Tab		Mov	lun		<u> </u>	Son	Oct	Nov	Dee		
(11)m-	Jan 21	29 29	21	20	1VIAY	Jun	31 21	Aug	Sep 20	21	20	21		(41)
(41)11=	31	20	31	30	31	30	31	51	30	31	30	31		(41)
4. Wa	ter hea	ting ene	rgy regu	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 ×	([1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	27		(42)
Annual Reduce t not more	averag the annua that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c 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	92 f	.86		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage i	n litres per	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	102.15	98.43	94.72	91	87.29	83.57	83.57	87.29	91	94.72	98.43	102.15		_
Ener <mark>gy c</mark>	ontent of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,ı	m x nm x L	OTm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1114.33	(44)
(45)m=	1 <mark>5</mark> 1.48	132.49	136.71	119.19	114.37	<mark>9</mark> 8.69	91.45	104.94	106.19	123.76	135.09	146.7		_
lf instanta	aneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1461.06	(45)
(46)m=	<mark>2</mark> 2.72	19.87	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22.01		(46)
Water a	storage	loss:												
Storage	e volum	ie (litres)	rinciuair	ng any so	biar or v	WHRS	storage		ame ves	sei		0		(47)
If comn Otherw	nunity r ise if no	eating a	and no ta hot wate	ank in dw er (this ir	/elling, e ocludes i	nter 110 nstantar) litres in Decus co	1 (47) Smbi boil	ers) ente	er 'O' in <i>(</i>	(47)			
Water s	storage	loss:	not wat			notantai	10000 00							
a) If m	anufact	urer's de	eclared l	loss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	e 2b								0		(49)
Energy	lost fro	m water	r storage	e, kWh/ye	ear			(48) x (49)) =		1	10		(50)
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:						1	
Hot wa	ter stor	age loss	actor fi	rom Tabl	le 2 (kW	h/litre/da	ay)				0.	02		(51)
Volume	e factor	from Ta	ble 2a	011 4.5							1	03		(52)
Tempe	rature f	actor fro	m Table	e 2b							0	.6		(53)
Enerav	lost fro	om water	r storage	e kWh/ve	ear			(47) x (51)) x (52) x (53) =		03		(54)
Enter ((50) or ((54) in (5	55)	,, j					, , , ,	,	1.	03		(55)
Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinde	r contain	s dedicate	d solar sto	l prage, (57)	I m = (56)m	x [(50) – (I (H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m =	(58) ÷ 36	65 × (41)	m				-	
(mod	lified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	alculated	for eac	h month	(61)m =	(60)) ÷ 36	5 × (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	neating c	alculated	l for	each	month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	206.76	182.41	191.99	172.68	169.64	15	2.18	146.73	160.22	159.69	179.04	188.59	201.98		(62)
Solar DI	-IW input	calculated	using Ap	pendix G o	r Appendix	H (r	negativ	e quantity	/) (enter 'C)' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	S and/or	WWHRS	ар	plies,	see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter												
(64)m=	206.76	182.41	191.99	172.68	169.64	15	2.18	146.73	160.22	159.69	179.04	188.59	201.98		
			-						Out	put from w	ater heate	er (annual)₁	12	2111.9	(64)
Heat g	ains fro	m water	heating	g, kWh/m	onth 0.2	5´[0.85 :	× (45)m	+ (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	94.59	83.99	89.68	82.43	82.25	75	5.61	74.63	79.11	78.1	85.37	87.71	93		(65)
inclu	de (57)	m in calo	ulation	of (65)m	only if c	ylin	der is	in the c	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. In	ternal g	ains (see	e Table	5 and 5a):	-			-				-	-	
Metab	olic gai	ns (Table	5) Wa	atts	, 										
motab	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	113.72	113.72	113.72	113.72	113.72	11	3.72	113.72	113.72	113.72	113.72	113.72	113.72		(66)
Liahtin	a dains	(calcula	ted in A		L. equat	ion	L9 or	L9a), a	lso see	Table 5					
(67)m=	17.83	15.84	12.88	9.75	7.29	6	.15	6.65	8.64	11.6	14.73	17.19	18.33	1	(67)
Applia	nces da	ins (calc	ulated i	n Appen	dix Lea	uati	on I 1	3 or 1:	3a) also	see Ta	ble 5	!			
(68)m=	200.04	202.11	196.88	185.74	171.69	15	8.48	149.65	147.57	152.81	163.94	178	191.21	1	(68)
Cookir			ted in 4	Appendix		ion	115 0	or 15a)		e Table	5			J	
(69)m=	34.37	34.37	34.37	34.37	34.37	34	37	34.37	34.37	34.37	34.37	34.37	34.37	1	(69)
Dump	and fa	ne gaine	(Table	52)											
(70)m-				$\frac{5a}{1}$	0		0	0	0	0	0	0	0	1	(70)
							<u> </u>	v	Ū	Ů	Ŭ	Ů	Ŭ	J	(
(71)m-) 0 00	00.08	00.08	00.08	00.08	00.08	00.08	1	(71)
(/ I)III-	-30.30		-30.30	-90.90	-30.30	-3	0.30	-30.30	-30.30	-90.90	-30.30	-30.30	-30.30]	()
vvater	neating	gains (1	able 5)	111 40	110 55	10	5 01	100.21	106.24	100.40	111 75	101.00	105	1	(72)
(72)11=	127.14	124.99	120.34	114.40	110.55	10	(00)	100.31	100.34	100.40	(70) - (7	121.02	125	J	(12)
I otal	nterna	i gains =	007.44	007.00	040.04	00		040.70		+ (69)11 + 1	(70)m + (1	(1) (72)		1	(72)
(73)m=	402.12	400.06	367.41	367.09	340.04	32	.0.76	313.72	319.07	330	350.53	374.13	391.05		(13)
Solar o	iai gain nains are	s. calculated	usina sol	ar flux from	Table 6a :	and :	associa	ated equa	tions to co	onvert to th	e annlica	ble orientat	ion		
Orient	ation:	Access F		Area			Flux	((n		FF		Gains	
Onorm		Table 6d	aotor	m²	L		Tab	le 6a	Г	able 6b	Т	able 6c		(W)	
North	0.9x	0.5/	,	(15	71	×Г	10) 63	×	04	<u> к</u> г	0.7		22 73	7(74)
North	0.94	0.54			71	ΩL γΓ		1.32		0.4	╡╻╷	0.7	=	12 11	」 ^(***)] ₍₇₄₎
North	0.0A	0.54	=		71	ΩL γΓ	20	1.53		0.4	╡ᆠ┟	0.7	=	72.00	」 ^{(,, ,,})] ₍₇₄₎
North	0.04	0.54	(71	ι Γ	54			0.4	╡╏╏	0.7		110 57	」(' ^{™)}](74)
North	0.9X	0.54	<u> </u>		74	^ L _ Г	50	1.70		0.4	╡゜┝	0.7		450.70	
North	0.9X	0.54)	15	.71	^ L	74	1.72	×	0.4	×	0.7	=	159.73	(74)

North	0.9x	0.54		x	15.	71	x	7	79.99	x	(0.4	×	0.7		=	170.99	(74)
North	0.9x	0.54		x	15.	71	x	7	74.68	x	(0.4	_ × [0.7		=	159.64	(74)
North	0.9x	0.54		x	15.	71	x	5	59.25	x	(0.4	×	0.7		=	126.66	(74)
North	0.9x	0.54		x	15.	71	x	4	11.52	x	(0.4	×	0.7		=	88.75	(74)
North	0.9x	0.54		x	15.	71	x	2	24.19	x	(0.4	×	0.7		= [51.71	(74)
North	0.9x	0.54		x	15.	71	x	1	3.12	x	(0.4	×	0.7		= [28.04	(74)
North	0.9x	0.54		x	15.	71	x		8.86	x	(0.4	×	0.7		= [18.95	(74)
West	0.9x	0.54		x	8.2	5	x	1	9.64	x	(0.4	×	0.7		= [22.05	(80)
West	0.9x	0.54		x	8.2	5	x	3	38.42	x	(0.4	×	0.7		= [43.13	(80)
West	0.9x	0.54		x	8.2	5	x	6	63.27	x	(0.4	x	0.7		=	71.03	(80)
West	0.9x	0.54		x	8.2	5	x	9	92.28	x	(0.4	×	0.7		= [103.6	(80)
West	0.9x	0.54		x	8.2	5	x	1	13.09	x	(0.4	×	0.7		= [126.96	(80)
West	0.9x	0.54		x	8.2	5	x	1	15.77	x	(0.4	×	0.7		=	129.97	(80)
West	0.9x	0.54		x	8.2	5	x	1	10.22	x	(0.4	×	0.7		= [123.74	(80)
West	0.9x	0.54		x	8.2	5	x	9	94.68	x	(0.4	x	0.7		= [106.29	(80)
West	0.9x	0.54		x	8.2	5	x	7	73.59	x	(0.4	×	0.7		= [82.62	(80)
West	0.9x	0.54		x	8.2	5	x	4	15.59	x	(0.4	x	0.7		= [51.18	(80)
West	0.9x	0.54		x	8.2	5	x	2	24.49	x		0.4	x	0.7		=	27.49	(80)
West	0.9x	0.54		x	8.2	5	x	1	6.15	x		0.4	×	0.7		- [18.13	(80)
Solar g	<mark>gain</mark> s in	watts, <mark>ca</mark>	l <mark>cu</mark> lat	ed	for eacl	n mont	th			(83)m	n = Sum	ı(74)m	. <mark>(8</mark> 2)m		_			
(83)m=	44.78	86.58	144.8	5	222.17	286.69	3 3	00.96	283.38	232	.95 1	71.37	102.89	55.54	37.	08		(83)
Total (gains – i	nternal a	nd sol	ar	(84)m =	: (73)n	ו + (ד	83)m	, watts	-	_			_	-			
(84)m=	446.9	486.63	532.2	7	589.27	633.3	4 6	27.72	597.11	552	.62 5	501.37	453.43	429.67	428	5.74		(84)
7. Me	ean inter	nal temp	eratur	e (heating	seasc	on)											
Temp	perature	during h	eating	pe	eriods ir	the liv	ving	area	from Tal	ble 9	, Th1 ((°C)					21	(85)
Utilis	ation fac	tor for ga	ains fo	or li	ving are	a, h1,	m (s	ee Ta	ble 9a)	·								
	Jan	Feb	Ma	r	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	D	ec		
(86)m=	1	1	0.99		0.95	0.85		0.66	0.49	0.5	55	0.82	0.97	0.99	1			(86)
Mear	n interna	l tempera	ature i	n li	iving are	ea T1 ((follo	ow ste	ps 3 to 7	7 in T	able 9	9c)		-				
(87)m=	20.04	20.15	20.36	;	20.65	20.88	2	20.98	21	20.	99 2	20.93	20.64	20.29	20.	02		(87)
Tem	perature	during h	eating	pe	eriods ir	rest o	of dw	velling	from Ta	able 9	9, Th2	: (°C)						
(88)m=	20.11	20.11	20.11		20.12	20.12	2	20.13	20.13	20.	14 2	20.13	20.12	20.12	20.	12		(88)
Utilis	ation fac	tor for a	ains fo	or re	est of d	velling	. h2	.m (se	ee Table	9a)	•			•	•			
(89)m=	1	0.99	0.98	T	0.94	0.81		0.58	0.39	0.4	45	0.75	0.96	0.99	1	I		(89)
Moor		l temper	aturo i	_ t	ho rost	of dwe		T2 (f	I ollow ste		to 7 i	n Table						
(90)m=	18.82	18.98	19.29		19.71	20.01		20.12	20.13	20.	13	20.07	19.7	19.2	18	.8		(90)
x/											_	fL	A = Liv	ing area ÷ (4) =	-	0.33) (91)
N4	, into	1 to me		f		ole de	ر مالاند	a) (۱۸ ۲۷	. /4	£1 A \	т о		·		L		` `
		1 temperative		ror	20.02			(g) = f	LA X 11	+ (1	- TLA)) × 12 20.36	20.01	10.56	10	2		(02)
(52)11=	1 10.22	1 10.07	13.04	· •	20.02	20.29	1 4	_0.41	1 20.42	1 20.	74 4	20.00	20.01	1 19.00	1 19	.		(02)

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

(93)m=	19.22	19.37	19.64	20.02	20.29	20.41	20.42	20.42	20.36	20.01	19.56	19.2		(93)
8. Sp	ace hea	ting requ	uirement	:										
Set T the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	mperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of	Table 9t	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	0.99	0.98	0.94	0.82	0.6	0.43	0.48	0.77	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	444.86	482.66	521.77	552.04	516.52	379.01	254.24	265.96	386.14	433.76	425.63	427.17		(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	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1029.9	996.22	902.68	754.08	581.44	387.84	255.19	267.84	420.1	636.93	847.41	1025.04		(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=	435.27	345.11	283.4	145.46	48.3	0	0	0	0	151.16	303.68	444.81		_
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	2157.19	(98)
Space	e heating	g require	ement in	kWh/m²	/year							Ī	30.31	(99)
9b. En	erav rea	uiremer	nts – Cor	nmunitv	heating	scheme)					L		7
This pa	art is use	ed for sp	ace hea	iting, spa	ace cooli	ng or wa	ater heat	ting prov	ided by	a c <mark>omm</mark>	unity sch	neme.		
Fractio	on of spa	ace heat	from se	condary/	supplen	nentary l	heating	(Table 1	1) '0' if n	one			0	(301)
Fractio	n of spa	ace heat	from co	<mark>mmu</mark> nity	system	1 - (301	1) =					[1	(302)
The com	nmunity so	heme may	y obtain he	eat from se	everal sour	ces. The p	procedure	allows for	CHP and u	up to four o	other heat	sources; th	ne latter	J
includes	boilers, h	eat pumps	s, geotherr	mal and wa	aste heat f	rom power	r stations.	See Apper	ndix C.			_		-
Fractio	on of hea	at from C	Commun	ity boiler	S								1	(303a)
Fractio	on of tota	al space	heat fro	m Comn	nunity bo	oilers				(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commu	unity hea	ting sys	tem		[1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	ommun	ity heatir	ng syste	m				[1.1	(306)
Space	heating	9											kWh/year	
Annua	I space	heating	requirem	nent									2157.19]
Space	heat fro	m Comr	nunity b	oilers					(98) x (30	04a) x (30	5) x (306) :	= [2372.91	(307a)
Efficier	ncy of se	econdary	/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)	[0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	oplemen	tary syst	tem	(98) x (30	01) x 100 -	÷ (308) =	[0	(309)
Water Annua	heating I water h	l neating r	equirem	ent								ſ	2111.9	1
lf DHW Water	/ from co heat fro	ommunit m Comn	ty schem nunity bo	ne: pilers					(64) x (30	03a) x (30	5) x (306) :	ו = [2323.09	(310a)
Electric	city used	d for hea	t distribu	ution				0.01	× [(307a).	(307e) +	· (310a)([310e)] =	46.96	(313)
Cooling	g Syster	n Energ	y Efficie	ncy Ratio	C							L [0) (314)
Space	cooling	(if there	is a fixe	d cooling	g system	n, if not e	enter 0)		= (107) ÷	(314) =		[0	(315)
Electric	city for p	oumps ai	nd fans v	within dw	velling (1	Table 4f)	:					L -		-
mecha	nical ve	ntilation	- balanc	ed, extra	act or po	sitive in	put from	outside					249.66	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b)) + (330g) =	249.66	(331)
Energy for lighting (calculated in Appendix L)			314.94	(332)
12b. CO2 Emissions – Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using t	two fuels repeat (363) to (366) for the second fue	el 96	(367a)
CO2 associated with heat source 1 [(307b)+(3	10b)] x 100 ÷ (367b) x	0	= 1056.6	(367)
Electrical energy for heat distribution [(313) x	0.52	= 24.37	(372)
Total CO2 associated with community systems (3	63)(366) + (368)(372)	:	= 1080.97	(373)
CO2 associated with space heating (secondary) (3	09) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantaneo	ous heater (312) x	0.22	= 0	(375)
Total CO2 associated with space and water heating (3	73) + (374) + (375) =		1080.97	(376)
CO2 associated with electricity for pumps and fans within dwellin	g (331)) x	0.52	= 129.58	(378)
CO2 associated with electricity for lighting (3	32))) x	0.52	= 163.45	(379)
Total CO2, kg/year sum of (376)(382) =			1374	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			19.3	(384)
El rating (section 14)			84.15	(385)

				User D	etails:						
Assessor Name: Software Name:	Stroma FSA	AP 201	2		Strom Softwa	a Num are Vei	ber: rsion:		Versic	on: 1.0.1.24	
			Р	roperty	Address	: Flat 5					
Address :											
1. Overall dwelling dimen	sions:										
				Are	a(m²)		Av. Hei	ight(m)	-	Volume(m ³)	_
Ground floor				4	2.57	(1a) x	2	2.5	(2a) =	106.42	(3a)
First floor				3	32.51	(1b) x	2	2.5	(2b) =	81.27	(3b)
Second floor				3	31.06	(1c) x	2	2.5	(2c) =	77.65	(3c)
Total floor area TFA = (1a)	+(1b)+(1c)+(1	ld)+(1e	e)+(1r	ı) <u> </u>	06.14	(4)			-		
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	265.35	(5)
2. Ventilation rate:											
	main heating	se h	econdar leating	у	other		total			m ³ per hour	
Number of chimneys	0] + [0] + [0] = [0	X ·	40 =	0	(6a)
Number of open flues	0	+	0	+	0	_ = _	0	x :	20 =	0	(6b)
Number of intermittent fans	3						0	x	10 =	0	(7a)
Number of passive vents							0	x	10 =	0	(7b)
Number of flueless gas fire	s						0	X	40 =	0	(7c)
									Air ch	nanges per hou	ır
Infiltration due to chimneys	, flu <mark>es and fa</mark>	ns = (6	a)+(6b)+(7	a)+(7b)+(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has bee	en carried out or i	is intende	ed, procee	d to (17),	otherwise o	continue fr	om (9) to (16)			
Number of storeys in the	dwelling (ns)									0	(9)
Additional infiltration								[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	5 for steel or	timber f	frame or	0.35 fo	r masoni	ry constr	ruction			0	(11)
if both types of wall are pres	sent, use the values (le corres	ponding to	the great	ter wall are	a (after					
If suspended wooden flo	or, enter 0.2 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	7(12)
If no draught lobby, ente	r 0.05. else el	nter 0		. (000.11	,	00				0	(12)
Percentage of windows	and doors dra	uaht st	ripped							0](14)
Window infiltration		0	••		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13) +	⊦ (15) =		0	(16)
Air permeability value, q	50, expressed	d in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	3	(17)
If based on air permeability	value, then	(18) = [(1	7) ÷ 20]+(8	B), otherw	ise (18) = ((16)		-		0.15	(18)
Air permeability value applies	if a pressurisatior	n test has	s been don	e or a de	gree air pe	rmeability	is being us	sed			
Number of sides sheltered										2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	[9)] =			0.85	(20)
Infiltration rate incorporation	g shelter facto	or			(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified for	monthly wind	speed	k I							1	
Jan Feb M	1ar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	
Monthly average wind spec	ed from Table	e 7					1			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 = $(22)m \div 4$									
(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		
Adjusted infiltration rate (allowing for shelter	and wind s	peed) =	(21a) x	(22a)m					
0.16 0.16 0.16 0.14 0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effective air change rate for the ap	plicable ca	se		-					
If the main call vertilation. If exhaust air heat nump using Appendix N (23b) = (23a) x Emv (e	equation (N	(5)) othe	rwise (23h) = (23a)			0.5	(23a)
If balanced with heat recovery: efficiency in % allowing	na for in-use f	actor (from	n Table 4h) =) = (200)			0.5	(230)
a) If balanced mechanical ventilation with	heat recove	⊃rv (M\/⊦	HR) (24a	/ a)m = (22	2h)m + ('	23h) 🗙 [ʻ	1 – (23c)	03.7 ∸ 1001	(200)
(24a)m= 0.34 0.34 0.34 0.32 0.32	2 0.3	0.3	0.3	0.31	0.32	0.32	0.33	. 100]	(24a)
b) If balanced mechanical ventilation with	ut heat rec	coverv (N	L /IV) (24b	m = (22)	2b)m + (2	23b)			
(24b)m= 0 0 0 0 0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or pos	itive input v	/entilatio	n from o	outside					
if (22b)m < 0.5 × (23b), then (24c) = (2	23b); otherv	vise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m= 0 0 0 0 0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house pos	itive input	ventilatio	on from I	oft					
if (22b)m = 1, then (24d)m = (22b)m o	therwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]				(244)
(24d)m= 0 0 0 0 0 0	0				0	0	0		(24u)
Effective air change rate - enter (24a) or (2	24b) or (240	c) or (24		(25)	0.22	0.22	0.22		(25)
(25)11= 0.54 0.54 0.54 0.52 0.52	0.3	0.3	0.5	0.51	0.32	0.32	0.33		(23)
3. Heat losses and heat loss parameter:									
ELEMENT Gross Openings area (m ²) m ²	Net Ar A .r	ea n²	U-val W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²·ł	↔ <	A X k kJ/K
Doors	2.1	X	2		4.2	<i>,</i>			(26)
Windows Type 1	6.21	x1/	/[1/(0.8)+	0.04] =	4.81				(27)
Windows Type 2	9.55	x1/	/[1/(0.8)+	0.04] =	7.4				(27)
Windows Type 3	9.82	x1/	/[1/(0.8)+	0.04] =	7.61				(27)
Windows Type 4	5.77		/[1/(0.8)+	0.04] =	4.47				(27)
Windows Type 5	9.55		/[1/(0.8)+	0.04] =	7.4	=			(27)
Windows Type 6	6.5		/[1/(0.8)+	0.04] =	5.04	=			(27)
Windows Type 7	5.24		/[1/(0.8)+	0.04] =	4.06	=			(27)
Windows Type 8	5.57		/[1/(0.8)+	0.04] =	4.32				(27)
Windows Type 9	4 07		/[1/(0.8)+	0.04] =	3 16	=			(27)
Windows Type 10	5.62		/[1/(0.8)+	0.04] =	4.36				(27)
Walls Type1 40.22 25.58	14.64	x	0.13	= [1.9	Ξ r			(29)
Walls Type2 39 17 21 82	17.35		0.13		2.26			4 6	(29)
Walls Type3 39 17 20 5	18.67		0.13		2.20	╡┟		\exists	(29)
Roof 31.06 0	31 06		0.13		2.70	╡┟			(30)
Total area of elements. m ²	151 7	^	0.12	[0.70	L			(31)
Devit all			0		0				(22)
Party wall	631	X			0			1 1	1021

* for wir ** includ	ndows and le the area	roof wind as on both	ows, use e sides of ir	ffective wi	ndow U-va Is and part	alue calcul titions	lated using	formula 1.	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				67.15	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	• = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For des can be i	ign assess used instea	ments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	K						11.1	(36)
if details	s of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)								_
Total f	abric he	at loss							(33) +	(36) =			78.25	(37)
Ventila	ation hea	t loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	30.13	29.85	29.57	28.17	27.9	26.5	26.5	26.22	27.06	27.9	28.45	29.01		(38)
Heat t	ransfer c	oefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	108.38	108.1	107.82	106.42	106.14	104.75	104.75	104.47	105.31	106.14	106.7	107.26		
							1			Average =	Sum(39)1.	12 /12=	106.35	(39)
Heat lo	oss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.02	1.02	1.02	1	1	0.99	0.99	0.98	0.99	1	1.01	1.01		_
	<u> </u>		() (T)							Average =	Sum(40)1	12 /12=	1	(40)
Numb	er of day	's in moi	nth (Tab	le 1a)					-			_	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ene	rgy <mark>requ</mark>	irement:								kWh/y	ear:	
Accur		nancy	м											(40)
if TF	A > 13.9 A $A = 13.9$), N = 1), N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0	00 <mark>13 x (</mark>	TFA -13.	9)	79		(42)
Annua	l averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.74		(43)
Reduce	the annua	l average	hot water	usage by a	5% if the a	lwelling is	designed t	to achieve	a water us	se target o	f			
not mor	e that 125	litres per	oerson per I	aay (all w	ater use, r	not and co I	1 1			r			I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage II	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	i able 1c x	(43)					1	
(44)m=	116.31	112.08	107.85	103.62	99.39	95.17	95.17	99.39	103.62	107.85	112.08	116.31		_
Enoral	contont of	hot wator	used cal	culated m	opthly - 1	100 v Vd r	т v nm v Г)Tm / 2600	kW/b/mor	Total = Su	m(44) ₁₁₂ =	= 0.1d)	1268.87	(44)
Energy		not water	useu - cai		5770779 = 4.	190 x vu,i						<i>c, 1u)</i>	I	
(45)m=	172.49	150.86	155.67	135.72	130.23	112.38	104.13	119.49	120.92	140.92	153.83	167.05		-
lf instan	taneous w	ater heati	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1663.69	(45)
(46)m=	25.87	22.63	23.35	20.36	19.53	16.86	15.62	17.92	18.14	21.14	23.07	25.06		(46)
Water	storage	loss:					-							
Storag	je volum	e (litres)) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	ind no ta	nk in dw	velling, e	nter 110) litres in	(47)	`	(0) -	(-)			
Other	vise it no	stored	not wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
a) If m	sionage	urer'e di	eclared I	oss facto	ar is kno	wn (k\//	n/dav).					0	l	(48)
Tomo	andiaol	actor fro	m Toble	255 18010 26		**** (12.841	"uuy).					0		(40)
rembe	siature la		in rable	20								υ		(49)

Energy b) If m Hot wa	y lost fro nanufact ater stor	m water urer's de age loss	r storage eclared o factor fr	, kWh/ye cylinder l com Tabl	ear oss fact e 2 (kWl	or is not h/litre/da	known: ay)	(48) x (49) =		1	10 02		(50) (51)
lf com Volum	munity h	eating s from Ta	see secti ble 2a	on 4.3	- (<i>.</i> ,					03		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)
Enera	v lost fro	m water	r storage	. kWh/ve	ear			(47) x (51) x (52) x (53) =	1	03		(54)
Enter	(50) or ((54) in (5	55)	, <i>,</i> , .					, (- , (/	1.	03		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m =	32.01	28.92	32.01	30.98	32 01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain:	s dedicate	d solar sto	rage, (57)r	n = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	ix H	()
(57)m-	22.01	28.02	22.01	20.08	32.01	20.08	22.01	22.01	20.08	22.01	20.09	22.01		(57)
(57)11=	32.01	20.92	32.01	30.96	32.01	30.90	32.01	32.01	30.96	32.01	30.96	32.01		(37)
Prima	ry circuit	loss (ar	nnual) fro	om Table	93		()					0		(58)
Primai	ry circuit	loss cal	Iculated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m	r tharma	atat)			
(110												22.26		(50)
(59)m=	23.20	21.01	23.26	22.51	23.20	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(39)
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)
Tota <mark>l h</mark>	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45) <mark>m +</mark>	(46)m +	(57)m +	(59)m + (61)	m
(62)m=	227.77	200.79	210.95	189.21	185.5	165.87	159.41	174.77	174.41	196.2	207.32	222.32		(62)
Solar D	HW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add a	ddi <mark>tiona</mark>	l lines <mark>if</mark>	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)
Outpu	t from w	ater hea	iter					-						
(64)m=	227.77	200.79	210.95	189.21	185.5	165.87	159.41	174.77	174.41	196.2	207.32	222.32		
								Out	out from wa	ater heate	r (annual)₁	12	2314.53	(64)
Heat o	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	
(65)m=	101.57	90.1	95.98	87.92	87.52	80.16	78.85	83.95	83	91.08	93.94	99.76	-	(65)
inclu	L Ide (57)	n in calo	L Culation (L of (65)m	only if c	ı vlinder i	s in the o	l dwelling	or hot w	ı ater is fr	i om com	munity h	eating	
5 In	ternal as	nine (soc	Table 5	and 5a	·	ymraer i		unoning	or not n		on con	in an incy in	ouung	
5 . III		/ T		, and 5a										
Metab	olic gain	Eob	<u>5), vvat</u>		May	lup		Δυσ	Son	Oct	Nov	Dec		
(66)m -	130 / 8	130.48	130.48	130.48	130 / 8	130 / 8	139.48	130.48	130.48	139.48	139.48	130.48		(66)
	100.40	(aalaula			100.40		r L Oc) - c			100.40	100.40	100.40		(00)
Lightin	ig gains		ted in Ap		L, equat		r L9a), a L			40.50	00.05			(67)
(67)m=	23.7	21.05	17.12	12.96	9.69	8.18	8.84	11.49	15.42	19.58	22.85	24.36		(07)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also r	see Ta	ble 5		· · · · · ·		()
(68)m=	265.89	268.65	261.7	246.89	228.21	210.65	198.92	196.16	203.11	217.91	236.6	254.16		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95		(69)
Pumps	s and fa	ns gains	(Table 5	ōa)		_								
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58		(71)
							•		•	•	•			

Water	heating	g gains (T	able 5))															
(72)m=	136.52	134.08	129.01		122.11	117.64	1	11.33	105.98	112	.84	115.28	122.4	2 13	0.48	134.09	9		(72)
Total	interna	l gains =						(66)	m + (67)m	n <mark>+ (6</mark> 8	3)m +	(69)m + (70)m +	(71)m	+ (72)r	n			
(73)m=	490.96	488.63	472.67	,	446.81	420.38	3	95.01	378.57	385	.33	398.65	424.7	5 45	4.77	477.46	6		(73)
6. Sc	lar gain	is:																	
Solar	gains are	calculated u	using so	lar	flux from Ta	able 6a	and	assoc	iated equa	tions	to con	vert to th	e appli	cable or	rientati	on.			
Orient	ation:	Access F	actor		Area m ²			Flu Tal	X Ne 6a		Та	g_ ble 6b] Table	FF			Gains	
										1			_		, 00		г	(**)	-
East	0.9x	1		x	6.21		X		9.64	X		0.4	×	<u> </u>	0.7	=	ľ	16.6	(76)
East	0.9x	1		x	9.82		X	1	9.64	X		0.4	×		0.7	=	Ľ	26.25	
East	0.9x	1		x	6.5		X	1	9.64	X		0.4	×		0.7	=	Ľ	17.37	
East	0.9x	1		X	5.62		X	1	9.64	X		0.4	×		0.7	=	Ľ	15.02	(76)
East	0.9x	1		×	6.21		X	3	8.42			0.4	╡ [×]		0.7	=	Ľ	32.47	
East	0.9x	1		x	9.82		X	3	8.42	X		0.4	×		0.7	=	Ľ	51.34	
East	0.9x	1		×	6.5		x	3	8.42	X		0.4			0.7	=	Ľ	33.98	
East	0.9x	1	_	x	5.62		x		8.42	×		0.4			0.7		Ľ	29.38	
East	0.9x			x	6.21		X	6	3.27	X		0.4		<u> </u>	0.7	_ ⁼		53.47	
East	0.9x	1		x	9.82		X	6	3.27	x		0.4			0.7		ļ	84.55	$ \begin{bmatrix} (76) \\ (76) \end{bmatrix} $
East	0.9x	1		×	6.5		Х	6	3.27	X		0.4		<u> </u>	0.7	=	Ľ	55.97	
East	0.9x	1		×	5.62		X	6	53.27	X		0.4			0.7		Ľ	48.39	
East	0.9x	1		×	6.21		X	g	2.28	X		0.4		<u> </u>	0.7	=	Ľ	77.98	
East	0.9x	1	4	×	9.82		x	9	2.28	X		0.4		<u>-</u>	0.7	=	Ľ	123.31	
East	0.9x	1		×	6.5		X	9	2.28	X		0.4	X	<u> </u>	0.7	=	Ľ	81.62	
Fast	0.9x	1		x	5.62		x		12.28			0.4	╡ ゚		0.7	=	Ľ	70.57	
Fast	0.9x	1		×	6.21		×		13.09			0.4	╡ Û		0.7		Ľ	95.57	
Fast	0.9x	1		x	9.82		x		13.09			0.4			0.7		Ľ	151.13	(70)
Fast	0.9X	1		×	6.5		×	1	13.09	× v		0.4			0.7			100.03	(70)
Fast	0.9X	1		`	5.62		~		13.09			0.4	╡ Û		0.7	=	Ľ	07.92	$ ^{(70)} ^{(70)} $
Fast	0.9X			`	0.21		~		10.77			0.4	╡Ĵ		0.7	=	Ľ	97.03	
Fast	0.3	1	-	`	9.82		Ŷ		15.77			0.4	╡ Û	<u> </u>	0.7	=	: L . T	102.4	(70)
Fast	0.3	1	-	`	5.62		Ŷ		15.77			0.4	╡ Û	<u> </u>	0.7	=	с L . Г	99.54	$\Box_{(76)}^{(70)}$
East	0.04	1		^	6.02		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	02.14	(70)
Fast	0.04	1	=	• •	0.21		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	147.20	(70)
East	0.04	1	:	^ •	9.02		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	07.40	(70)
East	0.3	1	:	`	5.62		Ŷ		10.22			0.4	╡Ĵ		0.7	=	: L . F	97.49	(70)
East	0.30			• •	6.04	\dashv	Ŷ		10.22			0.4	╡ Û		0.7	\dashv	Ĺ	04.29 20.01	$ \Box_{(76)}^{(70)} $
East	0.98			^ ↓	0.21		×		4.00	^ _		0.4	╡ Û		0.7	=	L T	126.52	$\Box_{(76)}^{(70)}$
East	0.98			^ ↓	9.82	=	×		4.00	^ v		0.4	╡ Û	<u> </u>	0.7	\dashv	L	120.02	$\Box_{(76)}^{(70)}$
East	0.97	1		r x	5.62		Ŷ		4.68			0.4	╡ Û		0.7	\dashv	L I	72 /1	$\Box_{(76)}^{(70)}$
	0.07				J.02		~	ı ö		~		UT	· ^	1	J.1			12.71	1,1.97

East	0.9x	1	x	6.21	×	73.59	x	0.4	x	0.7] =	62.19	(76)
East	0.9x	1	x	9.82	x	73.59	x	0.4	x	0.7	=	98.34	(76)
East	0.9x	1	x	6.5	x	73.59	x	0.4	x	0.7	=	65.09	(76)
East	0.9x	1	x	5.62	x	73.59	x	0.4	x	0.7	=	56.28	(76)
East	0.9x	1	x	6.21	x	45.59	x	0.4	x	0.7	=	38.53	(76)
East	0.9x	1	x	9.82	x	45.59	x	0.4	x	0.7	=	60.92	(76)
East	0.9x	1	x	6.5	x	45.59	x	0.4	x	0.7	=	40.32	(76)
East	0.9x	1	x	5.62	x	45.59	x	0.4	x	0.7	=	34.87	(76)
East	0.9x	1	x	6.21	x	24.49	x	0.4	x	0.7	=	20.69	(76)
East	0.9x	1	x	9.82	x	24.49	x	0.4	x	0.7	=	32.72	(76)
East	0.9x	1	x	6.5	x	24.49	x	0.4	x	0.7	=	21.66	(76)
East	0.9x	1	x	5.62	x	24.49	x	0.4	x	0.7	=	18.73	(76)
East	0.9x	1	x	6.21	x	16.15	x	0.4	x	0.7	=	13.65	(76)
East	0.9x	1	x	9.82	x	16.15	x	0.4	x	0.7	=	21.58	(76)
East	0.9x	1	x	6.5	x	16.15	x	0.4	x	0.7	=	14.29	(76)
East	0.9x	1	x	5.62	x	16.15	x	0.4	x	0.7	=	12.35	(76)
South	0.9x	0.54	x	9.55	x	46.75	x	0.4	x	0.7	=	60.76	(78)
South	0.9x	0.54	x	9.55	×	46.75	x	0.4	х	0.7] =	60.76	(78)
South	0.9x	0.54	x	5.57	x	46.75	x	0.4	x	0.7] =	35.44	(78)
South	0.9x	0.54	x	4.07	х	46.75] ×	0.4	x	0.7] =	25.89	(78)
South	0.9x	0.54	x	9.55	x	76.57	x	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	x	9.55	×	76.57	x	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	x	5.57	x	76.57	x	0.4	x	0.7	=	58.04	(78)
South	0.9x	0.54	x	4.07	x	76.57	x	0.4	x	0.7	=	42.41	(78)
South	0.9x	0.54	x	9.55	x	97.53	x	0.4	x	0.7	=	126.75	(78)
South	0.9x	0.54	x	9.55	x	97.53	x	0.4	x	0.7	=	126.75	(78)
South	0.9x	0.54	x	5.57	x	97.53	x	0.4	x	0.7	=	73.93	(78)
South	0.9x	0.54	x	4.07	x	97.53	x	0.4	x	0.7	=	54.02	(78)
South	0.9x	0.54	x	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	x	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	x	5.57	x	110.23	x	0.4	x	0.7	=	83.55	(78)
South	0.9x	0.54	x	4.07	x	110.23	x	0.4	x	0.7	=	61.05	(78)
South	0.9x	0.54	x	9.55	x	114.87	x	0.4	x	0.7	=	149.28	(78)
South	0.9x	0.54	x	9.55	x	114.87	x	0.4	x	0.7	=	149.28	(78)
South	0.9x	0.54	x	5.57	x	114.87	x	0.4	x	0.7	=	87.07	(78)
South	0.9x	0.54	x	4.07	x	114.87	x	0.4	x	0.7	=	63.62	(78)
South	0.9x	0.54	×	9.55	x	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	x	9.55	×	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	×	5.57	×	110.55	x	0.4	x	0.7] =	83.79	(78)
South	0.9x	0.54	×	4.07	×	110.55	×	0.4	x	0.7	=	61.23	(78)
South	0.9x	0.54	×	9.55	x	108.01	x	0.4	x	0.7	=	140.37	(78)

South	0.9x	0.54	×	9.55	×	108.01	×	0.4	x	0.7	=	140.37	(78)
South	0.9x	0.54	×	5.57	x	108.01	x	0.4	x	0.7] =	81.87	(78)
South	0.9x	0.54	x	4.07	x	108.01	x	0.4	x	0.7	=	59.82	(78)
South	0.9x	0.54	x	9.55	x	104.89	x	0.4	x	0.7	=	136.32	(78)
South	0.9x	0.54	x	9.55	x	104.89	x	0.4	x	0.7	=	136.32	(78)
South	0.9x	0.54	x	5.57	x	104.89	x	0.4	x	0.7	=	79.51	(78)
South	0.9x	0.54	×	4.07	×	104.89	x	0.4	x	0.7] =	58.1	(78)
South	0.9x	0.54	×	9.55	x	101.89	x	0.4	x	0.7	=	132.41	(78)
South	0.9x	0.54	x	9.55	x	101.89	x	0.4	x	0.7	=	132.41	(78)
South	0.9x	0.54	x	5.57	x	101.89	x	0.4	x	0.7	=	77.23	(78)
South	0.9x	0.54	x	4.07	x	101.89	x	0.4	x	0.7	=	56.43	(78)
South	0.9x	0.54	x	9.55	x	82.59	x	0.4	x	0.7	=	107.33	(78)
South	0.9x	0.54	x	9.55	x	82.59	x	0.4	x	0.7	=	107.33	(78)
South	0.9x	0.54	x	5.57	x	82.59	x	0.4	x	0.7	=	62.6	(78)
South	0.9x	0.54	x	4.07	x	82.59	x	0.4	x	0.7	=	45.74	(78)
South	0.9x	0.54	x	9.55	×	55.42	x	0.4	x	0.7	=	72.02	(78)
South	0.9x	0.54	x	9.55	x	55.42	x	0.4	x	0.7	=	72.02	(78)
South	0.9x	0.54	x	5.57	X	55.42	x	0.4	х	0.7] =	42	(78)
South	0.9x	0.54	x	4.07	x	55.42	x	0.4	х	0.7	=	30.69	(78)
South	0.9x	0.54	x	9.55	x	40.4) ×	0.4	x	0.7	=	52.5	(78)
South	0.9x	0.5 <mark>4</mark>	x	9.55	x	40.4	x	0.4	x	0.7	=	52.5	(78)
South	0.9x	0. <mark>5</mark> 4	x	5.57	×	40.4	x	0.4	x	0.7	=	30.62	(78)
South	0.9x	0.54	x	4.07	x	40.4	×	0.4	x	0.7	=	22.37	(78)
West	0.9x	0.54	x	5.77	x	19.64	x	0.4	x	0.7	=	15.42	(80)
West	0.9x	0.54	x	5.24	x	19.64	x	0.4	x	0.7	=	14	(80)
West	0.9x	0.54	x	5.77	x	38.42	x	0.4	x	0.7	=	30.17	(80)
West	0.9x	0.54	x	5.24	x	38.42	x	0.4	x	0.7	=	27.4	(80)
West	0.9x	0.54	x	5.77	x	63.27	x	0.4	x	0.7	=	49.68	(80)
West	0.9x	0.54	x	5.24	x	63.27	x	0.4	x	0.7	=	45.12	(80)
West	0.9x	0.54	x	5.77	x	92.28	x	0.4	x	0.7	=	72.46	(80)
West	0.9x	0.54	x	5.24	x	92.28	x	0.4	x	0.7	=	65.8	(80)
West	0.9x	0.54	x	5.77	x	113.09	x	0.4	x	0.7	=	88.8	(80)
West	0.9x	0.54	x	5.24	x	113.09	x	0.4	x	0.7	=	80.64	(80)
West	0.9x	0.54	x	5.77	x	115.77	x	0.4	x	0.7	=	90.9	(80)
West	0.9x	0.54	x	5.24	x	115.77	x	0.4	x	0.7	=	82.55	(80)
West	0.9x	0.54	x	5.77	x	110.22	x	0.4	x	0.7] =	86.54	(80)
West	0.9x	0.54	×	5.24	×	110.22	×	0.4	×	0.7] =	78.59	(80)
West	0.9x	0.54	x	5.77	x	94.68	x	0.4	x	0.7] =	74.34	(80)
West	0.9x	0.54	x	5.24	×	94.68	x	0.4	x	0.7	=	67.51	(80)
West	0.9x	0.54	x	5.77	×	73.59	x	0.4	x	0.7	=	57.78	(80)
West	0.9x	0.54	x	5.24	×	73.59	x	0.4	x	0.7	=	52.47	(80)

West	0.9x	0.54	x	5.7	7	x	4	5.59	x		0.4	x	0.7		=	35.8	(80)
West	0.9x	0.54	x	5.2	24	x	4	5.59	x		0.4	x	0.7		=	32.51	(80)
West	0.9x	0.54	x	5.7	7	x	2	4.49	x		0.4	x	0.7		=	19.23	(80)
West	0.9x	0.54	x	5.2	24	x	2	4.49	x		0.4	x	0.7		=	17.46	(80)
West	0.9x	0.54	×	5.7	7	x	1	6.15	x		0.4	×	0.7		=	12.68	(80)
West	0.9x	0.54	x	5.2	24	x	1	6.15	x		0.4	x	0.7		=	11.52	(80)
	L												L				
Solar g	gains in	watts, ca	alculate	d for eac	h month	1			(83)m	ι = Sι	um(74)m .	(82)m					
(83)m=	287.51	504.19	718.62	922.87	1051.91	10	49.27	1009.77	914	.75	790.62	565.9	3 347.23	244	4.06		(83)
Total g	jains – i	nternal a	nd sola	r (84)m =	= (73)m	+ (8	33)m	, watts									
(84)m=	778.47	992.82	1191.29	1369.68	1472.29	14	44.28	1388.34	1300	0.08	1189.27	990.6	8 802	72′	1.52		(84)
7. Me	an inter	rnal temp	perature	(heating	seasor	າ)											
Temp	erature	during h	eating p	periods in	n the livi	ng	area f	from Tab	ole 9,	Th	1 (°C)					21	(85)
Utilisa	ation fac	ctor for g	ains for	living are	ea, h1,m	า (s	ее Та	ble 9a)			` ,						
	Jan	Feb	Mar	Apr	May	È	Jun	Jul	A	ug	Sep	Oc	t Nov)ec		
(86)m=	0.99	0.98	0.94	0.82	0.65	(0.46	0.33	0.3	57	0.6	0.89	0.99		1		(86)
Mean		l temper	ature in	living ar		مالم	w ste	ns 3 to 7	7 in T	able	a 9c)			-			
(87)m=	20.06	20.3	20.59	20.85	20.97		21	21	2		20.98	20.8	20.37	20	.02		(87)
-		1 1 1 1				1					20.00						
l emp			eating p		n rest of	dw T	elling	from la	able 9), Ir ⊿ I	n2 (°C)		00.00		07		(00)
(88)m=	20.07	20.07	20.07	20.08	20.08		0.09	20.09	20.		20.09	20.08	20.08	20	.07		(00)
Utilisa	ation fac	ctor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)			_	_	-			
(89)m=	0.99	0.97	0.92	0.78	0.59		0.4	0.26	0.3	3	0.52	0.86	0.98		1		(89)
Me <mark>ar</mark>	interna	l temper	ature in	the rest	of dwell	ing	T2 (fo	ollow ste	eps 3	to 7	in Tabl	e 9 <mark>c)</mark>					
(90)m=	18.82	19.18	19.58	19. <mark>9</mark> 3	20.05	2	0.09	20.09	20.	.1	20.08	1 <mark>9.87</mark>	19.28	18	.77		(90)
											f	LA = Li	ving area ÷	(4) =		0.19	(91)
Mear	interna	l temper	ature (fo	or the wh	ole dwe	ellin	a) = fl	_A × T1	+ (1	– fL	A) × T2						
(92)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.2	27	, 20.25	20.05	5 19.49	1	9		(92)
Apply	v adjustr	nent to t	he meai	n interna	tempei	ratu	re fro	m Table	4e, '	whe	re appro	opriate		<u> </u>			
(93)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.2	27	20.25	20.05	5 19.49	1	9		(93)
8. Sp	ace hea	ating requ	uiremen	t													
Set T	i to the	mean int	ernal te	mperatu	re obtaiı	ned	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m	=(76)m ar	nd re	-calc	ulate	
the ut	tilisation	factor fo	or gains	using Ta	ble 9a	–			<u> </u>		-	_		1			
1.1012	Jan	Feb	Mar	Apr	Мау		Jun	Jul	Αι	ug	Sep	Oc	Nov)ec		
Utilisa		$\frac{1}{1}$	ains, nn	1: 1 0 79	0.6		1 <i>4</i> 1	0.28	0.2	1	0.54	0.95	0.08		00		(94)
		bmGm	$\frac{0.91}{10}$	$\frac{0.70}{4}$ m x (8	1)m		J.4 I	0.20	0.5	, ,	0.54	0.85	0.98	0.	99		(54)
(95)m=	770.97	962 29	1088.39	1074 27	881 78	5	91 12	383 92	403	79	638.2	846.3	7 782 11	716	67		(95)
Mont	L	age exte	rnal ten	1	from T	abl	e 8	000.02			000.Z	0.0.0	1				()
(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	nal tempo	erature.	Lm	, W =	L =[(39)m :	и х [(93	 3)m-	– (96)m	1		-			
(97)m=	1599.67	1566.47	1431.35	1192.18	905.28	5	, 93.34	384.11	404	.14	647.8	1002.9	93 1321.96	158	37.9		(97)
Spac	e heatin	ig require	ement fo	or each n	nonth, k	Wh	/mont	h = 0.02	<u>-</u> 24 x [(97)	m – (95)m] x	(41)m			I	
(98)m=	616.55	406.01	255.16	84.89	17.48		0	0	0		0	116.4	9 388.69	648	3.19		
						_							-				

	Total per year (kWh/y	ear) = Sum(98) _{15,912}	= 2533.47	(98)
Space heating requirement in kWh/m²/year			23.87	(99)
9b. Energy requirements – Community heating scheme				
This part is used for space heating, space cooling or wa	ter heating provided by a com	munity scheme.	0	(301)
Fraction of space heat from community supplementary in			0	
The community system $T = (30)^{-1}$) =	ur other heat acurace	the letter	(302)
includes boilers, heat pumps, geothermal and waste heat from power Fraction of heat from Community boilers	stations. See Appendix C.	ur other neat sources		(303a)
Fraction of total space heat from Community boilers		(302) x (303a) =	1	(304a)
Factor for control and charging method (Table $4c(3)$) for	community heating system		1	(305)
Distribution loss factor (Table 12c) for community heatin	a system		1.1	(306)
Space heating			kWh/ve	`´´
Annual space heating requirement			2533.47	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2786.81	(307a)
Efficiency of secondary/supplementary heating system i	n % (from Table 4a or Append	dix E)	0	(308
Space heating requirement from secondary/supplement	ary system (98) x (301) x 10	00 ÷ (308) =	0	(309)
Water heating				
Annual water heating requirement			2314.53	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2545.98	(310a)
Electricity used for heat distribution	0.01 × [(307a)(307e)	e) + (310a)(310e)] =	53.33	(313)
Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not e	nter 0) = (107) ÷ (314) =	=	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):				
mechanical ventilation - balanced, extract or positive inp	out from outside		267.07	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	267.07	(331)
Energy for lighting (calculated in Appendix L)			418.62	(332)
12b. CO2 Emissions – Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	r Emissions kg CO2/yea	r
CO2 from other sources of space and water heating (no Efficiency of heat source 1 (%)	t CHP) CHP using two fuels repeat (363) to (366) for the second fu	Jel 96	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0	= 1199.88	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 27.68	(372)
Total CO2 associated with community systems	(363)(366) + (368)(372)		= 1227.56	(373)
CO2 associated with space heating (secondary)	(309) x	0	= 0	(374)

CO2 associated with water from immer	intaneous heater (312) x	0.22	=	0	(375)	
Total CO2 associated with space and v	vater heating	(373) + (374) + (375) =			1227.56	(376)
CO2 associated with electricity for pum	ps and fans within	dwelling (331)) x	0.52	=	138.61	(378)
CO2 associated with electricity for light	ing	(332))) x	0.52	=	217.27	(379)
Total CO2, kg/year	sum of (376)(382) =	=			1583.43	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.92	(384)
El rating (section 14)					85.96	(385)



BRUKL Output Document

Compliance with England Building Regulations Part L 2013

Project name

Retail Lean

Date: Wed Jul 20 07:11:53 2016

Administrative information

Building Details

Address: Retail Unit, 317 Finchley Road, London, NW3 6EP

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3.3

BRUKL compliance check version: v5.2.d.2

Owner Details Name:

Telephone number: Address: , ,

Certifier details Name: Audley Franklin Telephone number: Address: MLM, ,

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	38.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	38.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	34.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.13	0.13	External Wall
Floor	0.25	-	-	No floors in project
Roof	0.25	-	-	No roofs in project
Windows***, roof windows, and rooflights	2.2	1.4	1.4	New Window
Personnel doors	2.2	1.39	1.39	Sliding Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
Lighting area-weighted average Lightles M	$l/(m^2 K)$			

 $U_{a-\text{Limit}} = \text{Limiting area-weighted average U-values [W/(m⁻K)]}$ $U_{a-\text{Calc}} = \text{Calculated area-weighted average U-values [W/(m²K)]}$

Ui-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	7

As designed

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- New HVAC System (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR	efficiency			
This system	0.91	2.6	-	-	0.7				
Standard value	Standard value 0.91* 2.6 N/A N/A N/A								
Automatic moni	Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES								
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.									

1- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]				
This building	1	0				
Standard value 0.9* N/A						
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.						

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
A1A2_Sales 1	-	85	30	894
A1A2_Sales 2	-	85	30	1220
A1A2_Sales 3	-	85	30	390

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
A1A2_Sales 1	NO (-33%)	NO
A1A2_Sales 2	NO (-84%)	NO
A1A2_Sales 3	NO (-99%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?		
Is evidence of such assessment available as a separate submission?		
Are any such measures included in the proposed design?		

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional	% A
Area [m ²]	236	236	100
External area [m ²]	165	165	-
Weather	LON	LON	71
Infiltration [m ³ /hm ² @ 50Pa]	7	5	
Average conductance [W/K]	89	130	74 N
Average U-value [W/m ² K]	0.54	0.78	
Alpha value* [%]	8.81	8.81	_

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.4	1.57
Cooling	17.44	17.4
Auxiliary	8.47	4.15
Lighting	39.01	52.35
Hot water	1.61	1.86
Equipment*	20.26	20.26
TOTAL**	67.93	77.33

* Energy used by equipment does not count towards the total for calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	176.44	242.28
Primary energy* [kWh/m ²]	203.94	225.15
Total emissions [kg/m ²]	34.5	38.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services	
A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways	
B1 Offices and Workshop businesses	
B2 to B7 General Industrial and Special Industrial Groups	
B8 Storage or Distribution	
C1 Hotels	
C2 Residential Inst.: Hospitals and Care Homes	
C2 Residential Inst.: Residential schools	
C2 Residential Inst.: Universities and colleges	
C2A Secure Residential Inst.	
Residential spaces	
D1 Non-residential Inst.: Community/Day Centre	
D1 Non-residential Inst.: Libraries, Museums, and Galleries	
D1 Non-residential Inst.: Education	
D1 Non-residential Inst.: Primary Health Care Building	
D1 Non-residential Inst.: Crown and County Courts	
D2 General Assembly and Leisure, Night Clubs and Theatres	
Others: Passenger terminals	
Others: Emergency services	
Others: Miscellaneous 24hr activities	
Others: Car Parks 24 hrs	
Others - Stand alone utility block	

ŀ	IVAC Sys	tems Per	formanc	е						
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[\$1] Split or m	ulti-split sy	stem, [HS]	LTHW boile	er, [HFT] Na	tural Gas, [CFT] Electr	icity		
	Actual	4.5	171.9	1.4	18.4	8.9	0.86	2.6	0.91	2.6
	Notional	4.9	237.4	1.7	18.3	4.4	0.82	3.6		And the second s

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*	
Wall	0.23	0.13	External Wall	
Floor	0.2	-	No floors in project	
Roof	0.15	-	No roofs in project	
Windows, roof windows, and rooflights	1.5	1.4	New Window	
Personnel doors	1.5	1.39	Sliding Door	
Vehicle access & similar large doors	1.5	-	No vehicle doors in project	
High usage entrance doors 1.5 - No high usage e			No high usage entrance doors in project	
U _{FTyp} = Typical individual element U-values [W/(m ² K)] U _{FMin} = Minimum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the minimum U-value occurs.				

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Appendix C - Step Three – 'Clean' Output Document and Energy Report Figures
				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	2		Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.1.24	
			Р	roperty <i>i</i>	Address	flat 1					
Address :											
1. Overall dwelling dime	nsions:			Aro	o(m ²)			iaht(m)		Volumo(m ³)	
Ground floor					a(III-) 57.7	(1a) x		1911(11) 25	(2a) =	144 25](3a)
First floor					5.67	(1b) x](2b) -	444.47](3b)
	-) · (4 -) · (4 -) ·	(1 -1) + (1 -)	. (4	4 ب	·0.07	(10) X	2		(20) -	114.17	
10tal floor area IFA = (13)	a)+(1D)+(1C)+	(1d)+(1e))+(1r	1) 1(03.37	(4)					_
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	258.42	(5)
2. Ventilation rate:	_									<u>, ,</u>	
	main heating	se h	condar eating	у	other		total			m ³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0	+	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns					- F	0	x 1	10 =	0	(7a)
Number of passive vents							0	x 1	10 =	0	(7b)
Number of flueless gas fi	res					Ē	0	x 4	40 =	0](7c)
Infiltration due to obimpo	in fluor and f) . (6b) . (7	(2) (7b) (7)	70) -		_				" "~~
If a pressurisation test has b	een carried out o	r is intended	d. procee	d to (17).	otherwise o	continue fre	0 om (9) to (16)	÷ (5) =	0	(8)
Number of storeys in th	ne dw <mark>elling</mark> (na	5)					- (-) - (-/		0	(9)
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	.25 for steel o	r timber f	rame or	0.35 foi	r masonr	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openir	resent, use the va nas): if equal user	lue corresp 0.35	oonding to	the great	er wall are	a (after					
If suspended wooden f	loor, enter 0.2	(unseale	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else	enter 0								0	(13)
Percentage of windows	s and doors dr	aught str	ripped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				_	(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cubi	ic metre	s per ho	our per so	quare m	etre of e	nvelope	area	3	(17)
IT Dased on air permeabili Air permeability value applie	ity value, then	(10) = [(17)	been don	o, onerwi	se (10) = (rmeahility	is haina us	ad		0.15	(18)
Number of sides sheltere	d	511 1031 1103	been don			Theability	is being ut	500		3](19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wir	nd speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tab	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	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 infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcula	ate effec	ctive air	change i	rate for t	he appli	cable ca	se	-				-		
IT ME				andia NL (O	0h) (00-	·) · · · · · · / ·	······································			(00-)			0.5	(23a)
If exh	aust air ne	eat pump	using Appe	enaix IN, (2	3D) = (238	a) × Fmv (e		v5)), otne	rwise (23b) = (23a)			0.5	(23b)
	inced with	n neat reco	overy: effic	iency in %	allowing f	or in-use to	actor (from $(N/N)/L$		$) = (2)^{2}$	2b)m i (ʻ	22h) v [1	1 (22c)	77.3	5 (23c)
a) 11 (24a)m-	0.26	0.26		0.24	0.24			0.22		0.24	0.24	0.25	- 100j	(24a)
(2-14)/11- b) If	bolonoo	d moob		ntilation	without	boot roc		1)/) (24h	1 = 0.20		0.24 02h)	0.20	l	(,)
(24b)m	Dalance				without			1 v) (240 0	D = (22)	20)III + (2	230)		1	(24b)
(240)m=	0	0					0	0		0	0	0		(240)
c) If v	whole h	ouse ex	tract ven	itilation o	or positiv	e input v	ventilatio	on from ($22k$		E v (22h)			
(240)m	0	1< 0.5 >) = (23L			c) = (22)	$\frac{1}{1}$	5 × (230)		1	(24c)
(240)11=	0				0					0	0	0	l	(240)
a) ir i	naturai f (22b)n	ventilation = 1 th	on or wn en (24d)	ole nous $m = (22h)$	e positiv	ve input v erwise (2	(4d)m = 0	on from 1 0 5 + [(2	0ft 2b)m ² x	0.51				
(24d)m=	0	0				0				0.0]	0	0		(24d)
Effec	tive air	change	rate - er	ter (24a) or (24h	(24)	c) or (24	d) in hor	(25)					, , , , , , , , , , , , , , , , , , ,
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25	1	(25)
(0.20	0120					<u> </u>				0.2.1			
2 Hay	et lesses													
з. неа	at losse	s and he	eat loss p	paramete	er:									
ELEN		s and he Gros area	eat loss p ss (m²)	oaramete Openin m	er: gs 2	Net Ar A ,r	ea n²	U-valı W/m2	ue :K	A X U (W/ł	<)	k-value kJ/m²-l	e K	A X k kJ/K
ELEN Doors	IE <mark>NT</mark>	s and he Gros area	eat loss p ss (m²)	Openin Openin m	er: gs ,2	Net Ar A ,r 2.1	ea n² ×	U-valı W/m2	ue K =	A X U (W/ł 4.2	<)	k-value kJ/m²·I	e K	A X k kJ/K (26)
ELEN Doors Windov	IENT	s and he Gros area	eat loss p ss (m²)	Openin Openin m	er: gs 2	Net Ar A ,r 2.1 3.69	ea n² x x ^{1/}	U-valı W/m2 2 /[1/(0.8)+	ue 2K 0.04] = [A X U (W/ł 4.2 2.86	<)	k-value kJ/m²-l	e K	A X k kJ/K (26) (27)
Doors Windov	IENT ws Type ws Type	S and he Gros area e 1 e 2	eat loss p ss (m²)	Openin M	er: gs ²	Net Ar A ,r 2.1 3.69 4.83	ea n ² x x x ¹ / x ¹ /	U-valu W/m2 2 /[1/(0.8)+	ue 2K 0.04] = [0.04] = [A X U (W/ł 4.2 2.86 3.74	<) 	k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27)
Doors Windov Windov	IENT ws Type ws Type ws Type	Gros area area area a 1 a 2 a 3	eat loss ; ss (m²)	Openin M	er: gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01	ea n ² x x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	ue K 0.04] = [0.04] = [0.04] = [A X U (W/ł 2.86 3.74 2.33	<) 	k-value kJ/m²+l	e K	A X k kJ/K (26) (27) (27) (27)
S. Here ELEN Doors Window Window Window	IENT ws Type ws Type ws Type ws Type	Gros area 9 1 9 2 9 3 9 4	eat loss ; ss (m²)	Openin M	er: gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	ue K 0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/ł 2.86 3.74 2.33 3.88		k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27)
S. Here ELEN Doors Window Window Window Floor	IENT ws Type ws Type ws Type ws Type	Gros area 4 2 3 4	eat loss ; ss (m²)	oaramete Openin m	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7	ea m ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13	ue K = 0.04] = [0.04] = [0.04] = [0.04] = [= =	A X U (W/ł 2.86 3.74 2.33 3.88 7.501		k-value kJ/m²·l	× K	A X k kJ/K (26) (27) (27) (27) (27) (28)
S. Here ELEN Doors Window Window Window Floor Walls T	IENT ws Type ws Type ws Type ws Type	s and he Gros area 9 1 9 2 9 3 9 4	of (m ²)	Openin m	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92		k-value kJ/m²+l		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
ELEN Doors Window Window Window Floor Walls T Walls T	IENT ws Type ws Type ws Type ws Type Type1	s and he Gros area 4 54.0 48.7	96 74	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= [= = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29)
S. Here ELEN Doors Window Window Window Window Floor Walls T Walls T Total a	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e	s and he Gros area 2 3 4 54.0 48.7 lements	06 74 , m ²	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31)
S. Here ELEN Doors Window Window Window Floor Walls T Walls T Total a Party w	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall	s and he Gros area 2 3 4 54.0 48.7 lements	206 74 5, m ²	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05	ea m ² x x ^{1/} x ^{1/}	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13 0.13	ue 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = =	A X U (W/k 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0		k-value kJ/m²·I		A X k kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)
S. Here ELEN Doors Window Window Window Window Floor Walls T Walls T Total a Party w * for window * include	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area	s and has Gross area 4 4 48.7 lements roof wind as on both	06 74 ows, use e sides of in	Darameta Openin m 8.52 8.02 effective wild internal wall	ndow U-va	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calcul titions	ea n ² x 1/ x 1	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13 0.13 0.13	$\begin{bmatrix} 2 \\ - \\ - \\ 0 \\ - \\ 0 \\ - \\ 0 \\ - \\ 0 \\ - \\ -$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)
S. Here ELEN Doors Window Window Window Window Floor Walls 1 Walls 1 Total a Party w * for window * include Fabric	IENT ws Type ws Type ws Type ws Type rype1 Type2 rea of e vall dows and e the area heat los	s and has $Gross area Gross wind as on both$	p_{1}^{0} p_{2}^{0} p_{3}^{0} p_{4}^{0} p_{4}^{0} p_{5}^{0} p_{4}^{0} p_{5}^{0} $p_{$	Copenin m	ndow U-va	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x ^{1/} x ^{1/}	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$\begin{array}{c} ue \\ K \\ 0.04] = [\\ 0.$	A X U (W/k 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32)
S. Free Boors Window Window Window Window Floor Walls T Walls T Total a Party w * for wind * for wind * for wind * fabric Heat ca	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los	s and he Gros area 4 1 2 3 4 1 48.7 1 48.7 1 1 1 1 1 1 1 1 1 1	$\frac{1000}{100}$ $\frac{1000}{100}$	effective winternal walk	er: gs 2 2 ndow U-va Is and part	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x ^{1/} x	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+)/[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+)/[1/	$\begin{array}{c} ue \\ K \\ 0.04] = [\\ 0.$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 e)+0.04] a	<)	k-value kJ/m²-l	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32) 4 (33)
S. Heat ca Therma	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los apacity al mass	s and has Gross area 4 54.0 48.7 48.7 48.7 48.7 10000 wind 10000 wind 10000 wind 10000 wind	$\frac{1000}{100}$ $\frac{1000}{1000}$ $\frac{1000}{100}$ $\frac{1000}{100}$ $\frac{1000}{100$	Definition of the second seco	er: gs 2 2 ndow U-va ls and part - TFA) ir	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea m ² x x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+ 0.13 0.13 0.13 0.13 0.13 (0.13 (0.13) (0.13) (1) (2)((0.13))	$\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$ $\frac{1}{2} = \frac{1}{2}$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a .(30) + (32 tive Value:	() () </td <td>k-value kJ/m²-I</td> <td>e K</td> <td>A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (31) (32) 4 (33) (34) (34)</td>	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (31) (32) 4 (33) (34) (34)
S. Herman BLEN Doors Window Window Window Window Floor Walls T Walls T Total a Party w * for wind ** include Fabric Heat ca Therma For desig	IENT ws Type ws Type ws Type ws Type ype1 Type2 rea of e vall dows and e the area heat los apacity al mass gn assess	s and he Gros area 4 54.0 48.7 48.7 lements <i>roof wind</i> as on both as on both 55, W/K = Cm = Signaments	p_{1}^{06} (m^2) p_{2}^{06} (m^2) p_{3}^{06} (m^2) p_{4}^{07} (m^2)	$\begin{bmatrix} 8.52 \\ \hline 8.02 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ $	er: gs 2 2 ndow U-va ls and part - TFA) ir construct	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x 1/ x	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$\begin{array}{c} ue \\ K \\ = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = \\ = \\ 0.04] = \\ $	A X U (W/k 4.2 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a .(30) + (32 tive Value: 9 values of	<) () () () () () () ()	k-value kJ/m²-l	x x 35.7 0 250	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (31) (32) (31) (32) (32)
S. Free B. S. Free B. S. Free	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los apacity al mass gn assess sed inste	s and has Gross area 4 54.0 48.7 48.7 48.7 48.7 48.7 48.7 48.7 1000 wind as on both as on both 55, W/K = 1000 Cm = 500 parameters and of a decision of the second	26 (m^2) 26 (m^2) 26 (m^2) 74 (m^2) 74 (m^2)	$\begin{bmatrix} 8.52 \\ 8.02 \end{bmatrix}$	er: gs 2 ² ndow U-va ds and pan - TFA) ir construct	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 5.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$ \begin{array}{c} $	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 e)+0.04] a .(30) + (32 tive Value: values of	<) () () () () () () ()	k-value kJ/m²-l	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32) (31) (32)

if detail	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			48.94	(37)
Ventila	ation hea	at loss ca	alculated	monthl	у	-	_		(38)m	= 0.33 × (25)m x (5)	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	22.3	22.05	21.8	20.56	20.32	19.08	19.08	18.83	19.57	20.32	20.81	21.31		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	71.24	70.99	70.74	69.5	69.25	68.01	68.01	67.77	68.51	69.25	69.75	70.24		
									/	Average =	Sum(39)1	12 /12=	69.44	(39)
Heat I	oss para	meter (H	HLP), W	/m²K	r	r	i		(40)m	= (39)m ÷	(4)	r	I	
(40)m=	0.69	0.69	0.68	0.67	0.67	0.66	0.66	0.66	0.66	0.67	0.67	0.68		
Numb	er of day	/s in mo	nth (Tab	le 1a)	-	-				Average =	Sum(40)1	12 /12=	0.67	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. W	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
		Ŭ											1	
Assun if TF	ned occu =A ⇒ 13 (Ipancy, I 9 N – 1	N + 1.76 x	[1 - exp	(-0 000?	849 x (TF	-13 Q)2)] + 0 ()013 x (⁻	TFA -13	2.	77		(42)
if TF	A £ 13.	9, N = 1	1 1.70 %		(0.0000	, , , , , , , , , , , , , , , , , , ,	10.0) <u>_</u>)] + 0.0		117(10.	.0)			
Ann <mark>ua</mark>	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.22		(43)
Reduce	e the annua re that 125	al average litres per	hot water	usage by a r day (all w	5% if the c	lwelling is hot and co	designed t Id)	to achieve	a water us	se target o	t			
not mor									0					
Hot wa	Jan	Feb	Mar Mar	Apr	May	Jun	Jul Table 1c x	(43)	Sep	Oct	Nov	Dec		
									100.11	407.00	444.50	445 74		
(44)m=	115.74	111.53	107.32	103.11	98.9	94.69	94.69	98.9	103.11	107.32	111.53	115.74	1000 50	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	1262.58	(44)
(45)m=	171.63	150.11	154.9	135.05	129.58	111.82	103.62	118.9	120.32	140.22	153.06	166.22		
16 :				- f		(· · · · · · · · · · · ·	h	-	Total = Su	m(45) ₁₁₂ =	=	1655.45	(45)
it instar	itaneous v	ater neati.	ng at point T	t of use (no	not watel	r storage), I	enter 0 in	boxes (46)) tO (61)	r		r	I	
(46)m=	25.75	22.52	23.24	20.26	19.44	16.77	15.54	17.84	18.05	21.03	22.96	24.93		(46)
Storad	siorage ne volum	iuss. ie (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	and no te	nk in dw	vellina e	nter 110) litres in	(47)				0		()
Other	wise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	(47) 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	10		(50)
b) If n	nanufact	urer's de	eclared	cylinder l	loss fact	or is not	known:							
Hot wa	ater stor	age loss	factor fi	om I abl	le 2 (kW	h/litre/da	ay)				0.	02		(51)
Volum	nunity f	from Ta	hle 22	011 4.3							4	02		(52)
Temp	erature f	actor fro	m Table	2b								.6		(53)
Energ	v lost fro	m water	storage	. kWh/v	ear			(47) x (51)	x (52) x (53) =		03		(54)
Enter	(50) or ((54) in (5	55)	, ,				、 , (- ·)	(-) (,	1.	03		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Prima	ry circuit	loss (ar	nnual) 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 wa	ter heati	ng and a	cylinde	r thermo	ostat)		_	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	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	neat req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	226.91	200.04	210.18	188.54	184.86	165.31	158.89	174.18	173.82	195.5	206.56	221.5		(62)
Solar D	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHRS	and/or \	WHRS	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=	226.91	200.04	210.18	188.54	184.86	165.31	158.89	174.18	173.82	195.5	206.56	221.5		-
								Outp	out from wa	ater heate	r (annual)₁	12	2306.29	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5	× (45)m	n + (61)n	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (59)m	1	
(65)m=	101.29	89.85	95.73	87.7	87.31	79.97	78.67	83.76	82.8	90.85	93.69	99.49		(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	rom com	<mark>mu</mark> nity h	neating	
5. In	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	s (Table	<mark>5), Wa</mark> t	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43		(66)
Lightir	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	25.03	22.23	18.08	13.69	10.23	8.64	9.33	12.13	16.28	20.67	24.13	25.72		(67)
Applia	nces ga	ins (calc	ulated in	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	i			
(68)m=	261.66	264.38	257.54	242.97	224.58	207.3	195.76	193.04	199.88	214.45	232.84	250.12		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equa	tion L15	or L15a), also se	ee Table	5				
(69)m=	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)	-	-	_	-	-	_	_	
(71)m=	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74		(71)
Water	haating	nains (T	Table 5)											
	neating	gains (1												
(72)m=	136.14	133.71	128.66	121.8	117.35	111.08	105.74	112.58	115	122.1	130.12	133.72		(72)
(72)m= Total i	136.14	133.71 gains =	128.66	121.8	117.35	111.08 (66)	105.74)m + (67)m	112.58 n + (68)m -	115 + (69)m + (122.1 (70)m + (7	130.12 (1)m + (72)	133.72 m]	(72)
(72)m= Total (73)m=	136.14 internal 487.36	gains (1 133.71 gains = 484.85	128.66 468.81	121.8 442.99	117.35 416.69	111.08 (66) 391.54	105.74)m + (67)m 375.36	112.58 n + (68)m - 382.27	115 + (69)m + (395.7	122.1 (70)m + (7 421.76	130.12 (1)m + (72) 451.62	133.72 m 474.09]	(72)

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	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.69	x	10.63	x	0.4	x	0.7] =	7.61	(74)
North	0.9x	0.77	x	4.83	x	10.63	x	0.4	x	0.7	j =	9.97	(74)
North	0.9x	0.77	x	3.01	x	10.63	x	0.4	x	0.7	=	6.21	(74)
North	0.9x	0.77	x	5.01	×	10.63	x	0.4	×	0.7] =	10.34	(74)
North	0.9x	0.77	x	3.69	x	20.32	x	0.4	x	0.7] =	14.55	(74)
North	0.9x	0.77	x	4.83	x	20.32	x	0.4	x	0.7	=	19.05	(74)
North	0.9x	0.77	x	3.01	x	20.32	x	0.4	x	0.7	=	11.87	(74)
North	0.9x	0.77	x	5.01	x	20.32	x	0.4	x	0.7	=	19.75	(74)
North	0.9x	0.77	x	3.69	x	34.53	x	0.4	x	0.7] =	24.72	(74)
North	0.9x	0.77	x	4.83	x	34.53	x	0.4	x	0.7] =	32.36	(74)
North	0.9x	0.77	x	3.01	x	34.53	x	0.4	x	0.7	=	20.17	(74)
North	0.9x	0.77	x	5.01	x	34.53	x	0.4	x	0.7] =	33.57	(74)
North	0.9x	0.77	x	3.69	x	55.46	x	0.4	x	0.7] =	39.71	(74)
North	0.9x	0.77	x	4.83	x	55.46	x	0.4	x	0.7] =	51.98	(74)
North	0.9x	0.77	x	3.01	×	55.46	x	0.4	×	0.7] =	32.39	(74)
North	0.9x	0.77	x	5.01	×	55.46	x	0.4	х	0.7		53.92	(74)
North	0.9x	0.77	x	3.69	x	74.72	x	0.4	x	0.7] =	53.5	(74)
North	0.9x	0.77	x	4.83	x	74.72] ×	0.4	x	0.7] =	70.02	(74)
North	0.9x	0.77	x	3.01	x	74.72	x	0.4	x	0.7] =	43.64	(74)
North	0.9x	0.77	x	5.01	x	74.72	x	0.4	x	0.7	=	72.63	(74)
North	0.9x	0.77	x	3.69	x	79.99	×	0.4	x	0.7] =	57.27	(74)
North	0.9x	0.77	x	4.83	x	79.99	x	0.4	x	0.7] =	74.96	(74)
North	0.9x	0.77	x	3.01	×	79.99	x	0.4	x	0.7	=	46.72	(74)
North	0.9x	0.77	x	5.01	x	79.99	x	0.4	x	0.7	=	77.76	(74)
North	0.9x	0.77	x	3.69	x	74.68	x	0.4	x	0.7	=	53.47	(74)
North	0.9x	0.77	x	4.83	x	74.68	x	0.4	x	0.7	=	69.99	(74)
North	0.9x	0.77	x	3.01	x	74.68	x	0.4	x	0.7	=	43.62	(74)
North	0.9x	0.77	x	5.01	x	74.68	x	0.4	x	0.7	=	72.6	(74)
North	0.9x	0.77	x	3.69	x	59.25	x	0.4	x	0.7	=	42.42	(74)
North	0.9x	0.77	x	4.83	x	59.25	x	0.4	x	0.7	=	55.53	(74)
North	0.9x	0.77	x	3.01	x	59.25	x	0.4	x	0.7	=	34.6	(74)
North	0.9x	0.77	x	5.01	x	59.25	x	0.4	x	0.7	=	57.6	(74)
North	0.9x	0.77	x	3.69	x	41.52	x	0.4	x	0.7	=	29.73	(74)
North	0.9x	0.77	x	4.83	x	41.52	x	0.4	x	0.7	=	38.91	(74)
North	0.9x	0.77	x	3.01	x	41.52	x	0.4	x	0.7	=	24.25	(74)
North	0.9x	0.77	x	5.01	×	41.52	x	0.4	×	0.7	=	40.36	(74)
North	0.9x	0.77	x	3.69	×	24.19	x	0.4	x	0.7	=	17.32	(74)
North	0.9x	0.77	x	4.83	×	24.19	x	0.4	×	0.7] =	22.67	(74)
North	0.9x	0.77	x	3.01	x	24.19	x	0.4	x	0.7] =	14.13	(74)

North	0.9x	0.77	x	5.0)1	×	2	4.19	x		0.4	x	0.7	=	23.52	(74)
North	0.9x	0.77	×	3.6	69	×	1	3.12	x		0.4	×	0.7	=	9.39	(74)
North	0.9x	0.77	x	4.8	3	×	1	3.12	x		0.4	×	0.7	=	12.29	(74)
North	0.9x	0.77	x	3.0)1	×	1	3.12	x		0.4	×	0.7	= =	7.66	(74)
North	0.9x	0.77	x	5.0)1	×	1	3.12	×		0.4	- x	0.7		12.75	(74)
North	0.9x	0.77	x	3.6	69	×	8	3.86	x		0.4	×	0.7	=	6.35	(74)
North	0.9x	0.77	×	4.8	3	×	8	3.86	x		0.4	×	0.7	=	8.31	(74)
North	0.9x	0.77	x	3.0)1	×	8	3.86	x		0.4	×	0.7	=	5.18	(74)
North	0.9x	0.77	×	5.0)1	×	8	3.86	×		0.4	×	0.7	=	8.62	(74)
	-					L										
Solar	gains in	watts, ca	alculated	for eac	h month				(83)m	ı = Su	um(74)m .	(82)m				
(83)m=	34.13	65.22	110.82	178.01	239.79	25	56.71	239.67	190	.15	133.24	77.63	42.1	28.45		(83)
Total (gains – i	nternal a	and solar	r (84)m =	= (73)m ·	+ (8	33)m	, watts						i		
(84)m=	521.49	550.07	579.63	621	656.48	64	8.25	615.03	572	.42	528.94	499.39	493.72	502.54		(84)
7. Me	ean inter	nal temp	perature	(heating	season)										
Temp	perature	during h	neating p	eriods ir	n the livi	ng a	area f	from Tab	ole 9	, Th1	1 (°C)				21	(85)
Utilis	ation fac	tor for g	ains for	living are	ea, h1,m	i (se	e Ta	ble 9a)	-				_			
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.88	0	.66	0.49	0.5	54	0.83	0.98	1	1		(86)
Me <mark>ar</mark>	n interna	l temper	ature in	living are	ea T1 <mark>(fo</mark>	ollov	w ste	ps 3 to 7	' in T	able	9c)					
(87)m=	20.34	20.41	20.55	20.77	20.93	20	0.99	21	2	1	20.97	20.77	20.53	20.33		(87)
Tem	oerature	during h	neating p	eriods ir	n rest of	dwe	elling	from Ta	able S	9, Th	n2 (°C)					
(88)m=	20.35	20.35	20.35	20.37	20.37	20	0.38	20.38	20.	38	20.37	20.37	20.36	20.36		(88)
Utilis	ation fac	tor for a	ains for	rest of d	welling	h2 i	m (se	e Table	9a)							
(89)m=	1	1	0.99	0.97	0.84	(D.6	0.42	0.4	17	0.78	0.97	1	1		(89)
Moor		l tompor	i aturo in	the rest	of dwalli	ing '	T2 (f			to 7	in Tabl					
(90)m=	19.45	19.56	19.77	20.08	20.3		0.37	20.38	20.	38	20.35	20.09	19.73	19.44		(90)
()											f	LA = Liv	ing area ÷ (4	4) =	0.29	(91)
				and a f) (I	л т 4			A) TO					
			ature (to 20) = TL 0.56	_A × 11	+ (1	- TL/	A) X IZ	20.20	10.06	10.7		(92)
	/ adjustr	nent to t	he mear	internal	temper	 atu	re fro	m Table	<u></u>	whe	re appro	priate	19.90	13.7		(02)
(93)m=	19.71	19.81	20	20.28	20.49	20	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(93)
8. Sp	ace hea	ting regi	uirement			<u> </u>										
Set T	i to the	mean int	ernal ter	mperatu	re obtair	ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=	⊧(76)m an	d re-calo	ulate	
the u	tilisation	factor fo	or gains	using Ta	ble 9a									i		
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilis	ation fac	tor for g	ains, hm I): I		-			1						I	
(94)m=	1	1	0.99	0.96	0.85	0).62	0.44	0.4	19	0.79	0.97	1	1		(94)
	u gains,	nmGm	, VV = (94)	4)m x (84	+)M	40	1 52	260 11	201	40	110 27	186.00	101 69	501.0	l	(05)
Mont	hly aver				$\int_{-5000}^{5000} T$	⁴⁰ able	,1.02 2 8	203.11	201	.49	713.21	400.08	491.00	501.9		(33)
(96)m=	4.3	4.9	6.5	8.9	11.7		4.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempo	erature	L Lm	, W =	[(39)m	x [(9:	<u>]</u> 3)m–	- (96)m	1	1		l	. ,
(97)m=	1097.49	1058.13	954.76	790.83	608.41	40)5.04	269.31	281	.96	440.43	- 671.04	897.26	1088.61		(97)

Space	e heating	g requir	ement fo	r each m	nonth, k'	Wh/mor	hth = 0.02	24 x [(97)m – (95	5)m] x (4	1)m		
(98)m=	429.2	342.54	282.66	138.43	36.9	0	0	0	0	137.6	292.02 436.51		
								Tota	al per year	(kWh/yea	r) = Sum(98) _{15,912} =	= 2095.88	(98)
Space	e heating	g requir	ement in	kWh/m ²	/year							20.28	(99)
9b. En	ergy req	luiremer	nts – Cor	mmunity	heating	schem	e						
This pa Fractio	art is use on of spa	ed for sp ice heat	bace hea from se	iting, spa condary/	ace cool (suppler	ing or w nentary	ater heat heating (ting prov (Table 1	′ided by 1) '0' if n	a comm one	unity scheme.	0	(301)
Fractio	on of spa	ice heat	from co	mmunity	system	1 – (30)1) =					1	(302)
The con	nmunity so	heme ma	y obtain he	eat from se	veral sou	rces. The	procedure	allows for	CHP and	up to four	other heat sources;	the latter	
includes Fractio	boilers, h	eat pump at from (s, geotheri	nal and wa	aste heat i	from powe	er stations.	See Appe	ndix C.			0.6	(303a)
Fractio	on of con	nmunitv	heat fro	m heat s	ource 2							0.0	(303b)
Fractio	on of tota	al space	heat fro	m Comn	nunity C	HP				(3	302) x (303a) =	0.4	(304a)
Fractio	on of tota	al space	heat fro	m comm	unity he	eat sour	ce 2			(3	802) x (303b) =	0.4	`´´ _(304b)
Factor	for cont	rol and	charging	method	(Table	4c(3)) fo	or commu	unity hea	ating sys	tem	, , ,	1	(305)
Distrib	ution los	s factor	(Table 1	l 2c) for c	òmmun	ity heat	ing syste	m	0,			1.1	(306)
Space	heating	a a a a a a a a a a a a a a a a a a a	·			·						kWh/vea	 r
Ann <mark>ua</mark>	l space	heating	requiren	hent								2095.88	7
Spa <mark>ce</mark>	heat fro	m Com	munity C	HP					(98) x (3	04a) x (30	5) x (306) =	1 <mark>3</mark> 83.28	(307a)
Spa <mark>ce</mark>	heat fro	m heat	source 2	2					(98) x (3	04b) x (30	5) x (306) =	922.19	(307b)
Efficier	ncy of se	econdar	y/supple	mentary	heating	system	n in % (fro	om Table	e 4a or A	pp <mark>endix</mark>	E)	0	(308
Space	heating	require	ment fro	<mark>m se</mark> con	dary/su	ppleme	ntary syst	tem	(98) x (3	01) x 100 ·	÷ (308) =	0	(309)
Water	heating	I											_
Annua	l water h	neating i	requirem	ent								2306.29	
If DHW Water	/ from co heat fro	ommuni m Comr	ty schen nunity C	าe: HP					(64) x (30	03a) x (30	5) x (306) =	1522.15	(310a)
Water	heat fro	m heat s	source 2						(64) x (3	03b) x (30	5) x (306) =	1014.77	(310b)
Electri	city used	d for hea	at distribu	ution				0.01	× [(307a)	(307e) +	+ (310a)(310e)] =	48.42	(313)
Coolin	g Syster	n Energ	y Efficie	ncy Ratio	C							0	(314)
Space	cooling	(if there	is a fixe	d cooling	g systen	n, if not	enter 0)		= (107) ÷	- (314) =		0	(315)
Electrio mecha	city for p nical ve	oumps a ntilation	nd fans v - balanc	within dw ced, extra	velling (⁻ act or po	Table 4f ositive ir	;): put from	outside				315.28	(330a)
warm a	air heatiı	ng syste	m fans									0	(330b)
pump 1	for solar	water h	eating									0	(330g)
Total e	electricity	for the	above, l	<wh td="" yea<=""><td>r</td><td></td><td></td><td></td><td>=(330a) ·</td><td>+ (330b) +</td><td>· (330g) =</td><td>315.28</td><td>(331)</td></wh>	r				=(330a) ·	+ (330b) +	· (330g) =	315.28	(331)
Energy	/ for ligh	ting (cal	culated	in Appen	idix L)							441.96	(332)
12b. C	O2 Emis	ssions –	Commu	inity hea	ting sch	eme						•	
Electri	cal effici	ency of	CHP uni	t								32	(361)

Heat efficiency of CHP unit					64	(362)
		Energy kWh/year	Emission factor kg CO2/kWh	Emiss kg CC	sions)2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2161.38 ×	0.22		466.86	(363)
less credit emissions for electricity	-(307a) × (361) ÷ (362) =	691.64 ×	0.52		-358.96	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	2378.36 ×	0.22		513.73	(365)
less credit emissions for electricity	-(310a) × (361) ÷ (362) =	761.07 ×	0.52		-395	(366)
Efficiency of heat source 2 (%)	If there is CHP	using two fuels repeat (363) to (366) for the second fu	el	96	(367b)
CO2 associated with heat source 2	[(30	07b)+(310b)] x 100 ÷ (367b) x	0.22	=	435.81	(368)
Electrical energy for heat distributio	n	[(313) x	0.52	=	25.13	(372)
Total CO2 associated with commun	ity systems	(363)(366) + (368)(372))	=	687.57	(373)
CO2 associated with space heating	(secondary)	(309) x	0	=	0	(374)
CO2 associated with water from im-	mersion heater or instan	taneous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space an	nd water heating	(373) + (374) + (375) =			687.57	(376)
CO2 associated with electricity for p	oumps and fans within d	welling (331)) x	0.52	=	163.63	(378)
CO2 associated with electricity for I	ighting	(332))) x	0.52	=	229.38	(379)
Total CO2, kg/year	sum of (376)(382) =				1080.58	(383)
Dwelling CO2 Emission Rat	e (383) ÷ (4) =				10.45	(384)
El rating (section 14)					90.24	(385)

	User D	etails:											
Assessor Name: Software Name: Stroma FSAP 2012		Stroma Softwa	a Num re Ver	ber: sion:		Versio	n: 1.0.1.24						
	Property A	Address:	Flat 2										
Address :													
1. Overall dwelling dimensions:	.	()			• • • •								
Ground floor	Area	i(m²)	(10)	Av. Hei	ght(m)		Volume(m ³)						
	50	0.32	(ia) x	2	.5	(2a) =	125.8	(38)					
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+$	(1n) 50	0.32	(4)			(0)		-					
Dwelling volume			(3a)+(3b)	+(3C)+(30))+(3e)+	.(3n) =	125.8	(5)					
2. Ventilation rate:							<u>,</u> ,						
main sec heating heating	ating	other		total			m ³ per hour						
Number of chimneys 0 +	0 +	0	=	0	X 4	40 =	0	(6a)					
Number of open flues 0 +	0 +	0] = [0	x 2	20 =	0	(6b)					
Number of intermittent fans			Ē	0	x ′	10 =	0	(7a)					
Number of passive vents			Γ	0	x ^	10 =	0	(7b)					
Number of flueless gas fires			Γ	0	x 4	40 =	0	(7c)					
Number of passive vents 0 $x 10 =$ 0 $(7s)$ Number of flueless gas fires 0 $x 40 =$ 0 $(7c)$ Air changes per hour													
Infiltration due to chimneys, flues and fans = (6a)-	+(6b)+(7a)+(7b)+(7	7c) =		0		÷ (5) =	0	(8)					
If a pressurisation test has been carried out or is intended,	proceed to (17), o	otherwise c	ontinue fro	om (9) to (16)	1							
Additional infiltration					[(9)-	-11x0 1 =	0	(9)					
Structural infiltration: 0.25 for steel or timber fra	ame or 0.35 for	masonr	constr	uction	[(0)	1,00.1 -	0	(10)					
if both types of wall are present, use the value correspo	onding to the greate	er wall area	a (after				0						
deducting areas of openings); if equal user 0.35	d or 0.1 (acala	d) alaa (ntor 0				_						
If no draught lobby enter 0.05 else enter 0	u) 01 0.1 (Seale	u), eise e					0	(12)					
Percentage of windows and doors draught strir	ned						0	[(13)] (14)]					
Window infiltration	opeu	0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)					
Infiltration rate		- (8) + (10) +	- (11) + (1	- 2) + (13) +	- (15) =		0	(16) (16)					
Air permeability value, q50, expressed in cubic	metres per ho	ur per sc	uare m	etre of e	nvelope	area	3](17)					
If based on air permeability value, then $(18) = [(17)]$	÷ 20]+(8), otherwis	se (18) = (1	6)				0.15	(18)					
Air permeability value applies if a pressurisation test has b	een done or a deg	ree air per	meability i	is being us	sed								
Number of sides sheltered		(00) (1		0.1			3	(19)					
Shelter factor		(20) = 1 - [(J.075 x (1	9)] =			0.78	(20)					
Infiltration rate incorporating shelter factor		(21) = (18)	x (20) =				0.12	(21)					
Infiltration rate modified for monthly wind speed			-										
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec							
Monthly average wind speed from Table 7		1					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 \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 (allow	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If ma	ate etter	ctive air	change	rate for t	he appli	cable ca	se						0.5	(220)
lf exh	aust air h	eat pump	using App	endix N. (2	3b) = (23a	a) x Fmv (e	equation (1	N5)), other	rwise (23b) = (23a)			0.5	(23a)
lf bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			77.05	(230)
a) If	halance	d mech	anical ve	ntilation	with he	at recove	orv (M\/I	HR) (24a	(2)m – (2)	2h)m + (23h) 🗸 [ʻ	l _ (23c)	 ∴ 1001	(230)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25]	(24a)
b) If	halance	d mech	anical ve	Intilation	without	heat rec		(1)/) (24b)	1 - (2)	$\frac{1}{2}$ () $m \pm ()$	23h)]	
(24b)m=					0				0		0	0	1	(24b)
c) If	whole h		tract ver	L	n nositiv		ventilatio	n from c	<u>utside</u>]	
0) 11	if (22b)n	n < 0.5 ×	(23b), t	then (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	lole hous	e positiv	/e input	ventilatio	n from l	oft				1	
	if (22b)n	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN		Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e .	A X k
_		area	(m²)	m) ²	A ,r	n²	W/m2	K	(W/I	K)	kJ/m²·l	K	kJ/K
Doors						2.1	×	2	=	4.2				(26)
Windo	ws Type	e 1				3.33	x1	/[1/(0.8)+	0.04] =	2.58				(27)
Windo	ws Type	e 2				5.01	x1	/[1/(0.8)+	0.04] =	3.88				(27)
Walls		59.4	19	10.4	4	49.05	5 X	0.13	=	6.38				(29)
Total a	area of e	lements	, m²			59.49)							(31)
Party v	wall					17.5	x	0	=	0				(32)
* for win	dows 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	3.2	
Fabric	heat los	s W/K :	= S (A x)		is and pan	1110/15		(26)(30)	+ (32) =				17.04	(33)
Heat c	apacity	Cm = St	′A x k)	0)				· / · / /	((28)	(30) + (3)	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm -	- TFA) ir	n k.I/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign assess	sments wh	ere the de	etails of the	construct	ion are not	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f	230	(00)
can be ι	used inste	ad of a de	tailed calc	ulation.				-						
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						5.35	(36)
if details	of therma	al bridging	are not kr	10wn (36) =	= 0.15 x (3	1)			(00)	(00)			r	
	abric ne	atioss	- - 4		_				(33) +	(36) =	05)		22.39	(37)
ventila	ation nea				/	l	1.1	A	(38)m	= 0.33 × (25)m x (5)	Dee	1	
(28)-	Jan	10.72				Jun		Aug	Sep		10.12	10.27		(38)
(30)11=	10.65	10.73		10.01	9.09	9.29	9.29	9.17	9.00	9.09	10.13	10.37	l	(00)
Heat tr	ranster o		nt, VV/K	00.1	00.00	04.00	04.00	04.50	(39)m	= (37) + (37)	38)m	00.70	1	
(39)m=	33.25	33.13	33	32.4	32.28	31.68	31.68	31.56	31.92	32.28	32.52 Sum(20)	32.76	20.07	(30)
									,	nverage =	Jun(39)1	12 / 12=	32.37	(55)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.66	0.66	0.66	0.64	0.64	0.63	0.63	0.63	0.63	0.64	0.65	0.65		
Numbo	r of day		uth (Tab	L 12)				1	,	Average =	Sum(40)1.	12 /12=	0.64	(40)
	Jan	Feh	Mar	Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(, L					0.							0.		
4. Wat	ter heat	ting ener	rgy 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 (⁻	TFA -13	1 .9)	.7		(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 day (all w	es per da 5% if the a rater 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	78 f	.49		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34		_
Ener <mark>gy c</mark>	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	941.86	(44)
(45)m=	128.04	111.98	115.55	100.74	96.66	83.41	77.3	88.7	89.76	104.6	114.18	124		_
lf instanta	aneous w	vater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46	-) to (61)	Total = Su	m(45) ₁₁₂ =	-	1234.92	(45)
(46)m=	19.21	16.8	17.33	15. <mark>11</mark>	14.5	12.51	11.59	13.3	13.46	15.69	17.13	18.6		(46)
Water s	storage	loss:	includir	na any se	olar or M		storage	within sa	ame ves	ما		0		(47)
lf com	ounity h	eating a	nd no ta	ink in dw	velling e	nter 110	litres in	(47)		501		0		(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	om water	storage	, kWh/ye	ear		I	(48) x (49)) =		1	10		(50)
Hot wat	ter stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	whown: ay)				0.	02		(51)
If comn	nunity r	from Tal	ee secti ble 22	on 4.3								00		(50)
Tempe	rature f	actor fro	m Table	2h							1.	6		(52) (53)
Energy	lost fro	m water	storage	_~ _k\//b///	or			(47) x (51)) x (52) x (¹	53) -		.0		(54)
Enter ((50) or ((54) in (5	55)	, KVVII/ yt	5ai			(47) X (01)	/ (() ~ ()	00) -	1.	03 03		(54)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(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	l lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (an	nual) fro	om Table	93							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		- (- ()			
(mod	lified by	tactor fi	rom Tab	le H5 if t	nere is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)	00.00	l	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(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=	183.31	161.91	170.83	154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		(62)
Solar DH	- IW input	calculated	using App	bendix G o	r Appendix	H (negat	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=	183.31	161.91	170.83	154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		
				-	-		-	Out	out from w	ater heate	r (annual)₁	12	1885.76	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	86.79	77.18	82.64	76.29	76.36	70.53	69.92	73.71	72.64	79	80.76	85.45		(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 fi	rom com	munity h	leating	
5. Int	ernal a	ains (see	e Table :	5 and 5a):	-		-				-	-	
Metab	olic dai	ns (Table	5) Wa	tte										
metab	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(66)m=	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	8 <mark>4.98</mark>	84.98	84.98		(66)
Lightin	d dains	(calcula	ted in A	ppendix	L equati	ion I 9 o	riga) a	lso see	Table 5		I			
(67)m=	14.05	12.48	10.15	7.69	5.74	4.85	5.24	6.81	9.14	11.61	13.55	14.44		(67)
Applia		aine (cale	ulated i			uation I	13 or L 1	32) 2/20		blo 5				
Appilai	148 07		145 73	137 49	127.08	1173		109 23		121 35	131 75	141 53		(68)
				nondiv						E	101.70	141.00		(00)
(60)m-	ig gains					21.5	01 L 15a	, also se		21.5	21.5	21.5		(69)
(09)11=	51.5	51.5	(Table	5 .5	31.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5		(00)
Pumps	and fa	ins gains		5a)		0							I	(70)
(70)m=	0	0	, U	0		0	0	0	0	0	0	0		(70)
Losses	s e.g. e	vaporatio	on (nega I	itive valu	es) (Tab T	le 5)			r	1			I	
(71)m=	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98		(71)
Water	heating) gains (T	able 5)									r	I	
(72)m=	116.66	114.84	111.08	105.96	102.64	97.96	93.98	99.08	100.89	106.19	112.17	114.85		(72)
Total i	nterna	l gains =	:	i		(66)m + (67)m +	ı + (68)m ·	+ (69)m +	(70)m + (7	′1)m + (72) +	m		
(73)m=	327.27	325.42	315.45	299.63	283.96	268.6	258.49	263.62	271.63	287.64	305.96	319.32		(73)
6. So	lar gain	s:												
Solar g	ains are	calculated	using sola -	ar flux from	Table 6a a	and assoc	iated equa	tions to co	onvert to th	e applicat	ole orientat	ion.		
Orienta	ation:	Access F Table 6d	actor	Area		Flu Ta	IX hle 6a	т	g_ able 6b	т	FF able 6c		Gains	
								, L		, , ,			(**)	-
North	0.9x	0.77	X	3.3	33	×	10.63	×	0.4		0.7	=	6.87	(74)
North	0.9x	0.77	X	5.0	01	×	10.63	×	0.4		0.7	=	10.34	(74)
North	0.9x	0.77	X	3.3	33	×	20.32	×	0.4		0.7	=	13.13	(74)
North	0.9x	0.77	x	5.0	01	×:	20.32	x	0.4	×	0.7	=	19.75	(74)
North	0.9x	0.77	x	3.3	33	x :	34.53	x	0.4	x	0.7	=	22.31	(74)

North	0.9x	0.77)	(5.01	×		34.53	x	0.4	x	0.7	=	33.57	(74)
North	0.9x	0.77)] ،	3.33	×		55.46	x	0.4	x	0.7	=	35.84	(74)
North	0.9x	0.77)] ،	5.01	×		55.46	x	0.4	x	0.7	=	53.92	(74)
North	0.9x	0.77)] ،	3.33	×		74.72	x	0.4	x	0.7	=	48.28	(74)
North	0.9x	0.77)] ،	5.01	×		74.72	x	0.4	x	0.7	=	72.63	(74)
North	0.9x	0.77)] ،	3.33	×		79.99	x	0.4	x	0.7	=	51.68	(74)
North	0.9x	0.77)] ،	5.01	×		79.99	x	0.4	x	0.7	=	77.76	(74)
North	0.9x	0.77)	۲	3.33	×		74.68	x	0.4	x	0.7	=	48.25	(74)
North	0.9x	0.77)] ،	5.01	×		74.68	x	0.4	x	0.7	=	72.6	(74)
North	0.9x	0.77	>	، [3.33	×		59.25	x	0.4	x	0.7	=	38.28	(74)
North	0.9x	0.77)	(5.01	x		59.25	x	0.4	x	0.7	=	57.6	(74)
North	0.9x	0.77	>	۰ [3.33	x		41.52	x	0.4	x	0.7	=	26.83	(74)
North	0.9x	0.77)	۰ [5.01	×		41.52	x	0.4	x	0.7	=	40.36	(74)
North	0.9x	0.77)	(3.33	×		24.19	x	0.4	x	0.7	=	15.63	(74)
North	0.9x	0.77)	۰ [5.01	×		24.19	x	0.4	x	0.7	=	23.52	(74)
North	0.9x	0.77)	<u>،</u>	3.33	×		13.12	x	0.4	x	0.7	=	8.48	(74)
North	0.9x	0.77	>	٠ [5.01	×		13.12	x	0.4	x	0.7	=	12.75	(74)
North	0.9x	0.77)	< [3.33	×		8.86	x	0.4	x	0.7	=	5.73	(74)
North	0.9x	0.77	,	< [5.01	×		8.86	x	0.4	×	0.7	=	8.62	(74)
Solar (gains in	watts, <mark>ca</mark>	alculate	d 1	for each mo	nth			(83)m	n = Sum(74)m	(8 <mark>2)m</mark>			,	(22)
(83)m=	17.21	32.89	55.88		89.76 120.	91	129.44	120.85	95.	88 67.19	39.15	21.23	14.35		(83)
Total (jains – I	nternal a		ar ((84)m = (73)	$m + \frac{1}{2}$	(83)m	, watts	050	40 000000	000 7	0.007.40	000.07		(0.4)
(84)m=	344.48	358.31	371.33	L	389.38 404.	8/	398.04	379.33	359	.49 338.82	326.7	8 327.19	333.67		(04)
7. Me	ean inter	nal temp	erature	e (I	heating seas	son)								r	
Temp	perature	during h	eating	pe	eriods in the	living) area	from Tal	ble 9	, Th1 (°C)				21	(85)
Utilis	ation fac	tor for ga	ains for	' liv	ving area, h	1,m (see T	able 9a)	1.					7	
()	Jan	Feb	Mar	╇	Apr M	ay	Jun	Jul	A	ug Sep	Oc	t Nov	Dec	_	(00)
(86)m=	0.99	0.99	0.97		0.89 0.7	2	0.51	0.37	0.	4 0.64	0.9	0.98	0.99		(86)
Mear	n interna	l temper	ature in	ı li	ving area T1	(foll	ow ste	eps 3 to 7	7 in T	able 9c)	-	-		-	()
(87)m=	20.56	20.63	20.76		20.91 20.9	99	21	21	2	1 21	20.92	2 20.73	20.55		(87)
Temp	perature	during h	eating	pe	eriods in rest	of d	welling	g from Ta	able	9, Th2 (°C)				-	
(88)m=	20.38	20.38	20.38		20.39 20.3	39	20.4	20.4	20.	41 20.4	20.39	20.39	20.38		(88)
Utilis	ation fac	tor for g	ains for	re	est of dwellir	ng, hź	2,m (s	ee Table	9a)						
(89)m=	0.99	0.98	0.96		0.87 0.6	8	0.46	0.32	0.3	35 0.59	0.88	0.97	0.99]	(89)
Mear	n interna	l temper	ature in	n th	ne rest of dw	/ellin	g T2 (follow ste	eps 3	to 7 in Tab	ole 9c)			_	
(90)m=	19.79	19.9	20.07	Т	20.29 20.3	38	20.4	20.4	20.	41 20.4	20.3	20.05	19.78]	(90)
	·			-	1				-		fLA = Li	ving area ÷ (4) =	0.48	(91)
Mear	n interna	l temper	ature (f	or	the whole d	welli	na) = 1	fLA x T1	+ (1	– fLA) x T2	2			•	
(92)m=	20.16	20.25	20.4	T	20.59 20.6	57	20.69	20.69	20.	69 20.68	20.6	20.37	20.15]	(92)
	L	1						1	1		1			-	

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

(93)m=	20.16	20.25	20.4	20.59	20.67	20.69	20.69	20.69	20.68	20.6	20.37	20.15		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti the ut	to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	e obtair Ible 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm											
(94)m=	0.99	0.98	0.96	0.88	0.7	0.48	0.34	0.38	0.62	0.89	0.97	0.99		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	340.44	351.66	356.24	342.03	284.08	192.67	129.55	135.39	208.62	289.49	318.24	330.44		(95)
Month	ly 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=	527.4	508.44	458.81	378.7	289.58	192.9	129.57	135.42	210.16	322.74	431.71	522.66		(97)
Space	e heating	g require	ement fo	r each n	nonth, k	Nh/mon	th = 0.02	4 x [(97])m – (95)m] x (4	1)m			
(98)m=	139.09	105.35	76.31	26.41	4.09	0	0	0	0	24.74	81.7	143.01		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	600.7	(98)
Space	e heating	g require	ement in	kWh/m²	/year								11.94	(99)
9b. Ene	ergy req	luiremen	nts – Cor	nmunity	heating	scheme)							
This pa	nt is use	ed for sp	ace hea	iting, spa		ing or wa	ater heat	ing prov	ided by a	a c <mark>omm</mark>	unity sch	neme.	0] (301)
Fraction of space heat from community system 1 – (301) =													0	
Fraction of space heat from community system $1 - (301) = 1$													(302)	
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter														
<i>includes</i> Fractio	<i>boilers, h</i> n of hea	eat pumps at from C	s, geothern Commun	^{mal and wa} ity CHP	aste heat f	rom powei	r stations. S	See Appei	ndix C.				0.6	(303a)
Fractio	n of con	nmunity	heat fro	m heat s	ource 2								0.4	(303b)
Fractio	n of tota	al space	heat fro	m Comn	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fractio	n of tota	al space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor	for cont	rol and o	charging	method	(Table	4c(3)) fo	r commu	inity hea	ting syst	tem			1	(305)
Distribu	ution los	s factor	(Table 1	2c) for c	commun	ity heatii	ng syster	m					1.1	(306)
Space	heating	9										i	kWh/year	-
Annual	space	heating	requirem	nent									600.7	
Space	heat fro	m Comr	nunity C	ΉP					(98) x (30	04a) x (30	5) x (306) :	=	396.46	(307a)
Space	heat fro	m heat s	source 2						(98) x (30	04b) x (30	5) x (306) :	=	264.31	(307b)
Efficier	icy of se	econdary	//supple	mentary	heating	system	in % (fro	m Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/su	oplemen	tary syst	em	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water Annual	heating water h	l neating r	equirem	ent									1885.76	
If DHW Water I	from concern	ommunit m Comn	y schen nunitv C	ne: HP					(64) x (30	03a) x (30	5) x (306) :	=	1244.6	(310a)
Water I	neat fro	m heat s	source 2						(64) x (30)3b) x (30	5) x (306) :	=	829.74	(310b)
Electric	city used	d for hea	t distribu	ution				0.01	× [(307a).	(307e) +	· (310a)([310e)] =	27.35	(313)

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not en	ter 0) = (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive inpu	it from outside	136.21	
warm air neating system fans		0	
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	136.21	(331)
Energy for lighting (calculated in Appendix L)		248.2	(332)
12b. CO2 Emissions – Community heating scheme			7
		32	_(361) _
Heat efficiency of CHP unit		64	(362)
	Energy Emission facto kWh/year kg CO2/kWh	r Emissions kg CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	619.47 × 0.22	133.81	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	198.23 × 0.52	-102.88	(364)
Water heated by CHP (310a) × 100 ÷ (362) =	1944.69 × 0.22	420.05	(365)
less credit emissions for electricity -(310a) × (361) ÷ (362) =	622.3 × 0.52	-322.97	(366)
Efficiency of heat source 2 (%) If there is Cl	HP using two fuels repeat (363) to (366) for the second f	uel 96	(367b)
CO2 associated with heat source 2 [[(307b)+(310b)] × 100 ÷ (367b) × 0.22	= 246.16	(368)
Electrical energy for heat distribution	[(313) x 0.52	= 14.2	(372)
Total CO2 associated with community systems	(363)(366) + (368)(372)	= 388.36	(373)
CO2 associated with space heating (secondary)	(309) x 0	= 0	(374)
CO2 associated with water from immersion heater or insta	antaneous heater (312) x 0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =	388.36	(376)
CO2 associated with electricity for pumps and fans within	dwelling (331)) x 0.52	= 70.69	(378)
CO2 associated with electricity for lighting	(332))) x 0.52	= 128.81	(379)
Total CO2, kg/year sum of (376)(382)	=	587.87	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =		11.68	(384)
El rating (section 14)		91.74	(385)

		U	lser De	etails:									
Assessor Name: Software Name:	Stroma FSAP 20 ⁻	12	S	Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.1.24				
		Prop	perty A	ddress:	Flat 3								
Address :													
1. Overall dwelling dime	ensions:			(a)									
Cround floor			Area((m²)	(1-)	Av. He	ight(m)		Volume(m ³)				
			66	.88	(1a) x	2	2.5	(2a) =	167.2	(3a)			
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	66	.88	(4)			<i>i</i>		_			
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	167.2	(5)			
2. Ventilation rate:													
	main s heating	econdary heating	C	other		total			m ³ per hour				
Number of chimneys	0 +	0	+	0] = [0	X 4	40 =	0	(6a)			
Number of open flues	0 +	0	+	0] = [0	x 2	20 =	0	(6b)			
Number of intermittent fa	ans				Γ	0	x ^	10 =	0	(7a)			
Number of passive vents	3				Γ	0	x ^	10 =	0	(7b)			
Number of flueless gas f	ires				Γ	0	x 4	40 =	0	(7c)			
Number of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour													
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+	+(7b)+(7d	c) =		0		÷ (5) =	0	(8)			
Number of storeys in t	he dwelling (ns)	ea, proceea lo) (<i>17)</i> , Oli	nerwise c	onunue no	om (9) to (10)		0	٦(9)			
Additional infiltration							[(9)	-1]x0.1 =	0	(10)			
Structural infiltration: 0).25 for steel or timber	frame or 0.	35 for I	masonr	y constr	uction			0	– (11)			
if both types of wall are p deducting areas of open	vresent, use the value corres ings); if equal user 0.35	sponding to the	e greatei	r wall area	a (after					-			
If suspended wooden	floor, enter 0.2 (unsea	led) or 0.1 ((sealed	d), else (enter 0				0	(12)			
If no draught lobby, er	nter 0.05, else enter 0								0	(13)			
Percentage of window	s and doors draught s	tripped							0	(14)			
Window infiltration			0	.25 - [0.2	x (14) ÷ 1	= [00			0	(15)			
Infiltration rate			3)	8) + (10) +	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)			
Air permeability value,	, q50, expressed in cul	bic metres p	ber hou	ur per so	uare m	etre of e	nvelope	area	3	(17)			
If based on air permeabi	lity value, then $(18) = [(10)]$	17) ÷ 20]+(8), c	otherwise	e (18) = (1	16)		1		0.15	(18)			
Air permeability value applie	ed	is been done o	or a degr	ee air per	meability l	is being us	sea		2				
Shelter factor	30		(2	20) = 1 - [0.075 x (1	9)] =			0.78	(10)			
Infiltration rate incorpora	ting shelter factor		(2	21) = (18)	x (20) =				0.12] ₍₂₁₎			
Infiltration rate modified	for monthly wind spee	d							-	_] ` ` `			
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind sp	peed 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 $(22a)m = (2a)m =$	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					
	! <u> </u>												

Adjust	ed infiltr	ation rat	e (allow	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
~ ' '	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If me	ate etter	<i>ctive air</i> al ventila	change	rate for t	ne appli	cable ca	se						0.5	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	N5)), othei	wise (23b) = (23a)			0.5	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =	, (,			77.25	(23c)
a) If	balance	d mech	anical ve	ntilation	with he	at recove	erv (MV/	- - - - - - - - - - - - - - - - - - -	n)m = (2)	2h)m + (23h) x [1	l – (23c)	<u> </u>	(200)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(24a)
b) If	balance	l d mech	i anical ve	entilation	without	heat rec	L Coverv (N	I //V) (24b)m = (22	I 2b)m + (;	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	tract ver	ntilation of	or positiv	e input v	ventilatio	n from c	outside	1				
	if (22b)n	n < 0.5 ×	(23b), t	hen (24	c) = (23b); other	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	se positiv	/e input	ventilatio	on from I	oft				-	
i	if (22b)n	n = 1, th	en (24d) I	m = (22t	o)m othe	erwise (2	24d)m = 0	0.5 + [(2	2b)m² x	0.5]			I	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				I	(05)
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	-0.22	0.23	0.24	0.24	0.25		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	/IENT	Gros	SS (m 2)	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value		A X k
Doore		area	(m²)	m	12	A,r	n²	vv/m2		(VV/I	K)	KJ/M ² ·I	1	KJ/K
Mindo		.1				2.1		2	=	4.2	H			(20)
		;]				19.23		/[1/(0.0)+	0.04] =	14.91	H			(27)
windo	ws type	2				9.5		/[1/(0.8)+	0.04] =	7.36	L.			(27)
	ws type	93 				20.61	x1,	/[1/(0.8)+	0.04] =	15.98	╡,			(27)
Walls		95.	5	51.4	4	44.06	3 X	0.13	=	5.73				(29)
Total a	area of e	elements	, m²			95.5								(31)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	formula 1,	/[(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) =				48.18	(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	: Medium		250	(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 noi	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	<						8.1	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			56.28	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	14.43	14.27	14.11	13.3	13.14	12.34	12.34	12.18	12.66	13.14	13.46	13.79		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	70.7	70.54	70.38	69.58	69.42	68.62	68.62	68.46	68.94	69.42	69.74	70.06		
										Average =	Sum(39)1.	12 /12=	69.54	(39)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05		
Numbo	r of dov		th (Tab					1	,	Average =	Sum(40)1.	12 /12=	1.04	(40)
	lan	Feb	Mar		May	lun	6.1	Δυσ	Sen	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 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	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	17		(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 a vater use, l	ay Vd,av Iwelling is not and co	erage = designed : ld)	(25 x N) to achieve	+ 36 a water us	se target o	90 f).2		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					-	
(44)m=	99.22	95.61	92.01	88.4	84.79	81.18	81.18	84.79	88.4	92.01	95.61	99.22		_
Energy c	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1082.42	(44)
(45)m=	147.14	128.69	132.8	115.78	111.09	<mark>9</mark> 5.86	88.83	101.94	103.15	12 <mark>0.21</mark>	131.22	142.5		_
lf instanta	aneous w	vater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	-	1419.22	(45)
(46)m=	<mark>2</mark> 2.07	19.3	19.92	17. <mark>37</mark>	16.66	14.38	13.32	15.29	15.47	18.03	19.68	21.38		(46)
Water s	storage	loss:	ingludir				etorogo	within or						(47)
Storage	e volum	e (intres)	nd no to	ig any so		ntor 110	storage		arrie ves	sei		0		(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			(48) x (49)) =		1	10		(50)
b) If ma	anufact	urer's de	eclared of factor fr	cylinder l	oss fact	or is not	known:							(54)
If comm	nunitv h	eating s	ee secti	on 4.3		1/1110/02	iy)				0.	02		(51)
Volume	factor	from Ta	ble 2a								1.	03		(52)
Tempe	rature f	actor fro	m Table	2b							0	.6		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter ((50) or ((54) in (5	5)	·							1.	03		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(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	l lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	lified by	factor fi	om Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	stat)		1	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(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 h	neating c	alculated	d fo	r eacl	n month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	202.42	178.62	188.08	169.27	166.37	14	49.36	144.11	157.21	156.65	175.49	184.72	197.78]	(62)
Solar DI	HW input	calculated	using Ap	pendix G c	r Appendix	<н((negativ	ve quantity	/) (enter	0' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHRS	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 v	vater hea	ter												
(64)m=	202.42	178.62	188.08	169.27	166.37	14	49.36	144.11	157.21	156.65	175.49	184.72	197.78		
			-						Ou	tput from w	ater heate	er (annual)	112	2070.06	(64)
Heat g	jains fro	om water	heating	, kWh/m	onth 0.2	5 ′	[0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	93.15	82.73	88.38	81.29	81.16	7	4.67	73.76	78.11	77.09	84.19	86.43	91.6		(65)
inclu	ude (57)m in calo	ulation	of (65)m	n only if c	ylir	nder is	s in the c	dwelling	g or hot w	vater is f	rom com	munity h	heating	
5. In	ternal g	ains (see	Table	5 and 5a	ı):										
Metab	olic dai	ns (Table	5) Wa	utts	,										
motab	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	108.4	108.4	108.4	108.4	108.4	1	08.4	108.4	108.4	108.4	108.4	108.4	108.4		(66)
Liahtin		(calcula	ted in A		L. equat	ion	L9 oi	r L9a), a	lso see	Table 5					
(67)m=	16.93	15.04	12.23	9.26	6.92	1	5.84	6.31	8.21	11.01	13.99	16.32	17.4	1	(67)
Annlia	nces da	ains (calc	ulated i	n Appen	dix Lea	Lat	tion L	13 or L 1:	l 3a) als	o see Ta	ble 5	1		1	
(68)m=	189.91	191.88	186.91	176.34	163	1	50.45	142.07	140.1	145.07	155.64	168,99	181.53	1	(68)
Cookir			tod in /	honondiv		tion	1 15	or 150)			5	100.00	101.00	J	()
(69)m-	19 yana	33.84	33.84	33.84			3.84	33.84	33.84	33.84	33.84	33.84	33.84	1	(69)
000)11-	00.04	00.04	(Table	50.04	00.04		0.04	00.04	00.04	55.04	00.04	00.04	00.04		(00)
Pumps	s and fa	ins gains		5a)		<u> </u>	0	0						1	(70)
(70)m=	0					Ļ	0	0	0	0	0	0	0	J	(70)
Losse	s e.g. e		on (nega		ies) (Tab	ble :	5)							1	(74)
(71)m=	-86.72	-86.72	-86.72	-86.72	-86.72		36.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	J	(71)
Water	heating	g gains (T	Table 5)	1		-						1		1	(70)
(72)m=	125.2	123.11	118.79	112.9	109.08	10	03.71	99.14	104.99	107.07	113.16	120.04	123.12	J	(72)
Total i	interna	l gains =	:			-	(66)	m + (67)m	n + (68)m r	+ (69)m +	(70)m + (1 1	71)m + (72))m 1	1	
(73)m=	387.56	385.55	373.45	354.02	334.52	3	15.52	303.05	308.82	318.68	338.31	360.87	377.57		(73)
6. So	lar gain	IS:													
Solar (jains are	calculated	using sol	ar flux from	1 able 6a	and	associ	ated equa	tions to a	convert to th	ne applica	ble orienta	tion.		
Orient	ation:	Access F Table 6d	actor	Area m ²	1		Flu Tab	x ble 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
Feet									. –					(**)	٦
⊏ast	0.9x	1	`	(19	.23	x	1	9.64		0.4	_ × Ļ	0.7	=	51.4	_(76)
⊏ast	0.9x	1	`	(19	.23	x	3	8.42		0.4	_ × L	0.7	=	100.54	_(76)
⊨ast –	0.9x	1)	(19	.23	x	6	3.27		0.4		0.7	=	165.57	(76)
East	0.9x	1)	(19	.23	x	9	2.28	×	0.4	× [0.7	=	241.48	(76)
East	0.9x	1	>	<mark>(</mark> 19	.23	x	1'	13.09	x	0.4	×	0.7	=	295.94	(76)

East	0.9x	1		x	19.	23	x	1	15.77	x		0.4	x	0.7		=	302.95	(76)
East	0.9x	1		x	19.3	23	j ×	1	10.22	x		0.4	×	0.7		=	288.42	(76)
East	0.9x	1		x	19.	23	x	9	94.68	x		0.4	×	0.7		=	247.75	(76)
East	0.9x	1		x	19.3	23	j ×	7	73.59	x		0.4	×	0.7		=	192.57	(76)
East	0.9x	1		x	19.:	23] ×	4	15.59	x		0.4	- X	0.7		=	119.3	(76)
East	0.9x	1		x	19.:	23] ×	2	24.49	x		0.4	×	0.7		=	64.08	(76)
East	0.9x	1		x	19.:	23	x	1	6.15	x		0.4	×	0.7		= [42.26	(76)
South	0.9x	0.54		x	9.	5	x	4	16.75	x		0.4	×	0.7		= [60.44	(78)
South	0.9x	0.54		x	9.9	5	x	7	76.57	x		0.4	×	0.7	:	=	98.98	(78)
South	0.9x	0.54		x	9.	5	x	9	97.53	x		0.4	×	0.7	:	=	126.09	(78)
South	0.9x	0.54		x	9.5	5	×	1	10.23	x		0.4	x	0.7	:	=	142.51	(78)
South	0.9x	0.54		x	9.9	5	x	1	14.87	x		0.4	×	0.7	:	=	148.5	(78)
South	0.9x	0.54		x	9.	5	x	1	10.55	x		0.4	×	0.7	:	=	142.91	(78)
South	0.9x	0.54		x	9.	5	x	1	08.01	x		0.4	×	0.7		=	139.63	(78)
South	0.9x	0.54		x	9.9	5	x	1	04.89	x		0.4	×	0.7	:	=	135.6	(78)
South	0.9x	0.54		x	9.	5	x	1	01.89	x		0.4	×	0.7	:	=	131.71	(78)
South	0.9x	0.54		x	9.	5	x	8	32.59	x		0.4	×	0.7		=	106.76	(78)
South	0.9x	0.54		x	9.	5	X	5	55.42	x		0.4	×	0.7		=	71.64	(78)
South	0.9x	0.54		x	9.	5	x		40.4) x		0.4	x	0.7		-	52.23	(78)
West	0.9x	0.54		x	20.	61	×		9.64] ×		0.4	×	0.7		=	55.08	(80)
West	0.9x	0.5 <mark>4</mark>		x	20.	61	x		38.42	x		0.4	×	0.7		= [107.75	(80)
West	0.9x	0.54		x	20.	61	x	6	63.27	x		0.4	×	0.7		=	177.46	(80)
West	0.9x	0.54		x	20.	61	x	Ę	92.28	x		0.4	×	0.7	:	=	258.81	(80)
West	0.9x	0.54		x	20.	61	×	1	13.09	x		0.4	×	0.7		=	3 <mark>17.18</mark>	(80)
West	0.9x	0.54		x	20.	61	x	1	15.77	x		0.4	×	0.7	:	=	324.69	(80)
West	0.9x	0.54		x	20.	61	x	1	10.22	x		0.4	×	0.7	:	=	309.12	(80)
West	0.9x	0.54		x	20.	61	x	ę	94.68	x		0.4	×	0.7	:	=	265.53	(80)
West	0.9x	0.54		x	20.	61	×	7	73.59	x		0.4	×	0.7	:	=	206.39	(80)
West	0.9x	0.54		x	20.	61	×	4	15.59	x		0.4	×	0.7	:	=	127.86	(80)
West	0.9x	0.54		x	20.	61	x	2	24.49	x		0.4	×	0.7	:	=	68.68	(80)
West	0.9x	0.54		x	20.	61	x	1	6.15	x		0.4	×	0.7	:	=	45.3	(80)
Solar (gains in	watts, ca	alculat	ed	for eac	n mon	th		1	(83)m	ו = Su	ım(74)m	.(82)m					(00)
(83)m=	166.92	307.28	469.1	2	642.8	761.6	2	770.55	737.17	648	.88	530.67	353.92	2 204.41	139.7	'9		(83)
				аі - Т	(04)111 =	= (73)				057	74	0.40.05	<u> </u>	505.07	5470			(94)
(04)11=	554.47	092.03	642.5	<u> </u>	990.82	1096.1		086.08	1040.22	957	./ 1	649.35	692.23	5 565.27	517.3	00		(04)
7. Me	ean inter	nal temp	peratur	e (heating	seaso	on)		· -		-					- 1		1
Temp	berature	during h	ieating	pe	eriods ir	n the li	ving	area	trom lat	ole 9	, I h 1	l (°C)					21	(85)
Utilis	ation fac	tor for g	ains to	r li	ving are	ea, h1,	m (9					600 I	0~*	Nov				
(86)m-		1 PED			Apr		y I	Jun			ug	0.55	OCt			C		(86)
(00)11=		0.97	0.91		0.11	0.58		0.4	0.29			0.00	0.00	0.90	0.99	'		(00)
Mear	interna	I temper	ature i	n li T	iving are	ea T1	(foll)	ow ste	ps 3 to 7	7 in T	able	9c)	00.00	00.4	00.07			(97)
(ŏ1)m=	20.1	20.34	20.64		20.89	20.98	<u>`</u>	21	21	2	1	20.99	20.82	20.4	20.05	С		(07)

Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)		-	-			
(89)m=	0.99	0.96	0.89	0.72	0.52	0.34	0.23	0.26	0.48	0.82	0.97	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	18.85	19.2	19.62	19.93	20.03	20.06	20.06	20.06	20.05	19.87	19.3	18.79		(90)
									f	iLA = Livin	g area ÷ (4	4) =	0.56	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.55	19.84	20.19	20.47	20.56	20.59	20.59	20.59	20.58	20.4	19.92	19.5		(92)
Apply	adjustn	nent to t	he mear	n internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.55	19.84	20.19	20.47	20.56	20.59	20.59	20.59	20.58	20.4	19.92	19.5		(93)
8. Sp	ace hea	ting requ	uirement											
Set T	i to the i	mean int	ernal ter	mperatur	e obtain	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm):	may	Udit	Uui	7.03	000		1101	200		
(94)m=	0.99	0.96	0.89	0.74	0.55	0.38	0.26	0.3	0.52	0.84	0.97	0.99		(94)
Us <mark>efu</mark>	ul gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	5 <mark>4</mark> 6.84	666.24	753.59	740.37	603.47	409.52	273.48	286.45	440.1	58 <mark>0.01</mark>	547.16	512.14		(95)
Mo <mark>ntl</mark>	nly aver	age ex <mark>te</mark>	ernal terr	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	los <mark>s rate</mark>	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				()
(97)m=	1078.33	1053.8	963.52	804.96	615.28	410.72	273.61	286.71	446.39	680.48	894.03	1071.8		(97)
Space	e heatin	g require	$\frac{15610}{15610}$	r each m	Nonth, K	/Vh/moni	$\ln = 0.02$	24 x [(97)m – (95 I)m] x (4 ⁻	1)m	116 20		
(90)11=	390.43	200.44	150.19	40.01	0.79	0	0	Tota		(k)//b///00	249.75	410.30	1609.22	(98)
•								TOLA	ii pei yeai	(KVVII/yeai) = Sum(9	0)15,912 =	1000.23	
Space	e neatin	g require	ement in	KVVN/m ²	/year								24.05	(99)
9b. En	ergy rec	quiremer	nts – Coi	mmunity	heating	scheme								
This pa Fractio	art is us on of spa	ed for sp ace heat	ace hea from se	iting, spa condary/	ace cooli Isupplen	ing or wa nentary l	ater heat	ting prov (Table 1	rided by a 1) '0' if n	a comm one	unity sch	neme.	0	(301)
Fractio	n of spa	ace heat	from co	mmunity	system	$1 - (30^{2})$	1) <u>-</u>		1) 0 11 1	0110			1	(302)
The ser				<i>(</i>	System	1 – (50	·) —	-llauna fam		un to form	- 44 - 11 4 4			(002)
includes	nmunity so boilers, h	cneme ma leat pump:	y obtain ne s, geotheri	eat from se mal and wa	veral soul aste heat f	rces. The p from power	roceaure r stations.	allows for See Appel	CHP and l ndix C.	up to tour (other neat	sources; ti	ne latter	
Fractio	on of hea	at from C	Commun	ity CHP		,							0.6	(303a)
Fractio	on of cor	nmunity	heat fro	m heat s	ource 2								0.4	(303b)
Fractio	on of tota	al space	heat fro	m Comn	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fractio	on of tota	al space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor	for cont	rol and	charging	method	(Table 4	4c(3)) fo	r commu	unity hea	ating sys	tem			1	(305)
Distrib	ution los	ss factor	(Table 1	I2c) for c	ommun	ity heatir	ng syste	m					1.1	(306)
Space	heating	g											kWh/ye	ear
Annua	l space	heating	requiren	nent									1608.23	

Space heat from Community CHP	(98) x (304a) x	(305) x (306) =	1061.43	(307a)
Space heat from heat source 2	(98) x (304b) x	(305) x (306) =	707.62	(307b)
Efficiency of secondary/supplementary heating system in % (from T	Table 4a or Appen	dix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 1	00 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			2070.06	7
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x	(305) x (306) =	1366.24	(310a)
Water heat from heat source 2	(64) x (303b) x	(305) x (306) =	910.83	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307	e) + (310a)(310e)] =	40.46	(313)
Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314)	=	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from out	side		234.58	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b	o) + (330g) =	234.58	(331)
Energy for lighting (calculated in Appendix L)			299	(332)
12b. CO2 Emissions – Community heating scheme				
Electrical efficiency of CHP unit			32	(361)
Heat efficiency of CHP unit			64	(362)
	Ener <mark>gy</mark> kWh/year	Emission factor kg CO2/kWh	Emiss <mark>ions</mark> kg CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	1658.49 ×	0.22	358.23	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	530.72 ×	0.52	-275.44	(364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2134.75 ×	0.22	461.11	(365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	683.12 ×	0.52	-354.54	(366)
Efficiency of heat source 2 (%) If there is CHP using two	o fuels repeat (363) to	(366) for the second fue	el 96	(367b)
CO2 associated with heat source 2 [(307b)+(310	b)] x 100 ÷ (367b) x	0.22	= 364.15	(368)
Electrical energy for heat distribution [(313	3) x	0.52	= 21	(372)
Total CO2 associated with community systems (363)(366) + (368)(372	r) =	= 574.51	(373)
CO2 associated with space heating (secondary) (309) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous	s heater (312) x	0.22	= 0	(375)
Total CO2 associated with space and water heating (373) + (374) + (375) =		574.51	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	= 121.75	(378)
CO2 associated with electricity for lighting (332))) x	0.52	= 155.18	(379)
Total CO2, kg/year sum of (376)(382) =			851.44	(383)

Dwelling CO2 Emission Rate $(383) \div (4) =$ El rating (section 14)

12.73	(384)
89.8	(385)



			User D	etails:									
Assessor Name: Software Name:	Stroma FSA	P 2012		Stroma Softwa	a Num Ire Ver	ber: sion:		Versio	on: 1.0.1.24				
		Р	roperty /	Address:	Flat 4								
Address :													
1. Overall dwelling dim	iensions:		-	()									
Cround floor			Area	a(m²)	(4)	Av. He	ight(m)		Volume(m ³)				
				1.18	(1a) x	2	2.5	(2a) =	177.95	(3a)			
Total floor area TFA = (1a)+(1b)+(1c)+(1	d)+(1e)+(1r	1) 7	1.18	(4)					_			
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	177.95	(5)			
2. Ventilation rate:													
	main heating	secondar heating	у	other		total			m ³ per hour				
Number of chimneys	0	+ 0	+	0] = [0	X 4	40 =	0	(6a)			
Number of open flues	0	+ 0	¯ + ¯	0] = [0	x	20 =	0	(6b)			
Number of intermittent f	ans				Ē	0	x ′	10 =	0	(7a)			
Number of passive vent	S				Γ	0	x ′	10 =	0	(7b)			
Number of flueless gas	fires				Г	0	X 4	40 =	0	(7c)			
Number of flueless gas fires 0 x 40 = 0 Air changes per													
Infiltration due to chimne	eys, flues and fan	S = (6a) + (6b) + (7)	(a)+(7b)+(7	7c) =		0	(16)	÷ (5) =	0	(8)			
Number of storeys in	the dwelling (ns)	intended, proceed	<i>a io</i> (<i>17)</i> , c		onunue no	5m (9) to (10)		0	7(9)			
Additional infiltration							[(9)	-1]x0.1 =	0	(10)			
Structural infiltration:	0.25 for steel or ti	mber frame or	0.35 for	masonr	y constr	uction			0	 (11)			
if both types of wall are deducting areas of oper	present, use the value nings); if equal user 0.	e corresponding to 35	the greate	er wall area	a (after					-			
If suspended wooden	floor, enter 0.2 (u	unsealed) or 0.	1 (seale	d), else	enter 0				0	(12)			
lf no draught lobby, e	nter 0.05, else en	ter 0							0	(13)			
Percentage of window	vs and doors drau	ught 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	, q50, expressed	in cubic metre	s per ho	our per so	quare m	etre of e	envelope	area	3	(17)			
If based on air permeab	bility value, then ($(8) = [(17) \div 20] + (8)$	s), otherwi	se(18) = (io) moobility	ia haina w	and		0.15	(18)			
Number of sides shelter	ed	lesi nas been don	le of a deg	liee all pei	meaning	is being us	seu		3	7(19)			
Shelter factor	00			(20) = 1 - [0.075 x (1	9)] =			0.78	(20)			
Infiltration rate incorpora	ating shelter facto	r		(21) = (18)	x (20) =				0.12] (21)			
Infiltration rate modified	for monthly wind	speed								-			
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind s	peed 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 $(22a)m = 0$	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					
	I			•			•	•					

Adjust	ed infiltr	ation rat	e (allow	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
<u> </u>	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If me	ate etter	ctive air al ventila	change	rate for t	he appli	cable ca	se						0.5	(23a)
lf exh	aust air h	eat pump (usina App	endix N. (2	3b) = (23a	a) × Fmv (e	equation (1	N5)) . othei	wise (23b) = (23a)			0.5	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use fa	actor (from	n Table 4h) =	, (,			77.25	(23c)
a) If	balance	d mech:	anical ve	ntilation	with he	at recove	erv (MVI	- - - - - - - - - - - - - - - - - - -	n)m = (22)	2h)m + (23h) x [1	l – (23c)	<u> </u>	(200)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(24a)
b) If	balance	d mecha	ı anical ve	entilation	without	heat rec	L Coverv (N	I //V) (24b)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	use ex	ract ver	ntilation of	n pripositiv	re input v	ventilatio	n from c	outside					
,	if (22b)n	n < 0.5 ×	(23 b), 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					
i 	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]		-	I	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in boy	(25)			0.05	l	(05)
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	-0.22	0.23	0.24	0.24	0.25		(25)
3. He	at l <mark>osse</mark>	s and he	eat loss	paramete	er:									
ELEN	<mark>/IE</mark> NT	Gros	SS (mr 2)	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value		A X k
Doore		area	(m²)	II	12	A,r		vv/m2		(\vv)	n)	KJ/M2+I		KJ/K
Windo		.1				2.1			=	4.2	H			(20)
Windo	ws Type					8.25		/[1/(0.0)+	0.04] =	6.4	H			(27)
Walla	ws type	; 2				15.71		/[1/(0.8)+	0.04] =	12.18	닏,			(27)
vvalis		91.8	8	26.0	6	65.74	1 ×	0.13		8.55	╡╞		\dashv	(29)
Roof	,	71.1	8	0		71.18	3 ×	0.12	= [8.54				(30)
Total a	area of e	lements	, m²			162.9	8		<i></i>					(31)
* for win ** inclua	dows and le the area	roof winde as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and pari	alue calcul titions	ated using	formula 1.	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)	,			(26)(30)	+ (32) =				39.86	(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	: Medium		250	(35)
For desi can be ı	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	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						13.8	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			53.66	(37)
Ventila	ation hea	at loss ca	alculated	monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	15.35	15.18	15.01	14.16	13.99	13.14	13.14	12.97	13.48	13.99	14.33	14.67		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	69.02	68.85	68.67	67.82	67.65	66.8	66.8	66.63	67.14	67.65	67.99	68.33		
										Average =	Sum(39)1.	12 /12=	67.78	(39)

Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.96	0.96		
								ļ	,	Average =	Sum(40)1.	12 /12=	0.95	(40)
Numbe	r of day	/s in moi	nth (Tab		Mov	lun		Aug	Son	Oct	Nov	Dee		
(11)m-	Jan 21	29 29	21	20	1VIAY	Jun	31 21	Aug	Sep 20	21	20	21		(41)
(41)11=	31	20	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter hea	ting ene	rgy regu	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 ×	([1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	27		(42)
Annual Reduce t not more	averag the annua that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c 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	92 f	.86		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage i	n litres per	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	102.15	98.43	94.72	91	87.29	83.57	83.57	87.29	91	94.72	98.43	102.15		_
Ener <mark>gy c</mark>	ontent of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,ı	m x nm x L	OTm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1114.33	(44)
(45)m=	1 <mark>5</mark> 1.48	132.49	136.71	119.19	114.37	<mark>9</mark> 8.69	91.45	104.94	106.19	123.76	135.09	146.7		_
lf instanta	aneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1461.06	(45)
(46)m=	<mark>2</mark> 2.72	19.87	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22.01		(46)
Water a	storage	loss:												
Storage	e volum	ie (litres)	rinciuair	ng any so	biar or v	WHRS	storage		ame ves	sei		0		(47)
If comn Otherw	nunity r ise if no	eating a	and no ta hot wate	ank in dw er (this ir	/elling, e ocludes i	nter 110 nstantar) litres in Decus co	1 (47) Smbi boil	ers) ente	er 'O' in <i>(</i>	(47)			
Water s	storage	loss:	not wat			notantai	10000 00							
a) If m	anufact	urer's de	eclared l	loss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	e 2b								0		(49)
Energy	lost fro	m water	r storage	e, kWh/ye	ear			(48) x (49)) =		1	10		(50)
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:						1	
Hot wa	ter stor	age loss	actor fi	rom Tabl	le 2 (kW	h/litre/da	ay)				0.	02		(51)
Volume	e factor	from Ta	ble 2a	011 4.5							1	03		(52)
Tempe	rature f	actor fro	m Table	e 2b							0	.6		(53)
Enerav	lost fro	om water	r storage	e kWh/ve	ear			(47) x (51)) x (52) x (53) =		03		(54)
Enter ((50) or ((54) in (5	55)	,, j					, , , ,	,	1.	03		(55)
Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinde	r contain	s dedicate	d solar sto	l prage, (57)	I m = (56)m	x [(50) – (I (H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m =	(58) ÷ 36	65 × (41)	m				-	
(mod	lified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	alculated	for eac	h month	(61)m =	(60)) ÷ 36	5 × (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	neating c	alculated	l for	each	month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	206.76	182.41	191.99	172.68	169.64	15	2.18	146.73	160.22	159.69	179.04	188.59	201.98		(62)
Solar DI	-IW input	calculated	using Ap	pendix G o	r Appendix	H (r	negativ	e quantity	/) (enter 'C)' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	S and/or	WWHRS	ар	plies,	see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter												
(64)m=	206.76	182.41	191.99	172.68	169.64	15	2.18	146.73	160.22	159.69	179.04	188.59	201.98		
			-						Out	put from w	ater heate	er (annual)₁	12	2111.9	(64)
Heat g	ains fro	m water	heating	g, kWh/m	onth 0.2	5´[0.85 :	× (45)m	+ (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	94.59	83.99	89.68	82.43	82.25	75	5.61	74.63	79.11	78.1	85.37	87.71	93		(65)
inclu	de (57)	m in calo	ulation	of (65)m	only if c	ylin	der is	in the c	dwelling	or hot w	ater is f	rom com	munity h	heating	
5. In	ternal g	ains (see	e Table	5 and 5a):	-			-				-	-	
Metab	olic gai	ns (Table	5) Wa	atts											
motab	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	113.72	113.72	113.72	113.72	113.72	11	3.72	113.72	113.72	113.72	113.72	113.72	113.72		(66)
Liahtin	a dains	(calcula	ted in A		L. equat	ion	L9 or	L9a), a	lso see	Table 5					
(67)m=	17.83	15.84	12.88	9.75	7.29	6	.15	6.65	8.64	11.6	14.73	17.19	18.33	1	(67)
Applia	nces da	ins (calc	ulated i	n Appen	dix Lea	uati	on I 1	3 or 1:	3a) also	see Ta	ble 5	!			
(68)m=	200.04	202.11	196.88	185.74	171.69	15	8.48	149.65	147.57	152.81	163.94	178	191.21	1	(68)
Cookir			ted in 4	Appendix		ion	115 0	or 15a)		e Table	5			J	
(69)m=	34.37	34.37	34.37	34.37	34.37	34	37	34.37	34.37	34.37	34.37	34.37	34.37	1	(69)
Dump	and fa	ne gaine	(Table	52)											
(70)m-				$\frac{5a}{1}$	0		0	0	0	0	0	0	0	1	(70)
							<u> </u>	v	Ū	Ů	Ŭ	Ů	Ŭ]	(
(71)m-) 0 00	00.08	00.08	00.08	00.08	00.08	00.08	1	(71)
(/ I)III-	-30.30		-30.30	-90.90	-30.30	-3	0.30	-30.30	-30.30	-90.90	-30.30	-30.30	-30.30]	()
vvater	neating	gains (1	able 5)	111 40	110 55	10	5 01	100.21	106.24	100.40	444 75	101.00	105	1	(72)
(72)11=	127.14	124.99	120.54	114.40	110.55	10	(00)	100.31	100.34	100.40	(70) - (7	121.02	125	J	(12)
I otal	nterna	i gains =	007.44	007.00	040.04	00		040.70		+ (69)11 + 1	(70)m + (1	(1) (72)		1	(72)
(73)m=	402.12	400.06	367.41	367.09	340.04	32	.0.76	313.72	319.07	330	350.53	374.13	391.05		(13)
Solar o	iai gain nains are	s. calculated	usina sol	ar flux from	Table 6a :	and :	associa	ated equa	tions to co	onvert to th	e annlica	ble orientat	ion		
Orient	ation:	Access F		Area			Flux	((n		FF		Gains	
Onorm		Table 6d	aotor	m²	L		Tab	le 6a	Г	able 6b	Т	able 6c		(W)	
North	0.9x	0.5/	,	(15	71	×Г	10) 63	×	04	<u> к</u> г	0.7		22 73	7(74)
North	0.94	0.54			71	ΩL γΓ		1.32		0.4	╡╻╷	0.7	=	12 11	」 ^(***)] ₍₇₄₎
North	0.0A	0.54	=		71	ΩL γΓ	20	1.53		0.4	╡ᆠ┟	0.7	=	72.00	」 ^{(,, ,,})] ₍₇₄₎
North	0.04	0.54	(71	ι Γ	54			0.4	╡╏╏	0.7		110 57	」(' ^{™)}](74)
North	0.9X	0.54	<u> </u>		74	^ L _ Г	50	1.70		0.4	╡゜┝	0.7		450.70	
North	0.9X	0.54)	15	.71	^ L	74	1.72	×	0.4	×	0.7	=	159.73	(74)

North	0.9x	0.54		x	15.	71	x	7	79.99	x	(0.4	×	0.7		=	170.99	(74)
North	0.9x	0.54		x	15.	71	x	7	74.68	x	(0.4	_ × [0.7		=	159.64	(74)
North	0.9x	0.54		x	15.	71	x	5	59.25	x	(0.4	×	0.7		=	126.66	(74)
North	0.9x	0.54		x	15.	71	x	4	11.52	x	(0.4	×	0.7		=	88.75	(74)
North	0.9x	0.54		x	15.	71	x	2	24.19	x	(0.4	×	0.7		= [51.71	(74)
North	0.9x	0.54		x	15.	71	x	1	3.12	x	(0.4	×	0.7		= [28.04	(74)
North	0.9x	0.54		x	15.	71	x		8.86	x	(0.4	×	0.7		= [18.95	(74)
West	0.9x	0.54		x	8.2	5	x	1	9.64	x	(0.4	×	0.7		= [22.05	(80)
West	0.9x	0.54		x	8.2	5	x	3	38.42	x	(0.4	×	0.7		= [43.13	(80)
West	0.9x	0.54		x	8.2	5	x	6	63.27	x	(0.4	x	0.7		=	71.03	(80)
West	0.9x	0.54		x	8.2	5	x	9	92.28	x	(0.4	×	0.7		= [103.6	(80)
West	0.9x	0.54		x	8.2	5	x	1	13.09	x	(0.4	×	0.7		= [126.96	(80)
West	0.9x	0.54		x	8.2	5	x	1	15.77	x	(0.4	×	0.7		=	129.97	(80)
West	0.9x	0.54		x	8.2	5	x	1	10.22	x	(0.4	×	0.7		= [123.74	(80)
West	0.9x	0.54		x	8.2	5	x	9	94.68	x	(0.4	x	0.7		= [106.29	(80)
West	0.9x	0.54		x	8.2	5	x	7	73.59	x	(0.4	×	0.7		= [82.62	(80)
West	0.9x	0.54		x	8.2	5	x	4	15.59	x	(0.4	x	0.7		= [51.18	(80)
West	0.9x	0.54		x	8.2	5	x	2	24.49	х		0.4	x	0.7		=	27.49	(80)
West	0.9x	0.54		x	8.2	5	x	1	6.15	x		0.4	×	0.7		- [18.13	(80)
Solar g	<mark>gain</mark> s in	watts, <mark>ca</mark>	l <mark>cu</mark> lat	ed	for eacl	n mont	th			(83)m	n = Sum	ı(74)m	. <mark>(8</mark> 2)m		_			
(83)m=	44.78	86.58	144.8	5	222.17	286.69	3 3	00.96	283.38	232	.95 1	71.37	102.89	55.54	37.	08		(83)
Total (gains – i	nternal a	nd sol	ar	(84)m =	: (73)n	ו + (ד	83)m	, watts	-	_			_	-			
(84)m=	446.9	486.63	532.2	7	589.27	633.3	4 6	27.72	597.11	552	.62 5	501.37	453.43	429.67	428	5.74		(84)
7. Me	ean inter	nal temp	eratur	e (heating	seasc	on)											
Temp	perature	during h	eating	pe	eriods ir	the liv	ving	area	from Tal	ble 9	, Th1 ((°C)					21	(85)
Utilis	ation fac	tor for ga	ains fo	or li	ving are	a, h1,	m (s	ee Ta	ble 9a)	·								
	Jan	Feb	Ma	r	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	D	ec		
(86)m=	1	1	0.99		0.95	0.85		0.66	0.49	0.5	55	0.82	0.97	0.99	1			(86)
Mear	n interna	l tempera	ature i	n li	iving are	ea T1 ((follo	ow ste	ps 3 to 7	7 in T	able 9	9c)		-				
(87)m=	20.04	20.15	20.36	;	20.65	20.88	2	20.98	21	20.	99 2	20.93	20.64	20.29	20.	02		(87)
Tem	perature	during h	eating	pe	eriods ir	rest o	of dw	velling	from Ta	able 9	9, Th2	: (°C)						
(88)m=	20.11	20.11	20.11		20.12	20.12	2	20.13	20.13	20.	14 2	20.13	20.12	20.12	20.	12		(88)
Utilis	ation fac	tor for a	ains fo	or re	est of d	velling	. h2	.m (se	ee Table	9a)	•			•	•			
(89)m=	1	0.99	0.98	T	0.94	0.81		0.58	0.39	0.4	45	0.75	0.96	0.99	1	I		(89)
Moor		l temper	aturo i	_ t	ho rost	of dwe		T2 (f	I ollow ste		to 7 i	n Table						
(90)m=	18.82	18.98	19.29		19.71	20.01		20.12	20.13	20.	13	20.07	19.7	19.2	18	.8		(90)
x/											_	fL	A = Liv	ing area ÷ (4) =	-	0.33) (91)
N4	, into	1 to me		f		ole de	ر مالاند	a) (۱۸ ۲۷	. /4	£1 A \	т о		·		L		` `
		1 temperative		ror	20.02			(g) = f	LA X 11	+ (1	- TLA)) × 12 20.36	20.01	10.56	10	2		(02)
(52)11=	1 10.22	1 10.07	13.04	· •	20.02	20.29	1 4	_0.41	1 20.42	1 20.	74 4	20.00	20.01	1 19.00	1 19	.		(02)

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

(93)m=	19.22	19.37	19.64	20.02	20.29	20.41	20.42	20.42	20.36	20.01	19.56	19.2		(93)
8. Spa	ice heat	ting requ	iirement											
Set Ti the uti	to the r lisation	nean inte factor fo	ernal ter or gains	nperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of ⁻	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Γ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for ga	ains, hm	:										
(94)m=	1	0.99	0.98	0.94	0.82	0.6	0.43	0.48	0.77	0.96	0.99	1		(94)
Usefu	gains,	hmGm ,	W = (94	1)m x (84	4)m									
(95)m=	444.86	482.66	521.77	552.04	516.52	379.01	254.24	265.96	386.14	433.76	425.63	427.17		(95)
Month	ly 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 l	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m ×	‹ [(93)m-	– (96)m]				
(97)m=	1029.9	996.22	902.68	754.08	581.44	387.84	255.19	267.84	420.1	636.93	847.41	1025.04		(97)
Space	heating	g require	ement fo	r each m	nonth, k	Nh/mont	th = 0.02	4 x [(97))m – (95)m] x (4	1)m			
(98)m=	435.27	345.11	283.4	145.46	48.3	0	0	0	0	151.16	303.68	444.81		_
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	2157.19	(98)
Space	heating	g require	ement in	kWh/m²	/year								30.31	(99)
9b. Ene	ergy req	uiremen	ts – Cor	nmunity	heating	scheme	;							
This pa Fraction	rt is use h of spa	ed for sp	ace hea from se	ting, spa	ace cooli (supplen	ing or wa	ater heati heating (ing prov Table 11	ided by a 1) '0' if n	a c <mark>omm</mark> one	unity sch	neme.	0] (301)
Fraction	action of space heat from community system 1 – (301) =													
Fraction	action of space heat from community system 1 – (301) =													
The com	munity sc	heme may	obtain he	eat from se	everal sour	ces. The p	procedure a	allows for	CHP and u	up to four o	other heat	sources; ti	he latter	
Fraction	n of hea	it from C	ommun	ity CHP	iste neat i	rom power	r stations. c	see Apper	idix C.				0.6	(303a)
Fractio	n of con	nmunity	heat fro	m heat s	ource 2								0.4	(303b)
Fractio	n of tota	I space	heat fro	m Comm	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fraction	n of tota	I space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commu	nity hea	ting syst	tem			1	(305)
Distribu	ition los	s factor	(Table 1	2c) for c	commun	ity heatir	ng syster	n					1.1	(306)
Space	heating	J											kWh/year	-
Annual	space I	neating I	requirem	nent									2157.19	
Space	heat fro	m Comr	nunity C	HP					(98) x (30	04a) x (30	5) x (306) :	=	1423.75	(307a)
Space	heat fro	m heat s	source 2						(98) x (30	04b) x (30	5) x (306) :	=	949.17	(307b)
Efficien	cy of se	econdary	/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space	heating	requirer	nent froi	m secon	dary/su	oplemen	tary syste	em	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water I Annual	h eating water h	eating r	equirem	ent									2111.9]
lf DHW Water h	from concept	ommunit n Comm	y schem nunity C	ne: HP					(64) x (30)3a) x (30!	5) x (306) :	- -	1393.85	(310a)
Water h	neat from	n heat s	ource 2						(64) x (30)3b) x (30	5) x (306) :	=	929.24](310b)
Electric	ity used	for hea	t distribu	ution				0.01	× [(307a).	(307e) +	(310a)([310e)] =	46.96](313)

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):	6.24c		
mechanical ventilation - balanced, extract or positive input from o	butside	249.66	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	249.66	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)
12b. CO2 Emissions – Community heating scheme			7
Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		64	(362)
	Energy Emission facto kWh/year kg CO2/kWh	or Emissions kg CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	2224.61 × 0.22	480.52	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	711.87 × 0.52	-369.46	(364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2177.9 X 0.22	470.43	(365)
less credit emissions for electricity -(310a) × (361) ÷ (362) =	696.93 × 0.52	-361.71	(366)
Efficiency of heat source 2 (%) If there is CHP using	two fuels repeat (363) to (366) for the second f	uel 96	(367b)
CO2 associated with heat source 2 [(307b)+(3	310b)] x 100 ÷ (367b) x 0.22	= 422.64	(368)
Electrical energy for heat distribution [(313) x 0.52	= 24.37	(372)
Total CO2 associated with community systems (3	363)(366) + (368)(372)	= 666.79	(373)
CO2 associated with space heating (secondary) (3	309) x 0	= 0	(374)
CO2 associated with water from immersion heater or instantaneo	ous heater (312) x 0.22	= 0	(375)
Total CO2 associated with space and water heating (3	373) + (374) + (375) =	666.79	(376)
CO2 associated with electricity for pumps and fans within dwellin	g (331)) x 0.52	= 129.58	(378)
CO2 associated with electricity for lighting (3	332))) x 0.52	= 163.45	(379)
Total CO2, kg/year sum of (376)(382) =		959.82	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =		13.48	(384)
El rating (section 14)		88.93	(385)

				User D	etails:						
Assessor Name: Software Name:	Stroma FSA	AP 201	2		Strom Softwa	a Num are Vei	ber: rsion:		Versic	on: 1.0.1.24	
			Р	roperty	Address	: Flat 5					
Address :											
1. Overall dwelling dimen	sions:										
				Are	a(m²)		Av. Hei	ight(m)	-	Volume(m ³)	_
Ground floor				4	2.57	(1a) x	2	2.5	(2a) =	106.42	(3a)
First floor				3	32.51	(1b) x	2	2.5	(2b) =	81.27	(3b)
Second floor				3	31.06	(1c) x	2	2.5	(2c) =	77.65	(3c)
Total floor area TFA = (1a)	+(1b)+(1c)+(1	ld)+(1e	e)+(1r	ı) <u> </u>	06.14	(4)			-		
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	265.35	(5)
2. Ventilation rate:											
	main heating	se h	econdar leating	у	other		total			m ³ per hour	
Number of chimneys	0	(6a)									
Number of open flues	0	+	0	+	0	_ = _	0	x :	20 =	0	(6b)
Number of intermittent fans	3						0	x	10 =	0	(7a)
Number of passive vents							0	x	10 =	0	(7b)
Number of flueless gas fire	s						0	X	40 =	0	(7c)
									Air ch	nanges per hou	ır
Infiltration due to chimneys	, flu <mark>es and fa</mark>	ns = (6	a)+(6b)+(7	a)+(7b)+(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has bee	en carried out or i	is intende	ed, procee	d to (17),	otherwise o	continue fr	om (9) to (16)			
Number of storeys in the	dwelling (ns)									0	(9)
Additional infiltration								[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	5 for steel or	timber f	frame or	0.35 fo	r masoni	ry constr	ruction			0	(11)
if both types of wall are pres	sent, use the values (le corres	ponding to	the great	ter wall are	a (after					
If suspended wooden flo	or, enter 0.2 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	7(12)
If no draught lobby, ente	r 0.05. else el	nter 0		. (00041	,	00				0	(12)
Percentage of windows	and doors dra	uaht st	ripped							0](14)
Window infiltration		0	••		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13) +	⊦ (15) =		0	(16)
Air permeability value, q	50, expressed	d in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	3	(17)
If based on air permeability	value, then	(18) = [(1	7) ÷ 20]+(8	B), otherw	ise (18) = ((16)		-		0.15	(18)
Air permeability value applies	if a pressurisatior	n test has	s been don	e or a de	gree air pe	rmeability	is being us	sed			
Number of sides sheltered										2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	g shelter facto	or			(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified for	monthly wind	speed	k I							1	
Jan Feb M	1ar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	
Monthly average wind spec	ed from Table	e 7					1			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 = $(22)m \div 4$									
(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		
Adjusted infiltration rate (allowing for shelter	and wind s	peed) =	(21a) x	(22a)m					
0.16 0.16 0.16 0.14 0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effective air change rate for the ap	plicable ca	se		-					(02-)
If the main call vertilation. If exhaust air heat nump using Appendix N (23b) = (23a) x Emv (e	equation (N	(5)) othe	rwise (23h) = (23a)			0.5	(23a)
If balanced with heat recovery: efficiency in % allowing	na for in-use f	actor (from	n Table 4h) =) = (200)			0.5	(230)
a) If balanced mechanical ventilation with	heat recove	⊃rv (M\/⊦	HR) (24a	/ a)m = (22	2h)m + ('	23h) 🗙 [ʻ	1 – (23c)	03.7 ∸ 1001	(200)
(24a)m= 0.34 0.34 0.34 0.32 0.32	2 0.3	0.3	0.3	0.31	0.32	0.32	0.33	. 100]	(24a)
b) If balanced mechanical ventilation with	ut heat rec	coverv (N	L /IV) (24b	m = (22)	2b)m + (2	23b)			
(24b)m= 0 0 0 0 0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or pos	itive input v	/entilatio	n from o	outside					
if (22b)m < 0.5 × (23b), then (24c) = (2	23b); otherv	vise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m= 0 0 0 0 0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house pos	itive input	ventilatio	on from I	oft					
if (22b)m = 1, then (24d)m = (22b)m o	therwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]				(244)
(24d)m= 0 0 0 0 0 0	0				0	0	0		(24u)
Effective air change rate - enter (24a) or (2	24b) or (240	c) or (24		(25)	0.22	0.22	0.22		(25)
(25)11= 0.54 0.54 0.54 0.52 0.52	0.3	0.3	0.5	0.51	0.32	0.32	0.33		(23)
3. Heat losses and heat loss parameter:									
ELEMENT Gross Openings area (m ²) m ²	Net Ar A .r	ea n²	U-val W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²·ł	↔ <	A X k kJ/K
Doors	2.1	X	2		4.2	<i>,</i>			(26)
Windows Type 1	6.21	x1/	/[1/(0.8)+	0.04] =	4.81				(27)
Windows Type 2	9.55	x1/	/[1/(0.8)+	0.04] =	7.4				(27)
Windows Type 3	9.82	x1/	/[1/(0.8)+	0.04] =	7.61				(27)
Windows Type 4	5.77		/[1/(0.8)+	0.04] =	4.47				(27)
Windows Type 5	9.55		/[1/(0.8)+	0.04] =	7.4	=			(27)
Windows Type 6	6.5		/[1/(0.8)+	0.04] =	5.04	=			(27)
Windows Type 7	5.24		/[1/(0.8)+	0.04] =	4.06	=			(27)
Windows Type 8	5.57		/[1/(0.8)+	0.04] =	4.32				(27)
Windows Type 9	4 07		/[1/(0.8)+	0.04] =	3 16	=			(27)
Windows Type 10	5.62		/[1/(0.8)+	0.04] =	4.36				(27)
Walls Type1 40.22 25.58	14.64	x	0.13	= [1.9	Ξ r			(29)
Walls Type2 39 17 21 82	17.35		0.13		2.26			4 6	(29)
Walls Type3 39 17 20 5	18.67		0.13		2.20	╡┟		\exists	(29)
Roof 31.06 0	31 06		0.13		2.70	╡┟			(30)
Total area of elements. m ²	151 7	^	0.12	[0.70	L			(31)
Devit all			0		0				(22)
Party wall	631	X			0			1 1	1021

* for wir ** includ	ndows and le the area	roof wind as on both	ows, use e sides of ir	ffective wi	ndow U-va Is and part	alue calcul titions	lated using	formula 1.	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				67.15	(33)	
Heat c	windows and roof windows, use effective window U-value calculated using formula <i>I</i> , f(1/U-value)+0.04] as given in paragraph 3.2 nalude the areas on both states of internal walks and partitions 67.15														
Therm	al mass	parame	ter (TMF	• = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)	
For des can be i	ign assess used instea	ments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f			
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	K						11.1	(36)	
if details	s of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)								_	
Total f	abric he	at loss							(33) +	(36) =			78.25	(37)	
Ventila	ation hea	t loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	30.13	29.85	29.57	28.17	27.9	26.5	26.5	26.22	27.06	27.9	28.45	29.01		(38)	
Heat t	ransfer o	oefficie	nt, W/K						(39)m	= (37) + (3	38)m				
(39)m=	108.38	108.1	107.82	106.42	106.14	104.75	104.75	104.47	105.31	106.14	106.7	107.26			
							1			Average =	Sum(39)1.	12 /12=	106.35	(39)	
Heat lo	Heat loss parameter (HLP), W/m ² K (40)m = (39)m \div (4) (40)m = 1.02 1.02 1 1 0.99 0.98 0.99 1 1.01 1.01 (40)m = 1.02 1.02 1 1 0.99 0.99 0.99 1 1.01 1.01 Average = Sum(40) ₁₁₂ /12=														
(40)m=	1.02	1.01		_											
	<u> </u>	12 /12=	1	(40)											
Numb	er of day	's in moi	nth (Tab	le 1a)					-			_	1		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$															
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)	
4. Wa	ater heat	ing ene	rgy <mark>requ</mark>	irement:								kWh/y	ear:		
Accur		nancy	м											(40)	
if TF	A > 13.9 A $A = 13.9$), N = 1), N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0	00 <mark>13 x (</mark>	TFA -13.	9)	79		(42)	
Annua	l averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.74		(43)	
Reduce	the annua	l average	hot water	usage by a	5% if the a	lwelling is	designed t	to achieve	a water us	se target o	f				
not mor	e that 125	litres per	oerson per I	aay (all w	ater use, r	not and co I	1 1			r			I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wat	er usage II	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	i able 1c x	(43)					1		
(44)m=	116.31	112.08	107.85	103.62	99.39	95.17	95.17	99.39	103.62	107.85	112.08	116.31		_	
Enoral	contont of	hot wator	used cal	culated m	onthly - 1	100 v Vd r	т v рт v Г)Tm / 2600	kW/b/mor	Total = Su	m(44) ₁₁₂ =	= 0.1d)	1268.87	(44)	
Energy		not water	useu - cai		5770779 = 4.	190 x vu,i						<i>c, ru)</i>	I		
(45)m=	172.49	150.86	155.67	135.72	130.23	112.38	104.13	119.49	120.92	140.92	153.83	167.05		-	
lf instan	taneous w	ater heati	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1663.69	(45)	
(46)m=	25.87	22.63	23.35	20.36	19.53	16.86	15.62	17.92	18.14	21.14	23.07	25.06		(46)	
Water	storage	loss:					-								
Storag	je volum	e (litres)) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)	
If com	munity h	eating a	ind no ta	nk in dw	velling, e	nter 110) litres in	(47)	`	(0) -	(-)				
Other	vise it no	stored	not wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)				
a) If m	siorage	urer'e di	eclared I	oss facto	or is kno	wn (k\//	n/dav).					0	l	(48)	
Tomo	andiaol	actor fro	m Toble	255 18010 26		**** (12.841	"uuy).					0		(40)	
rembe	siature la		in rable	20								υ		(49)	

Energy b) If m Hot wa	y lost fro nanufact ater stor	m water urer's de age loss	r storage eclared o factor fr	, kWh/ye cylinder l com Tabl	ear oss fact e 2 (kWl	or is not h/litre/da	known: ay)	(48) x (49) =		1	10 02		(50) (51)
lf com Volum	munity h	eating s from Ta	see secti ble 2a	on 4.3	- (,					03		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)
Enera	v lost fro	m water	r storage	. kWh/ve	ear			(47) x (51) x (52) x (53) =	1	03		(54)
Enter	(50) or ((54) in (5	55)	, <i>,</i> , .					, (- , (/	1.	03		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m =	32.01	28.92	32.01	30.98	32 01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain:	s dedicate	d solar sto	rage, (57)r	n = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	ix H	()
(57)m-	22.01	28.02	22.01	20.08	32.01	20.08	22.01	22.01	20.08	22.01	20.09	22.01		(57)
(57)11=	32.01	20.92	32.01	30.96	32.01	30.90	32.01	32.01	30.96	32.01	30.96	32.01		(37)
Prima	ry circuit	loss (ar	nnual) fro	om Table	93		()					0		(58)
Primai	ry circuit	loss cal	Iculated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m	r tharma	atat)			
(110												22.26		(50)
(59)m=	23.20	21.01	23.26	22.51	23.20	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(39)
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)
Tota <mark>l h</mark>	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45) <mark>m +</mark>	(46)m +	(57)m +	(59)m + (61)	m
(62)m=	227.77	200.79	210.95	189.21	185.5	165.87	159.41	174.77	174.41	196.2	207.32	222.32		(62)
Solar D	HW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add a	ddi <mark>tiona</mark>	l lines <mark>if</mark>	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)
Outpu	t from w	ater hea	iter					-						
(64)m=	227.77	200.79	210.95	189.21	185.5	165.87	159.41	174.77	174.41	196.2	207.32	222.32		
								Out	out from wa	ater heate	r (annual)₁	12	2314.53	(64)
Heat o	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	
(65)m=	101.57	90.1	95.98	87.92	87.52	80.16	78.85	83.95	83	91.08	93.94	99.76	-	(65)
inclu	L Ide (57)	n in calo	ulation (L of (65)m	only if c	ı vlinder i	s in the o	l dwelling	or hot w	ı ater is fr	i om com	munity h	eating	
5 In	ternal as	nine (soc	Table 5	and 5a	·	ymraer i		unoning	or not n		on con	in an incy in	ouung	
5 . III		(T))		, and 5a										
Metab	olic gain	Eob	<u>5), vvat</u>		May	lup		Δυσ	Son	Oct	Nov	Dec		
(66)m -	130 / 8	130.48	130.48	130.48	130 / 8	130 / 8	139.48	130.48	130.48	139.48	139.48	130.48		(66)
	100.40	(aalaula			100.40		r L Oc) - c			100.40	100.40	100.40		(00)
Lightin	ig gains		ted in Ap		L, equat		r L9a), a L			40.50	00.05			(67)
(67)m=	23.7	21.05	17.12	12.96	9.69	8.18	8.84	11.49	15.42	19.58	22.85	24.36		(07)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also r	see Ta	ble 5		· · · · · ·		()
(68)m=	265.89	268.65	261.7	246.89	228.21	210.65	198.92	196.16	203.11	217.91	236.6	254.16		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95		(69)
Pumps	s and fa	ns gains	(Table 5	ōa)		_								
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58		(71)
							•		•	•	•			

Water	heating	g gains (T	able 5))															
(72)m=	136.52	134.08	129.01		122.11	117.64	1	11.33	105.98	112	.84	115.28	122.4	2 13	0.48	134.09	9		(72)
Total	interna	l gains =						(66)	m + (67)m	n <mark>+ (6</mark> 8	3)m +	(69)m + (70)m +	(71)m	+ (72)r	n			
(73)m=	490.96	488.63	472.67	,	446.81	420.38	3	95.01	378.57	385	.33	398.65	424.7	5 45	4.77	477.46	6		(73)
6. Sc	lar gain	is:																	
Solar	gains are	calculated u	using so	lar	flux from Ta	able 6a	and	assoc	iated equa	tions	to con	vert to th	e appli	cable or	rientati	on.			
Orient	ation:	Access F	actor		Area m ²			Flu Tal	X Ne 6a		Та	g_ ble 6b		Table	FF			Gains	
										1			_		, 00		г	(**)	-
East	0.9x	1		x	6.21		X		9.64	X		0.4	×	<u> </u>	0.7	=	ľ	16.6	(76)
East	0.9x	1		x	9.82		X	1	9.64	X		0.4	×		0.7	=	Ľ	26.25	
East	0.9x	1		x	6.5		X	1	9.64	X		0.4	×		0.7	=	Ľ	17.37	
East	0.9x	1		X	5.62		X	1	9.64	X		0.4	×		0.7	=	Ľ	15.02	(76)
East	0.9x	1		×	6.21		X	3	8.42			0.4	╡ [×]		0.7	=	Ľ	32.47	
East	0.9x	1		x	9.82		X	3	8.42	X		0.4	×		0.7	=	Ľ	51.34	
East	0.9x	1		×	6.5		x	3	8.42	X		0.4			0.7	=	Ľ	33.98	
East	0.9x	1	_	x	5.62		x		8.42	×		0.4			0.7		- L -	29.38	
East	0.9x			x	6.21		X	6	3.27	X		0.4		<u> </u>	0.7	_ ⁼		53.47	
East	0.9x	1		x	9.82		X	6	3.27	x		0.4			0.7		ļ	84.55	$ \begin{bmatrix} (76) \\ (76) \end{bmatrix} $
East	0.9x	1		×	6.5		Х	6	3.27	X		0.4		<u> </u>	0.7	=	Ľ	55.97	
East	0.9x	1		×	5.62		X	6	53.27	X		0.4			0.7		Ľ	48.39	
East	0.9x	1		×	6.21		X	g	2.28	X		0.4		<u> </u>	0.7	=	Ľ	77.98	
East	0.9x	1	4	×	9.82		x	9	2.28	X		0.4		<u>-</u>	0.7	=	Ľ	123.31	
East	0.9x	1		×	6.5		X	9	2.28	X		0.4	X	<u> </u>	0.7	=	Ľ	81.62	
Fast	0.9x	1		x	5.62		x		12.28			0.4	╡ ゚		0.7	=	Ľ	70.57	
Fast	0.9x	1		×	6.21		×		13.09			0.4	╡ Û		0.7		Ľ	95.57	
Fast	0.9x	1		x	9.82		x		13.09			0.4			0.7		Ľ	151.13	(70)
Fast	0.9X	1		×	6.5		×	1	13.09	× v		0.4			0.7			100.03	(70)
Fast	0.9X	1		`	5.62		~		13.09			0.4	╡ Û		0.7		Ľ	07.92	(70) (76)
Fast	0.9X			`	0.21		~		10.77			0.4	╡Ĵ		0.7	=	Ľ	97.03	
Fast	0.3	1	-	`	9.82		Ŷ		15.77			0.4	╡ Û	<u> </u>	0.7	=	: L . T	102.4	(70)
Fast	0.3	1	-	`	5.62		~ ~		15.77			0.4	╡Ĵ	<u> </u>	0.7	=	с L . Г	99.54	$\Box_{(76)}^{(70)}$
East	0.04	1		^	6.02		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	02.14	(70)
Fast	0.04	1	=	• •	0.21		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	147.20	(70)
East	0.04	1	:	^ •	9.02		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	07.40	(70)
East	0.3	1	:	`	5.62		Ŷ		10.22			0.4	╡Ĵ		0.7	=	: L . F	97.49	(70)
East	0.30			• •	6.04	\dashv	Ŷ		10.22			0.4	╡ Û		0.7	\dashv	Ĺ	04.29 20.01	$ \Box_{(76)}^{(70)} $
East	0.98			^ ↓	0.21		×		4.00	^ _		0.4	╡ Û		0.7	=	L T	126.52	$\Box_{(76)}^{(70)}$
East	0.98			^ ↓	9.82	=	×		4.00	^ v		0.4	╡ Û	<u> </u>	0.7	\dashv	L	120.02	$\Box_{(76)}^{(70)}$
East	0.97	1		r x	5.62		Ŷ		4.68			0.4	╡ Û		0.7	\dashv	L I	72 /1	$ \Box_{(76)}^{(70)} $
	0.07				J.02		~	ı ö		~		UT	· ^	1	J.1			12.71	1,1.97

East	0.9x	1	x	6.21	×	73.59	x	0.4	x	0.7] =	62.19	(76)
East	0.9x	1	x	9.82	x	73.59	x	0.4	x	0.7	=	98.34	(76)
East	0.9x	1	x	6.5	x	73.59	x	0.4	x	0.7	=	65.09	(76)
East	0.9x	1	x	5.62	x	73.59	x	0.4	x	0.7	=	56.28	(76)
East	0.9x	1	x	6.21	x	45.59	x	0.4	x	0.7	=	38.53	(76)
East	0.9x	1	x	9.82	x	45.59	x	0.4	x	0.7	=	60.92	(76)
East	0.9x	1	x	6.5	x	45.59	x	0.4	x	0.7	=	40.32	(76)
East	0.9x	1	x	5.62	x	45.59	x	0.4	x	0.7	=	34.87	(76)
East	0.9x	1	x	6.21	x	24.49	x	0.4	x	0.7	=	20.69	(76)
East	0.9x	1	x	9.82	x	24.49	x	0.4	x	0.7	=	32.72	(76)
East	0.9x	1	x	6.5	x	24.49	x	0.4	x	0.7	=	21.66	(76)
East	0.9x	1	x	5.62	x	24.49	x	0.4	x	0.7	=	18.73	(76)
East	0.9x	1	x	6.21	x	16.15	x	0.4	x	0.7	=	13.65	(76)
East	0.9x	1	x	9.82	x	16.15	x	0.4	x	0.7	=	21.58	(76)
East	0.9x	1	x	6.5	x	16.15	x	0.4	x	0.7	=	14.29	(76)
East	0.9x	1	x	5.62	x	16.15	x	0.4	x	0.7	=	12.35	(76)
South	0.9x	0.54	x	9.55	x	46.75	x	0.4	x	0.7	=	60.76	(78)
South	0.9x	0.54	x	9.55	×	46.75	x	0.4	х	0.7] =	60.76	(78)
South	0.9x	0.54	x	5.57	x	46.75	x	0.4	x	0.7] =	35.44	(78)
South	0.9x	0.54	x	4.07	х	46.75] ×	0.4	x	0.7] =	25.89	(78)
South	0.9x	0.54	x	9.55	x	76.57	x	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	x	9.55	×	76.57	x	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	x	5.57	x	76.57	x	0.4	x	0.7	=	58.04	(78)
South	0.9x	0.54	x	4.07	x	76.57	x	0.4	x	0.7	=	42.41	(78)
South	0.9x	0.54	x	9.55	x	97.53	x	0.4	x	0.7	=	126.75	(78)
South	0.9x	0.54	x	9.55	x	97.53	x	0.4	x	0.7	=	126.75	(78)
South	0.9x	0.54	x	5.57	x	97.53	x	0.4	x	0.7	=	73.93	(78)
South	0.9x	0.54	x	4.07	x	97.53	x	0.4	x	0.7	=	54.02	(78)
South	0.9x	0.54	x	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	x	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	x	5.57	x	110.23	x	0.4	x	0.7	=	83.55	(78)
South	0.9x	0.54	x	4.07	x	110.23	x	0.4	x	0.7	=	61.05	(78)
South	0.9x	0.54	x	9.55	x	114.87	x	0.4	x	0.7	=	149.28	(78)
South	0.9x	0.54	x	9.55	x	114.87	x	0.4	x	0.7	=	149.28	(78)
South	0.9x	0.54	x	5.57	x	114.87	x	0.4	x	0.7	=	87.07	(78)
South	0.9x	0.54	x	4.07	x	114.87	x	0.4	x	0.7	=	63.62	(78)
South	0.9x	0.54	×	9.55	x	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	×	9.55	×	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	×	5.57	×	110.55	x	0.4	x	0.7] =	83.79	(78)
South	0.9x	0.54	×	4.07	×	110.55	×	0.4	x	0.7	=	61.23	(78)
South	0.9x	0.54	×	9.55	x	108.01	x	0.4	x	0.7	=	140.37	(78)
South	0.9x	0.54	×	9.55	×	108.01	×	0.4	x	0.7	=	140.37	(78)
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South	0.9x	0.54	×	5.57	x	108.01	x	0.4	x	0.7] =	81.87	(78)
South	0.9x	0.54	x	4.07	x	108.01	x	0.4	x	0.7	=	59.82	(78)
South	0.9x	0.54	x	9.55	x	104.89	x	0.4	x	0.7	=	136.32	(78)
South	0.9x	0.54	x	9.55	x	104.89	x	0.4	x	0.7	=	136.32	(78)
South	0.9x	0.54	x	5.57	x	104.89	x	0.4	x	0.7	=	79.51	(78)
South	0.9x	0.54	×	4.07	×	104.89	x	0.4	x	0.7] =	58.1	(78)
South	0.9x	0.54	×	9.55	x	101.89	x	0.4	x	0.7	=	132.41	(78)
South	0.9x	0.54	x	9.55	x	101.89	x	0.4	x	0.7	=	132.41	(78)
South	0.9x	0.54	x	5.57	x	101.89	x	0.4	x	0.7	=	77.23	(78)
South	0.9x	0.54	x	4.07	x	101.89	x	0.4	x	0.7	=	56.43	(78)
South	0.9x	0.54	x	9.55	x	82.59	x	0.4	x	0.7	=	107.33	(78)
South	0.9x	0.54	x	9.55	x	82.59	x	0.4	x	0.7	=	107.33	(78)
South	0.9x	0.54	x	5.57	x	82.59	x	0.4	x	0.7	=	62.6	(78)
South	0.9x	0.54	x	4.07	x	82.59	x	0.4	x	0.7	=	45.74	(78)
South	0.9x	0.54	x	9.55	×	55.42	x	0.4	x	0.7	=	72.02	(78)
South	0.9x	0.54	x	9.55	x	55.42	x	0.4	x	0.7	=	72.02	(78)
South	0.9x	0.54	x	5.57	X	55.42	x	0.4	х	0.7] =	42	(78)
South	0.9x	0.54	x	4.07	x	55.42	x	0.4	х	0.7	=	30.69	(78)
South	0.9x	0. <mark>54</mark>	x	9.55	x	40.4) ×	0.4	x	0.7	=	52.5	(78)
South	0.9x	0.5 <mark>4</mark>	x	9.55	x	40.4	x	0.4	x	0.7	=	52.5	(78)
South	0.9x	0. <mark>5</mark> 4	x	5.57	×	40.4	x	0.4	x	0.7	=	30.62	(78)
South	0.9x	0.54	x	4.07	x	40.4	×	0.4	x	0.7	=	22.37	(78)
West	0.9x	0.54	x	5.77	x	19.64	x	0.4	x	0.7	=	15.42	(80)
West	0.9x	0.54	x	5.24	x	19.64	x	0.4	x	0.7	=	14	(80)
West	0.9x	0.54	x	5.77	x	38.42	x	0.4	x	0.7	=	30.17	(80)
West	0.9x	0.54	x	5.24	x	38.42	x	0.4	x	0.7	=	27.4	(80)
West	0.9x	0.54	x	5.77	x	63.27	x	0.4	x	0.7	=	49.68	(80)
West	0.9x	0.54	x	5.24	x	63.27	x	0.4	x	0.7	=	45.12	(80)
West	0.9x	0.54	x	5.77	x	92.28	x	0.4	x	0.7	=	72.46	(80)
West	0.9x	0.54	x	5.24	x	92.28	x	0.4	x	0.7	=	65.8	(80)
West	0.9x	0.54	x	5.77	x	113.09	x	0.4	x	0.7	=	88.8	(80)
West	0.9x	0.54	x	5.24	x	113.09	x	0.4	x	0.7	=	80.64	(80)
West	0.9x	0.54	x	5.77	x	115.77	x	0.4	x	0.7	=	90.9	(80)
West	0.9x	0.54	x	5.24	x	115.77	x	0.4	x	0.7	=	82.55	(80)
West	0.9x	0.54	x	5.77	x	110.22	x	0.4	x	0.7] =	86.54	(80)
West	0.9x	0.54	×	5.24	×	110.22	×	0.4	×	0.7] =	78.59	(80)
West	0.9x	0.54	x	5.77	x	94.68	x	0.4	x	0.7] =	74.34	(80)
West	0.9x	0.54	x	5.24	×	94.68	x	0.4	x	0.7	=	67.51	(80)
West	0.9x	0.54	x	5.77	×	73.59	x	0.4	x	0.7	=	57.78	(80)
West	0.9x	0.54	x	5.24	×	73.59	x	0.4	x	0.7	=	52.47	(80)

West	0.9x	0.54	x	5.7	7	x	4	5.59	x		0.4	x	0.7		=	35.8	(80)
West	0.9x	0.54	x	5.2	24	x	4	5.59	x		0.4	x	0.7		=	32.51	(80)
West	0.9x	0.54	x	5.7	7	x	2	4.49	x		0.4	x	0.7		=	19.23	(80)
West	0.9x	0.54	x	5.2	24	x	2	4.49	x		0.4	x	0.7		=	17.46	(80)
West	0.9x	0.54	×	5.7	7	x	1	6.15	x		0.4	×	0.7		=	12.68	(80)
West	0.9x	0.54	x	5.2	24	x	1	6.15	x		0.4	x	0.7		=	11.52	(80)
	L												L				
Solar g	gains in	watts, ca	alculate	d for eac	h month	1			(83)m	ι = Sι	um(74)m .	(82)m					
(83)m=	287.51	504.19	718.62	922.87	1051.91	10	49.27	1009.77	914	.75	790.62	565.9	3 347.23	244	4.06		(83)
Total g	jains – i	nternal a	nd sola	r (84)m =	= (73)m	+ (8	33)m	, watts									
(84)m=	778.47	992.82	1191.29	1369.68	1472.29	14	44.28	1388.34	1300	0.08	1189.27	990.6	8 802	72′	1.52		(84)
7. Me	an inter	rnal temp	perature	(heating	seasor	າ)											
Temp	erature	during h	eating p	periods in	n the livi	ng	area f	from Tab	ole 9,	Th	1 (°C)					21	(85)
Utilisa	ation fac	ctor for g	ains for	living are	ea, h1,m	า (s	ее Та	ble 9a)			` ,						
	Jan	Feb	Mar	Apr	May	È	Jun	Jul	A	ug	Sep	Oc	l Nov)ec		
(86)m=	0.99	0.98	0.94	0.82	0.65	(0.46	0.33	0.3	57	0.6	0.89	0.99		1		(86)
Mean		l temper	ature in	living ar		مالم	w ste	ns 3 to 7	7 in T	able	a 9c)			-			
(87)m=	20.06	20.3	20.59	20.85	20.97		21	21	2		20.98	20.8	20.37	20	.02		(87)
-		1 1 1 1				1					20.00						
l emp			eating p		n rest of	dw T	elling	from la	able 9	∂, Ir ⊿ I	n2 (°C)		00.00		07		(00)
(88)m=	20.07	20.07	20.07	20.08	20.08		0.09	20.09	20.		20.09	20.08	20.08	20	.07		(00)
Utilisa	ation fac	ctor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)			_	_	-			
(89)m=	0.99	0.97	0.92	0.78	0.59		0.4	0.26	0.3	3	0.52	0.86	0.98		1		(89)
Me <mark>ar</mark>	interna	l temper	ature in	the rest	of dwell	ing	T2 (fo	ollow ste	eps 3	to 7	in Tabl	e 9 <mark>c)</mark>					
(90)m=	18.82	19.18	19.58	19. <mark>9</mark> 3	20.05	2	0.09	20.09	20.	.1	20.08	1 <mark>9.87</mark>	19.28	18	.77		(90)
											f	LA = Li	ving area ÷	(4) =		0.19	(91)
Mear	interna	l temper	ature (fo	or the wh	ole dwe	ellin	a) = fl	_A × T1	+ (1	– fL	A) × T2						
(92)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.2	27	, 20.25	20.05	5 19.49	1	9		(92)
Apply	v adjustr	nent to t	he meai	n interna	tempei	ratu	re fro	m Table	4e, '	whe	re appro	opriate		<u> </u>			
(93)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.2	27	20.25	20.05	5 19.49	1	9		(93)
8. Sp	ace hea	ating requ	uiremen	t													
Set T	i to the	mean int	ernal te	mperatu	re obtaiı	ned	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m	=(76)m ar	nd re	-calc	ulate	
the ut	tilisation	factor fo	or gains	using Ta	ble 9a	–			<u> </u>		-	_		1			
1.1012	Jan	Feb	Mar	Apr	Мау		Jun	Jul	Αι	ug	Sep	Oc	Nov)ec		
Utilisa		$\frac{1}{1}$	ains, nn	1: 1 0 79	0.6		1 <i>4</i> 1	0.28	0.2	1	0.54	0.95	0.08		00		(94)
		bmGm	$\frac{0.91}{10}$	$\frac{0.70}{4}$ m x (8	1)m		5.41	0.20	0.5	, ,	0.54	0.85	0.98	0.	99		(54)
(95)m=	770.97	962 29	1088.39	1074 27	881 78	5	91 12	383 92	403	79	638.2	846.3	7 782 11	716	67		(95)
Mont	L	age exte	rnal ten	1	from T	abl	e 8	000.02			000.L	0.0.0	1				()
(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	nal tempo	erature.	Lm	, W =	L =[(39)m :	и х [(93	 3)m-	- (96)m	1		-			
(97)m=	1599.67	1566.47	1431.35	1192.18	905.28	5	, 93.34	384.11	404	.14	647.8	1002.9	93 1321.96	158	37.9		(97)
Spac	e heatin	ig require	ement fo	or each n	nonth, k	Wh	/mont	h = 0.02	<u>-</u> 24 x [(97)	m – (95)m] x	(41)m			I	
(98)m=	616.55	406.01	255.16	84.89	17.48		0	0	0		0	116.4	9 388.69	648	3.19		
						_							-				

	Total per year (kWh/year) = Sum(98) _{15,912} =	2533.47	(98)
Space heating requirement in kWh/m²/year		23.87	(99)
9b. Energy requirements – Community heating scheme			_
This part is used for space heating, space cooling or water heating Fraction of space heat from secondary/supplementary heating (Tab	provided by a community scheme.	0	– (301)
Fraction of space heat from community system $1 - (301) -$		1	(301)
The community scheme may obtain heat from several sources. The procedure allow	s for CHP and up to four other heat sources: th	ne latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See	Appendix C.		-
Fraction of heat from Community CHP		0.6	(303a)
Fraction of community heat from heat source 2		0.4	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.6	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.4	(304b)
Factor for control and charging method (Table 4c(3)) for community	heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	[1.1	(306)
Space heating	F	kWh/year	
Annual space heating requirement		2533.47	
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1672.09	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	1114.73	(307b)
Efficiency of secondary/supplementary heating system in % (from T	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement		2314.53	٦
If DHW from community scheme:	(64) × (2025) × (205) × (206)	4507.50	
Water heat from beat source 2	$(64) \times (303b) \times (305) \times (306) =$	1018 20	(310a)
Electricity used for heat distribution	$(0.01 \times [(3072)) (3076) + (3102) (3106)] =$		
	0.01 x [(307a)(307e) + (310a)(310e)] =		
	(107) - (014)		
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from out	side	267.07	(330a)
warm air heating system fans	[0	(330b)
pump for solar water heating]	0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	267.07	(331)
Energy for lighting (calculated in Appendix L)		418.62	(332)
12b. CO2 Emissions – Community heating scheme			_
Electrical efficiency of CHP unit	[32	(361)
Heat efficiency of CHP unit	[64	(362)

		Energy kWh/year	Emissio kg CO2/I	n factor E kWh k	missions g CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	2612.64	x 0.22		564.33	(363)
less credit emissions for electricity	-(307a) × (361) ÷ (362) =	836.04	x 0.52		-433.91	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	2386.86	x 0.22		515.56	(365)
less credit emissions for electricity	-(310a) × (361) ÷ (362) =	763.79	x 0.52		-396.41	(366)
Efficiency of heat source 2 (%)	If there is CH	IP using two fuels repeat (363	3) to (366) for the	second fuel	96	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b)	x 0.22	=	479.95	(368)
Electrical energy for heat distributio	n	[(313) x	0.52	=	27.68	(372)
Total CO2 associated with commun	nity systems	(363)(366) + (368)	.(372)	=	757.2	(373)
CO2 associated with space heating	(secondary)	(309) x	0	=	0	(374)
CO2 associated with water from im-	mersion heater or insta	intaneous heater (312)	x 0.22	=	0	(375)
Total CO2 associated with space an	nd water heating	(373) + (374) + (375) =	=		757.2	(376)
CO2 associated with electricity for p	oumps and fans within	dwelling (331)) x	0.52	=	138.61	(378)
CO2 associated with electricity for I	ighting	(332))) x	0.52	=	217.27	(379)
Total CO2, kg/year	sum of (376)(382) =				1113.08	(383)
Dwelling CO2 Emission Rat	e (383) ÷ (4) =				10.49	(384)
El rating (section 14)					90.13	(385)

Appendix D - Step Four – 'Green' Output Document and Energy Report Figures

BRUKL Output Document

Compliance with England Building Regulations Part L 2013

Project name

Retail Clean

Date: Wed Jul 20 07:19:41 2016

Administrative information

Building Details

Address: Retail Unit, 317 Finchley Road, London, NW3 6EP

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3.3

BRUKL compliance check version: v5.2.d.2

Owner Details Name:

Telephone number: Address: , ,

Certifier details Name: Audley Franklin Telephone number: Address: MLM, ,

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	38.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	38.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	31.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.13	0.13	External Wall
Floor	0.25	-	-	No floors in project
Roof	0.25	-	-	No roofs in project
Windows***, roof windows, and rooflights	2.2	1.4	1.4	New Window
Personnel doors	2.2	1.39	1.39	Sliding Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
Lighting area-weighted average Lightles M	$l/(m^2 K)$			

 $U_{a-\text{Limit}} = \text{Limiting area-weighted average U-values [W/(m⁻K)]}$ $U_{a-\text{Calc}} = \text{Calculated area-weighted average U-values [W/(m²K)]}$

Ui-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	7

As designed

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- New HVAC System (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency				
This system	0.91	2.6	-	-	0.7				
Standard value	0.91*	2.6	N/A	N/A	N/A				
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES									
* Standard shown is f efficiency is 0.86. For	for gas single boiler system any individual boiler in a n	s <=2 MW output. For sing nulti-boiler system, limiting	le boiler systems >2 MW o efficiency is 0.82.	r multi-boiler system	is, (overall) limiting				

1- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]					
This building	1	0					
Standard value	Standard value 0.9* N/A						
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.							

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
A1A2_Sales 1	-	85	30	894
A1A2_Sales 2	-	85	30	1220
A1A2_Sales 3	-	85	30	390

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
A1A2_Sales 1	NO (-33%)	NO
A1A2_Sales 2	NO (-84%)	NO
A1A2_Sales 3	NO (-99%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

		_
Actual	Notional	
236	236	
165	165	
LON	LON	
7	5	
89	130	
0.54	0.78	
8.81	8.81	
	Actual 236 165 LON 7 89 0.54 8.81	ActualNotional236236165165LONLON75891300.540.788.818.81

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.33	0.53
Cooling	12.6	17.4
Auxiliary	8.47	4.15
Lighting	39.01	52.35
Hot water	1.61	1.86
Equipment*	20.26	20.26
TOTAL**	62.02	76.29

* Energy used by equipment does not count towards the total for calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	176.44	242.28
Primary energy* [kWh/m ²]	188.5	224.82
Total emissions [kg/m ²]	31.9	38.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

ŀ	IVAC Sys	tems Per	formanc	е						
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[\$1] Split or m	ulti-split sy	stem, [HS]	LTHW boile	er, [HFT] Na	tural Gas, [CFT] Electr	icity		
	Actual	4.5	171.9	1.4	18.4	8.9	0.86	2.6	0.91	2.6
	Notional	4.9	237.4	1.7	18.3	4.4	0.82	3.6		And the second s

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*
Wall	0.23	0.13	External Wall
Floor	0.2	-	No floors in project
Roof	0.15	-	No roofs in project
Windows, roof windows, and rooflights	1.5	1.4	New Window
Personnel doors	1.5	1.39	Sliding Door
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{FTyp} = Typical individual element U-values [W/(m ² K)]		UI-Min = Minimum individual element U-values [W/(m ² K)]
* There might be more than one surface where the n	ninimum U	l-value oc	curs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	2		Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.1.24	
			Р	roperty <i>i</i>	Address	flat 1					
Address :											
1. Overall dwelling dime	nsions:			Aro	o(m ²)			iaht(m)		Volumo(m ³)	
Ground floor					a(III-) 57.7	(1a) x		1911(11) 25	(2a) =	144 25](3a)
First floor					5.67	(1b) x](2b) -	444.47](3b)
	-) · (4 -) · (4 -) ·	(1 -1) + (1 -)	. (4	4 ب	·0.07	(10) X	2		(20) -	114.17	
10tal floor area IFA = (13)	a)+(1D)+(1C)+	(1d)+(1e))+(1r	1) 1(03.37	(4)					_
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	258.42	(5)
2. Ventilation rate:	_									<u>, ,</u>	
	main heating	se h	condar eating	у	other		total			m ³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0	+	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns					- F	0	x 1	10 =	0	(7a)
Number of passive vents							0	x 1	10 =	0	(7b)
Number of flueless gas fi	res					Ē	0	x 4	40 =	0](7c)
Infiltration due to obimpo	in fluor and f) . (6b) . (7	(2) (7b) (7)	70) -		_	_			" "~~
If a pressurisation test has b	een carried out o	r is intended	d. procee	d to (17).	otherwise o	continue fre	0 om (9) to (16)	÷ (5) =	0	(8)
Number of storeys in th	ne dw <mark>elling</mark> (na	5)					- (-) - (-/		0	(9)
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	.25 for steel o	r timber f	rame or	0.35 foi	r masonr	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openir	resent, use the va nas): if equal user	lue corresp 0.35	oonding to	the great	er wall are	a (after					
If suspended wooden f	loor, enter 0.2	(unseale	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else	enter 0								0	(13)
Percentage of windows	s and doors dr	aught str	ripped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				_	(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cubi	ic metre	s per ho	our per so	quare m	etre of e	nvelope	area	3	(17)
IT Dased on air permeabili Air permeability value applie	ity value, then	(10) = [(17)	been don	o, onerwi	se (10) = (rmeahility	is haina us	ad		0.15	(18)
Number of sides sheltere	d	511 1031 1103	been don			Theability	is being ut	500		3](19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wir	nd speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tab	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	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 infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcula	ate effec	ctive air	change i	rate for t	he appli	cable ca	se	-				-		
IT ME				andia NL (O	0h) (00-	·) · · · · · · / ·	······································			(00-)			0.5	(23a)
If exh	aust air ne	eat pump	using Appe	enaix IN, (2	3D) = (238	a) × Fmv (e		v5)), otne	rwise (23b) = (23a)			0.5	(23b)
	inced with	n neat reco	overy: effic	iency in %	allowing f	or in-use to			$) = (2)^{2}$	2b)m i (ʻ	22h) v [1	1 (22c)	77.3	5 (23c)
a) 11 (24a)m-	0.26	0.26		0.24	0.24			0.22		0.24	0.24	0.25	- 100j	(24a)
(2-14)/11- b) If	bolonoo	d moob		ntilation	without	boot roc		1)/) (24h	1 = 0.20		0.24 02h)	0.20	l	(,)
(24b)m	Dalance				without			1 v) (240 0	D = (22)	20)III + (2	230)		1	(24b)
(240)m=	0	0					0	0		0	0	0		(240)
c) If v	whole h	ouse ex	tract ven	itilation o	or positiv	e input v	ventilatio	on from ($22k$		E v (22h)			
(240)m	0	1< 0.5 >) = (23L			C = (22)	$\frac{1}{1}$	5 × (230)		1	(24c)
(240)11=	0				0					0	0	0	l	(240)
a) ir i	naturai f (22b)n	ventilation = 1 th	on or wn en (24d)	ole nous $m = (22h)$	e positiv	ve input v erwise (2	(4d)m = 0	on from 1 0 5 + [(2	0ft 2b)m ² x	0.51				
(24d)m=	0	0				0				0.0]	0	0		(24d)
Effec	tive air	change	rate - er	ter (24a) or (24h	(24)	c) or (24	d) in hor	(25)					, , , , , , , , , , , , , , , , , , ,
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25	1	(25)
(0.20	0120					<u> </u>				0.2.1			
2 Hay	et lesses													
з. неа	at losse	s and he	eat loss p	paramete	er:									
ELEN		s and he Gros area	eat loss p ss (m²)	oaramete Openin m	er: gs 2	Net Ar A ,r	ea n²	U-valı W/m2	ue :K	A X U (W/ł	<)	k-value kJ/m²-l	e K	A X k kJ/K
ELEN Doors	IE <mark>NT</mark>	s and he Gros area	eat loss p ss (m²)	Openin Openin m	er: gs ,2	Net Ar A ,r 2.1	ea n² ×	U-valı W/m2	ue K =	A X U (W/ł 4.2	<)	k-value kJ/m²·I	e K	A X k kJ/K (26)
ELEN Doors Windov	IENT	s and he Gros area	eat loss p ss (m²)	Openin Openin m	er: gs 2	Net Ar A ,r 2.1 3.69	ea n² x x ^{1/}	U-valı W/m2 2 /[1/(0.8)+	ue 2K 0.04] = [A X U (W/ł 4.2 2.86	<)	k-value kJ/m²-l	e K	A X k kJ/K (26) (27)
Doors Windov	IENT ws Type ws Type	s and he Gros area e 1 e 2	eat loss p ss (m²)	Openin M	er: gs ²	Net Ar A ,r 2.1 3.69 4.83	ea n ² x x x ¹ / x ¹ /	U-valu W/m2 2 /[1/(0.8)+	ue 2K 0.04] = [0.04] = [A X U (W/ł 4.2 2.86 3.74	<) 	k-value kJ/m²·I	e K	A X k kJ/K (26) (27) (27)
Doors Windov Windov	IENT ws Type ws Type ws Type	Gros area area area a 1 a 2 a 3	eat loss ; ss (m²)	Openin M	er: gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01	ea n ² x x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	ue K 0.04] = [0.04] = [0.04] = [A X U (W/ł 2.86 3.74 2.33		k-value kJ/m²+l	e K	A X k kJ/K (26) (27) (27) (27)
S. Here ELEN Doors Window Window Window	IENT ws Type ws Type ws Type ws Type	Gros area 9 1 9 2 9 3 9 4	eat loss ; ss (m²)	Openin M	er: gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	ue K 0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/ł 2.86 3.74 2.33 3.88		k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27)
S. Here ELEN Doors Window Window Window Floor	IENT ws Type ws Type ws Type ws Type	Gros area 4 2 3 4	eat loss ; ss (m²)	oaramete Openin m	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7	ea m ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13	ue K = 0.04] = [0.04] = [0.04] = [0.04] = [= =	A X U (W/ł 2.86 3.74 2.33 3.88 7.501		k-value kJ/m²·I	× K	A X k kJ/K (26) (27) (27) (27) (27) (28)
S. Here ELEN Doors Window Window Window Floor Walls T	IENT ws Type ws Type ws Type ws Type	s and he Gros area 9 1 9 2 9 3 9 4	of (m ²)	Openin m	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92		k-value kJ/m²+l		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
ELEN Doors Window Window Window Floor Walls T Walls T	IENT ws Type ws Type ws Type ws Type Type1	s and he Gros area 4 54.0 48.7	96 74	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= [= = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29)
S. Here ELEN Doors Window Window Window Window Floor Walls T Walls T Total a	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e	s and he Gros area 2 3 4 54.0 48.7 lements	06 74 , m ²	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6	ea n ² x x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/} x ^{1/}	U-valı W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13	ue K 0.04] = [0.04] = [0.04] = [0.04] = [= = [= = [A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31)
S. Here ELEN Doors Window Window Window Floor Walls T Walls T Total a Party w	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall	s and he Gros area 2 3 4 54.0 48.7 lements	206 74 5, m ²	Openin m 8.52 8.02	gs 2	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05	ea m ² x x ^{1/} x ^{1/}	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13 0.13	ue 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = =	A X U (W/k 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0		k-value kJ/m²-I		A X k kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)
S. Here ELEN Doors Window Window Window Window Floor Walls T Walls T Total a Party w * for window * include	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area	s and has Gross area 4 4 48.7 lements roof wind as on both	06 74 ows, use e sides of in	Darameta Openin m 8.52 8.02 effective will internal wall	ndow U-va	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calcul titions	ea n ² x 1/ x 1	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ 0.13 0.13 0.13 0.13 0.13	$\begin{bmatrix} 2 \\ - \\ - \\ 0 \\ - \\ 0 \\ - \\ 0 \\ - \\ 0 \\ - \\ -$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)
S. Here ELEN Doors Window Window Window Window Floor Walls 1 Walls 1 Total a Party w * for window * include Fabric	IENT ws Type ws Type ws Type ws Type ype1 Type2 rea of e vall dows and e the area heat los	s and has $Gross area Gross wind as on both$	p_{1}^{0} p_{2}^{0} p_{3}^{0} p_{4}^{0} p_{4}^{0} p_{5}^{0} p_{4}^{0} p_{5}^{0} $p_{$	Copenin m	ndow U-va	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x ^{1/} x ^{1/}	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$\begin{array}{c} ue \\ K \\ 0.04] = [\\ 0.$	A X U (W/k 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a	<)	k-value kJ/m²-I	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32)
S. Free Boors Window Window Window Window Floor Walls T Walls T Total a Party w * for wind * for wind * for wind * fabric Heat ca	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los	s and he Gros area 4 1 2 3 4 1 48.7 1 48.7 1 1 1 1 1 1 1 1 1 1	$\frac{1000}{100}$ $\frac{1000}{100}$	effective winternal walk	er: gs 2 2 ndow U-va Is and part	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x ^{1/} x	U-valu W/m2 2 /[1/(0.8)+ /[1/(0.8)+)/[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+)/[1/	$\begin{array}{c} ue \\ K \\ 0.04] = \\ $	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 e)+0.04] a	<)	k-value kJ/m²-l	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32) 4 (33)
S. Heat ca Therma	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los apacity al mass	s and has Gross area 4 54.0 48.7 48.7 48.7 48.7 10000 wind 10000 wind 10000 wind 10000 wind	$\frac{1000}{100}$ $\frac{1000}{1000}$ $\frac{1000}{100}$ $\frac{1000}{100}$ $\frac{1000}{100$	Definition of the second seco	er: gs 2 2 ndow U-va ls and part - TFA) ir	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea m ² x x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+ 0.13 0.13 0.13 0.13 0.13 (0.13 (0.13) (0.13) (1) (2)((0.13))	$\frac{1}{2}$	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a .(30) + (32 tive Value:	() () </td <td>k-value kJ/m²-I</td> <td>e K] [] [] [] []] []] []] []]] []]] []]] []]] []]] []]] []]] []]] []]] []]]]</td> <td>A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (31) (32) 4 (33) (34) (34)</td>	k-value kJ/m²-I	e K] [] [] [] []] []] []] []]] []]] []]] []]] []]] []]] []]] []]] []]] []]]]	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (31) (31) (32) 4 (33) (34) (34)
S. Herman BLEN Doors Window Window Window Window Floor Walls T Walls T Total a Party w * for wind ** include Fabric Heat ca Therma For desig	IENT ws Type ws Type ws Type ws Type ype1 Type2 rea of e vall dows and e the area heat los apacity al mass gn assess	s and he Gros area 4 54.0 48.7 48.7 lements <i>roof wind</i> as on both as on both 55, W/K = Cm = Signaments	p_{1}^{06} (m^2) p_{2}^{06} (m^2) p_{3}^{06} (m^2) p_{4}^{06} (m^2)	$\begin{bmatrix} 8.52 \\ \hline 8.02 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ $	er: gs 2 2 ndow U-va ls and part - TFA) ir construct	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x x 1/ x	U-valu W/m2 2 (1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$\begin{array}{c} ue \\ K \\ = \\ 0.04] $	A X U (W/k 4.2 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 0 re)+0.04] a .(30) + (32 tive Value: 9 values of	<) () () () () () () ()	k-value kJ/m²-l	x x 35.7 0 250	A X k kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (31) (32) (31) (32) (32)
S. Free B. S. Free B. S. Free	IENT ws Type ws Type ws Type ws Type Type1 Type2 rea of e vall dows and e the area heat los apacity al mass gn assess sed inste	s and has Gross area 4 54.0 48.7 48.7 48.7 48.7 48.7 1000000000000000000000000000000000000	26 (m^2) 26 (m^2) 26 (m^2) 74 (m^2) 74 (m^2)	$\begin{bmatrix} 8.52 \\ 8.02 \end{bmatrix}$	er: gs 2 ² ndow U-va ds and pan - TFA) ir construct	Net Ar A ,r 2.1 3.69 4.83 3.01 5.01 5.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	ea n ² x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/	U-valu W/m2 2 ([1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ (1/(0.8)+)))))))))))))))))))))))))))))))))))	$ \begin{array}{c} $	A X U (W/ł 2.86 3.74 2.33 3.88 7.501 5.92 5.29 0 e)+0.04] a .(30) + (32 tive Value: values of	<) () () () () () () ()	k-value kJ/m²-l	e K	A X k kJ/K (26) (27) (27) (27) (27) (27) (29) (29) (29) (31) (32) (31) (32)

if detail	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			48.94	(37)
Ventila	ation hea	at loss ca	alculated	monthl	у	-	_		(38)m	= 0.33 × (25)m x (5)	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	22.3	22.05	21.8	20.56	20.32	19.08	19.08	18.83	19.57	20.32	20.81	21.31		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	71.24	70.99	70.74	69.5	69.25	68.01	68.01	67.77	68.51	69.25	69.75	70.24		
									/	Average =	Sum(39)1	12 /12=	69.44	(39)
Heat I	oss para	meter (H	HLP), W	/m²K	r	r	i		(40)m	= (39)m ÷	(4)	r	I	
(40)m=	0.69	0.69	0.68	0.67	0.67	0.66	0.66	0.66	0.66	0.67	0.67	0.68		
Numb	er of day	/s in mo	nth (Tab	le 1a)	-	-				Average =	Sum(40)1	12 /12=	0.67	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. W	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
		Ŭ											1	
Assun if TF	ned occu =A ⇒ 13 (Ipancy, I 9 N – 1	N + 1.76 x	[1 - exp	(-0 000?	849 x (TF	-13 Q)2)] + 0 ()013 x (⁻	TFA -13	2.	77		(42)
if TF	A £ 13.	9, N = 1	1 1.70 %		(0.0000	, , , , , , , , , , , , , , , , , , ,	10.0	<i>[2)</i>] + 0.0		1177 10.	.0)			
Ann <mark>ua</mark>	al averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.22		(43)
Reduce	e the annua re that 125	al average litres per	hot water	usage by a r day (all w	5% if the c	lwelling is hot and co	designed t Id)	to achieve	a water us	se target o	t			
not mor									0					
Hot wa	Jan	Feb	Mar Mar	Apr	May	Jun	Jul Table 1c x	(43)	Sep	Oct	Nov	Dec		
									100.11	407.00	444.50	445 74		
(44)m=	115.74	111.53	107.32	103.11	98.9	94.69	94.69	98.9	103.11	107.32	111.53	115.74	1000 50	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	m(44) ₁₁₂ = ables 1b, 1	= c, 1d)	1262.58	(44)
(45)m=	171.63	150.11	154.9	135.05	129.58	111.82	103.62	118.9	120.32	140.22	153.06	166.22		
16 :				- f		(· · · · · · · · · · · ·	h	-	Total = Su	m(45) ₁₁₂ =	=	1655.45	(45)
it instar	itaneous v	ater neati.	ng at point T	t of use (no	not watel	r storage), I	enter 0 in	boxes (46)) tO (61)	r		r	I	
(46)m=	25.75	22.52	23.24	20.26	19.44	16.77	15.54	17.84	18.05	21.03	22.96	24.93		(46)
Storad	siorage ne volum	iuss. ie (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	and no te	nk in dw	vellina e	nter 110) litres in	(47)				0		()
Other	wise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	(47) 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	10		(50)
b) If n	nanufact	urer's de	eclared	cylinder l	loss fact	or is not	known:							
Hot wa	ater stor	age loss	factor fi	om I abl	le 2 (kW	h/litre/da	ay)				0.	02		(51)
Volum	nunity f	from Ta	hle 22	011 4.3							4	02		(52)
Temp	erature f	actor fro	m Table	2b								.6		(53)
Energ	v lost fro	m water	storage	. kWh/v	ear			(47) x (51)	x (52) x (53) =		03		(54)
Enter	(50) or ((54) in (5	55)	, ,				、 , (- ·)	(-) (,	1.	03		(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Prima	ry circuit	loss (ar	nnual) 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 wa	ter heati	ng and a	cylinde	r thermo	ostat)		_	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	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	neat req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	226.91	200.04	210.18	188.54	184.86	165.31	158.89	174.18	173.82	195.5	206.56	221.5		(62)
Solar D	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHRS	and/or \	WHRS	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=	226.91	200.04	210.18	188.54	184.86	165.31	158.89	174.18	173.82	195.5	206.56	221.5		-
								Outp	out from wa	ater heate	r (annual)₁	12	2306.29	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5	× (45)m	n + (61)n	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (59)m	1	
(65)m=	101.29	89.85	95.73	87.7	87.31	79.97	78.67	83.76	82.8	90.85	93.69	99.49		(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	rom com	<mark>mu</mark> nity h	neating	
5. In	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	s (Table	<mark>5), Wa</mark> t	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43	138.43		(66)
Lightir	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	25.03	22.23	18.08	13.69	10.23	8.64	9.33	12.13	16.28	20.67	24.13	25.72		(67)
Applia	nces ga	ins (calc	ulated in	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	i			
(68)m=	261.66	264.38	257.54	242.97	224.58	207.3	195.76	193.04	199.88	214.45	232.84	250.12		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equa	tion L15	or L15a), also se	ee Table	5				
(69)m=	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84	36.84		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)	-	-	_	-	-	_	_	
(71)m=	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74	-110.74		(71)
Water	haating	nains (T	Table 5)											
	neating	gains (1												
(72)m=	136.14	133.71	128.66	121.8	117.35	111.08	105.74	112.58	115	122.1	130.12	133.72		(72)
(72)m= Total i	136.14	133.71 gains =	128.66	121.8	117.35	111.08 (66)	105.74)m + (67)m	112.58 n + (68)m -	115 + (69)m + (122.1 (70)m + (7	130.12 (1)m + (72)	133.72 m]	(72)
(72)m= Total (73)m=	136.14 internal 487.36	gains (1 133.71 gains = 484.85	128.66 468.81	121.8 442.99	117.35 416.69	111.08 (66) 391.54	105.74)m + (67)m 375.36	112.58 n + (68)m - 382.27	115 + (69)m + (395.7	122.1 (70)m + (7 421.76	130.12 (1)m + (72) 451.62	133.72 m 474.09]	(72)

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	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.69	x	10.63	x	0.4	x	0.7] =	7.61	(74)
North	0.9x	0.77	x	4.83	x	10.63	x	0.4	x	0.7	i =	9.97	(74)
North	0.9x	0.77	x	3.01	x	10.63	x	0.4	x	0.7	=	6.21	(74)
North	0.9x	0.77	x	5.01	×	10.63	x	0.4	×	0.7] =	10.34	(74)
North	0.9x	0.77	x	3.69	x	20.32	x	0.4	x	0.7] =	14.55	(74)
North	0.9x	0.77	x	4.83	x	20.32	x	0.4	x	0.7	=	19.05	(74)
North	0.9x	0.77	x	3.01	x	20.32	x	0.4	x	0.7	=	11.87	(74)
North	0.9x	0.77	x	5.01	x	20.32	x	0.4	x	0.7	=	19.75	(74)
North	0.9x	0.77	x	3.69	x	34.53	x	0.4	x	0.7] =	24.72	(74)
North	0.9x	0.77	x	4.83	x	34.53	x	0.4	x	0.7] =	32.36	(74)
North	0.9x	0.77	x	3.01	x	34.53	x	0.4	x	0.7	=	20.17	(74)
North	0.9x	0.77	x	5.01	x	34.53	x	0.4	x	0.7] =	33.57	(74)
North	0.9x	0.77	x	3.69	x	55.46	x	0.4	x	0.7] =	39.71	(74)
North	0.9x	0.77	x	4.83	x	55.46	x	0.4	x	0.7] =	51.98	(74)
North	0.9x	0.77	x	3.01	×	55.46	x	0.4	x	0.7] =	32.39	(74)
North	0.9x	0.77	x	5.01	×	55.46	x	0.4	х	0.7		53.92	(74)
North	0.9x	0.77	x	3.69	x	74.72	x	0.4	x	0.7] =	53.5	(74)
North	0.9x	0.77	x	4.83	x	74.72] ×	0.4	x	0.7] =	70.02	(74)
North	0.9x	0.77	x	3.01	x	74.72	x	0.4	x	0.7] =	43.64	(74)
North	0.9x	0.77	x	5.01	x	74.72	x	0.4	x	0.7	=	72.63	(74)
North	0.9x	0.77	x	3.69	x	79.99	×	0.4	x	0.7] =	57.27	(74)
North	0.9x	0.77	x	4.83	x	79.99	x	0.4	x	0.7] =	74.96	(74)
North	0.9x	0.77	x	3.01	×	79.99	x	0.4	x	0.7	=	46.72	(74)
North	0.9x	0.77	x	5.01	x	79.99	x	0.4	x	0.7	=	77.76	(74)
North	0.9x	0.77	x	3.69	x	74.68	x	0.4	x	0.7	=	53.47	(74)
North	0.9x	0.77	x	4.83	x	74.68	x	0.4	x	0.7	=	69.99	(74)
North	0.9x	0.77	x	3.01	x	74.68	x	0.4	x	0.7	=	43.62	(74)
North	0.9x	0.77	x	5.01	x	74.68	x	0.4	x	0.7	=	72.6	(74)
North	0.9x	0.77	x	3.69	x	59.25	x	0.4	x	0.7	=	42.42	(74)
North	0.9x	0.77	x	4.83	x	59.25	x	0.4	x	0.7	=	55.53	(74)
North	0.9x	0.77	x	3.01	x	59.25	x	0.4	x	0.7	=	34.6	(74)
North	0.9x	0.77	x	5.01	x	59.25	x	0.4	x	0.7	=	57.6	(74)
North	0.9x	0.77	x	3.69	x	41.52	x	0.4	x	0.7	=	29.73	(74)
North	0.9x	0.77	x	4.83	x	41.52	x	0.4	x	0.7	=	38.91	(74)
North	0.9x	0.77	x	3.01	x	41.52	x	0.4	x	0.7	=	24.25	(74)
North	0.9x	0.77	x	5.01	×	41.52	×	0.4	×	0.7	=	40.36	(74)
North	0.9x	0.77	x	3.69	×	24.19	x	0.4	x	0.7	=	17.32	(74)
North	0.9x	0.77	x	4.83	×	24.19	x	0.4	×	0.7] =	22.67	(74)
North	0.9x	0.77	x	3.01	x	24.19	x	0.4	x	0.7] =	14.13	(74)

North	0.9x	0.77	x	5.0)1	×	2	4.19	x		0.4	x	0.7	=	23.52	(74)
North	0.9x	0.77	×	3.6	69	×	1	3.12	x		0.4	×	0.7	=	9.39	(74)
North	0.9x	0.77	x	4.8	3	×	1	3.12	x		0.4	×	0.7	=	12.29	(74)
North	0.9x	0.77	x	3.0)1	×	1	3.12	x		0.4	×	0.7	= =	7.66	(74)
North	0.9x	0.77	x	5.0)1	×	1	3.12	×		0.4	- x	0.7		12.75	(74)
North	0.9x	0.77	x	3.6	69	×	8	3.86	x		0.4	×	0.7	=	6.35	(74)
North	0.9x	0.77	×	4.8	3	×	8	3.86	x		0.4	×	0.7	=	8.31	(74)
North	0.9x	0.77	x	3.0)1	×	8	3.86	x		0.4	×	0.7	=	5.18	(74)
North	0.9x	0.77	×	5.0)1	×	8	3.86	×		0.4	×	0.7	=	8.62	(74)
	-					L										
Solar	gains in	watts, ca	alculated	for eac	h month				(83)m	ı = Su	um(74)m .	(82)m				
(83)m=	34.13	65.22	110.82	178.01	239.79	25	56.71	239.67	190	.15	133.24	77.63	42.1	28.45		(83)
Total (gains – i	nternal a	and solar	r (84)m =	= (73)m ·	+ (8	33)m	, watts						i		
(84)m=	521.49	550.07	579.63	621	656.48	64	8.25	615.03	572	.42	528.94	499.39	493.72	502.54		(84)
7. Me	ean inter	nal temp	perature	(heating	season)										
Temp	perature	during h	neating p	eriods ir	n the livi	ng a	area f	from Tab	ole 9	, Th1	1 (°C)				21	(85)
Utilis	ation fac	tor for g	ains for	living are	ea, h1,m	i (se	e Ta	ble 9a)	-				_			
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.88	0	.66	0.49	0.5	54	0.83	0.98	1	1		(86)
Me <mark>ar</mark>	n interna	l temper	ature in	living are	ea T1 <mark>(fo</mark>	ollov	w ste	ps 3 to 7	' in T	able	9c)					
(87)m=	20.34	20.41	20.55	20.77	20.93	20	0.99	21	2	1	20.97	20.77	20.53	20.33		(87)
Tem	oerature	during h	neating p	eriods ir	n rest of	dwe	elling	from Ta	able S	9, Th	n2 (°C)					
(88)m=	20.35	20.35	20.35	20.37	20.37	20	0.38	20.38	20.	38	20.37	20.37	20.36	20.36		(88)
Utilis	ation fac	tor for a	ains for	rest of d	welling	h2 i	m (se	e Table	9a)							
(89)m=	1	1	0.99	0.97	0.84	(D.6	0.42	0.4	17	0.78	0.97	1	1		(89)
Moor		l tompor	i aturo in	the rest	of dwalli	ing '	T2 (f			to 7	in Tabl					
(90)m=	19.45	19.56	19.77	20.08	20.3		0.37	20.38	20.	38	20.35	20.09	19.73	19.44		(90)
()											f	LA = Liv	ing area ÷ (4	4) =	0.29	(91)
				and a f) (I	л т 4			A) TO					
			ature (to 20) = TL 0.56	_A × 11	+ (1	- TL/	A) X IZ	20.20	10.06	10.7		(92)
	/ adjustr	nent to t	he mear	internal	temper	 atu	re fro	m Table	<u></u>	whe	re appro	priate	19.90	13.7		(02)
(93)m=	19.71	19.81	20	20.28	20.49	20	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(93)
8. Sp	ace hea	ting reg	uirement			<u> </u>										
Set T	i to the	mean int	ernal ter	mperatu	re obtair	ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=	⊧(76)m an	d re-calo	ulate	
the u	tilisation	factor fo	or gains	using Ta	ble 9a									i		
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilis	ation fac	tor for g	ains, hm I): I		-			1						I	
(94)m=	1	1	0.99	0.96	0.85	0).62	0.44	0.4	19	0.79	0.97	1	1		(94)
	u gains,	nmGm	, VV = (94)	4)m x (84	+)M	40	1 52	260 11	201	40	110 27	186.00	101 69	501.0	l	(05)
Mont	hly aver				$\int_{-5000}^{5000} T$	⁴⁰ able	,1.02 2 8	203.11	201	.49	713.21	400.08	491.00	501.9	l	(33)
(96)m=	4.3	4.9	6.5	8.9	11.7		4.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempo	erature	L Lm	, W =	[(39)m	x [(9:	<u>]</u> 3)m–	- (96)m	1	1		l	. ,
(97)m=	1097.49	1058.13	954.76	790.83	608.41	40)5.04	269.31	281	.96	440.43	- 671.04	897.26	1088.61		(97)

Space heating requirement for each month, kWh/month = 0.024	x [(97)m – (95)m] x (41)m		
(98)m= 429.2 342.54 282.66 138.43 36.9 0 0	0 0 137.6 292.02 436.51		_
	Total per year (kWh/year) = $Sum(98)_{15,912}$ =	2095.88	(98)
Space heating requirement in kWh/m²/year		20.28	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heatir Fraction of space heat from secondary/supplementary heating (T	ng provided by a community scheme. Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure al	lows for CHP and up to four other heat sources; th	he latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. So Fraction of heat from Community CHP	ee Appendix C.	0.6	(303a)
Fraction of community heat from heat source 2		0.4	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.6	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.4	(304b)
Factor for control and charging method (Table 4c(3)) for commur	nity heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		kWh/year	
Annual space heating requirement		2095.88	ļ
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	1383.28	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	922.19	(307b)
Efficiency of secondary/supplementary heating system in % (from	n Table 4a or Appendix E)	0	(308
Spa <mark>ce heating requi</mark> rement fro <mark>m se</mark> condary/supplementary syste	m (98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement		2306.29	7
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1522.15	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	1014.77	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	48.42	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from c	putside	315.28	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	315.28	(331)
Energy for lighting (calculated in Appendix L)		441.96	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-176.61	(333)
			-

Electricity generated by wind turbine (Appendix M) (negative qu	antity)		0	(334)
12b. CO2 Emissions – Community heating scheme				
Electrical efficiency of CHP unit			32	(361)
Heat efficiency of CHP unit			64	(362)
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	2161.38 ×	0.22	466.86	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	691.64 ×	0.52	-358.96	(364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2378.36 ×	0.22	513.73	(365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	761.07 ×	0.52	-395	(366)
Efficiency of heat source 2 (%) If there is CHP using	g two fuels repeat (363) to	(366) for the second fue	el 96	(367b)
CO2 associated with heat source 2 [(307b)+	(310b)] x 100 ÷ (367b) x	0.22	435.81	(368)
Electrical energy for heat distribution	[(313) x	0.52	= 25.13	(372)
Total CO2 associated with community systems	(363)(366) + (368)(372	2) :	687.57	(373)
CO2 associated with space heating (secondary)	(309) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantane	ous heater (312) x	0.22	= 0	(375 <mark>)</mark>
Total CO2 associated with space and water heating	(373) + (374) + (375) =		687.57	(376)
CO2 associated with electricity for pumps and fans within dwelli	ing (331)) x	0.52	163.63	(378)
CO2 associated with electricity for lighting	<u>(332))) x</u>	0.52	229.38	(379)
Energy saving/generation technologies (333) to (334) as application technologies (333) to (334) to (334) to (334) technologies (334)	able	0.52 x 0.01 =	-91.66	(380)
Total CO2, kg/year sum of (376)(382) =			988.92	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			9.57	(384)
El rating (section 14)			91.07	(385)

	User D	etails:									
Assessor Name: Software Name: Stroma FSAP 2012		Stroma Softwa	a Num re Ver	ber: sion:		Versio	n: 1.0.1.24				
	Property A	Address:	Flat 2								
Address :											
1. Overall dwelling dimensions:	.	()			• • • •						
Ground floor	Area	i(m²)	(10)	Av. Hei	ght(m)		Volume(m ³)				
	50	0.32	(ia) x	2	.5	(2a) =	125.8	(38)			
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+$	(1n) 50	0.32	(4)			(0)		-			
Dwelling volume			(3a)+(3b)	+(3C)+(30))+(3e)+	.(3n) =	125.8	(5)			
2. Ventilation rate:							<u>,</u> ,				
main sec heating heating	ating	other		total			m ³ per hour				
Number of chimneys 0 +	0 +	0	=	0	X 4	40 =	0	(6a)			
Number of open flues 0 +	0 +	0] = [0	x 2	20 =	0	(6b)			
Number of intermittent fans			Ē	0	x ′	10 =	0	(7a)			
Number of passive vents			Γ	0	x ^	10 =	0	(7b)			
Number of flueless gas fires			Γ	0	x 4	40 =	0	(7c)			
Number of flueless gas fires 0 x 40 = Air change											
Infiltration due to chimneys, flues and fans = (6a)-	+(6b)+(7a)+(7b)+(7	7c) =		0		÷ (5) =	0	(8)			
If a pressurisation test has been carried out or is intended,	proceed to (17), o	otherwise c	ontinue fre	om (9) to (16)	1					
Additional infiltration					[(9)-	-11x0 1 =	0	(9)			
Structural infiltration: 0.25 for steel or timber fra	ame or 0.35 for	masonr	constr	uction	[(0)	1,00.1 -	0	(10)			
if both types of wall are present, use the value correspo	onding to the greate	er wall area	a (after				0				
deducting areas of openings); if equal user 0.35	d or 0.1 (acala	d) alaa (ntor 0				_				
If no draught lobby enter 0.05 else enter 0	u) 01 0.1 (Seale	u), eise e					0	(12)			
Percentage of windows and doors draught strir	ned						0	[(13)] (14)]			
Window infiltration	opeu	0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)			
Infiltration rate		- (8) + (10) +	- (11) + (1	- 2) + (13) +	- (15) =		0	(16) (16)			
Air permeability value, q50, expressed in cubic	metres per ho	ur per sc	uare m	etre of e	nvelope	area	3](17)			
If based on air permeability value, then $(18) = [(17)]$	÷ 20]+(8), otherwis	se (18) = (1	6)				0.15	(18)			
Air permeability value applies if a pressurisation test has b	een done or a deg	ree air per	meability i	is being us	sed						
Number of sides sheltered		(00) (1		0.1			3	(19)			
Shelter factor		(20) = 1 - [(J.075 x (1	9)] =			0.78	(20)			
Infiltration rate incorporating shelter factor		(21) = (18)	x (20) =				0.12	(21)			
Infiltration rate modified for monthly wind speed			-								
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind speed from Table 7		1					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 \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 (allow	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If ma	ate etter	ctive air	change	rate for t	he appli	cable ca	se						0.5	(220)
lf exh	aust air h	eat pump	using App	endix N. (2	3b) = (23a	a) x Fmv (e	equation (1	N5)), other	rwise (23b) = (23a)			0.5	(23a)
lf bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			77.05	(230)
a) If	halance	d mech	anical ve	ntilation	with he	at recove	orv (M\/I	HR) (24a	(2)m – (2)	2h)m + (23h) 🗸 [ʻ	l _ (23c)	 ∴ 1001	(230)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25]	(24a)
b) If	halance	d mech	anical ve	Intilation	without	heat rec		(1)/) (24b)	1 - (2)	$\frac{1}{2}$	23h)]	
(24b)m=					0				0		0	0	1	(24b)
c) If	whole h		tract ver	L	n nositiv		ventilatio	n from c	<u>utside</u>]	
0) 11	if (22b)n	n < 0.5 ×	(23b), t	then (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	lole hous	e positiv	/e input	ventilatio	n from l	oft				1	
	if (22b)n	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN		Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e .	A X k
_		area	(m²)	m) ²	A ,r	n²	W/m2	K	(W/I	K)	kJ/m²·l	K	kJ/K
Doors						2.1	×	2	=	4.2				(26)
Windo	ws Type	e 1				3.33	x1	/[1/(0.8)+	0.04] =	2.58				(27)
Windo	ws Type	e 2				5.01	x1	/[1/(0.8)+	0.04] =	3.88				(27)
Walls		59.4	19	10.4	4	49.05	5 X	0.13	=	6.38				(29)
Total a	area of e	lements	, m²			59.49)							(31)
Party v	wall					17.5	x	0	=	0				(32)
* for win	dows 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	3.2	
Fabric	heat los	s W/K :	= S (A x)		is and pan	1110/15		(26)(30)	+ (32) =				17.04	(33)
Heat c	apacity	Cm = St	′A x k)	0)				· / · / /	((28)	(30) + (3)	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm -	- TFA) ir	n k.I/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign assess	sments wh	ere the de	etails of the	construct	ion are not	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f	230	(00)
can be ι	used inste	ad of a de	tailed calc	ulation.				-						
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						5.35	(36)
if details	of therma	al bridging	are not kr	10wn (36) =	= 0.15 x (3	1)			(00)	(00)			r	
	abric ne	atioss	- - 4		_				(33) +	(36) =	05)		22.39	(37)
ventila	ation nea				/	l	1.1	A	(38)m	= 0.33 × (25)m x (5)	Dee	1	
(28)-	Jan	10.72				Jun		Aug	Sep		10.12	10.27		(38)
(30)11=	10.65	10.73		10.01	9.09	9.29	9.29	9.17	9.00	9.09	10.13	10.37	l	(50)
Heat tr	ranster o		nt, VV/K	00.1	00.00	04.00	04.00	04.50	(39)m	= (37) + (37)	38)m	00.70	1	
(39)m=	33.25	33.13	33	32.4	32.28	31.68	31.68	31.56	31.92	32.28	32.52 Sum(20)	32.76	20.07	(30)
									,	nverage =	Jun(39)1	12 / 12=	32.37	(55)

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.66	0.66	0.66	0.64	0.64	0.63	0.63	0.63	0.63	0.64	0.65	0.65		
Numbo	r of day		uth (Tab	L 12)				1	,	Average =	Sum(40)1.	12 /12=	0.64	(40)
	Jan	Feh	Mar	Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(, L					0.							0.		
4. Wat	ter heat	ting ener	rgy 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 (⁻	TFA -13	1 .9)	.7		(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 day (all w	es per da 5% if the a rater 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	78 f	.49		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34		_
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 oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	941.86	(44)
(45)m=	128.04	111.98	115.55	100.74	96.66	83.41	77.3	88.7	89.76	104.6	114.18	124		_
lf instanta	aneous w	vater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46	-) to (61)	Total = Su	m(45) ₁₁₂ =	-	1234.92	(45)
(46)m=	19.21	16.8	17.33	15. <mark>11</mark>	14.5	12.51	11.59	13.3	13.46	15.69	17.13	18.6		(46)
Water s	storage	loss:	includir	na any se	olar or M		storage	within sa	ame ves	ما		0		(47)
lf com	ounity h	eating a	nd no ta	ink in dw	velling e	nter 110	litres in	(47)		501		0		(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	om water	storage	, kWh/ye	ear		I	(48) x (49)) =		1	10		(50)
Hot wat	ter stor	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	whown: ay)				0.	02		(51)
If comn	nunity r	from Tal	ee secti ble 22	on 4.3								00		(50)
Tempe	rature f	actor fro	m Table	2h							1.	6		(52) (53)
Energy	lost fro	m water	storage	_~ _k\//b///	or			(47) x (51)) x (52) x (¹	53) -		.0		(54)
Enter ((50) or ((54) in (5	55)	, KVVII/ yt	5ai			(47) X (01)	/ (() ~ ()	00) -	1.	03 03		(54)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(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	l lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (an	nual) fro	om Table	93							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		- (- ()			
(mod	lified by	tactor fi	rom Tab	le H5 if t	nere is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)	00.00	l	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(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=	183.31	161.91	170.83	154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		(62)
Solar DH	- IW input	calculated	using App	bendix G o	r Appendix	H (negat	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=	183.31	161.91	170.83	154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		
				-	-		-	Out	out from w	ater heate	r (annual)₁	12	1885.76	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	86.79	77.18	82.64	76.29	76.36	70.53	69.92	73.71	72.64	79	80.76	85.45		(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 fi	rom com	munity h	leating	
5. Int	ernal a	ains (see	e Table :	5 and 5a):	-		-				-	-	
Metab	olic dai	ns (Table	5) Wa	tte										
metab	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(66)m=	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	8 <mark>4.98</mark>	84.98	84.98		(66)
Lightin	d dains	(calcula	ted in A	ppendix	L equati	ion I 9 o	riga) a	lso see	Table 5		I			
(67)m=	14.05	12.48	10.15	7.69	5.74	4.85	5.24	6.81	9.14	11.61	13.55	14.44		(67)
Applia		aine (cale	ulated i			uation I	13 or L 1	32) 2/20		blo 5				
Appilai	148 07		145 73	137 49	127.08	1173		109 23		121 35	131 75	141 53		(68)
				nondiv						E	101.70	141.00		(00)
(60)m-	ig gains					21.5	01 L 15a	, also se		21.5	21.5	21.5		(69)
(09)11=	51.5	51.5	(Table	5 .5	31.5	51.5	51.5	51.5	51.5	51.5	51.5	51.5		(00)
Pumps	and fa	ins gains		5a)		0							I	(70)
(70)m=	0	0	, U	0		0	0	0	0	0	0	0		(70)
Losses	s e.g. e	vaporatio	on (nega I	itive valu	es) (Tab I	le 5)			r	1	I		I	
(71)m=	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98	-67.98		(71)
Water	heating) gains (T	able 5)									r	I	
(72)m=	116.66	114.84	111.08	105.96	102.64	97.96	93.98	99.08	100.89	106.19	112.17	114.85		(72)
Total i	nterna	l gains =	:	i		(66)m + (67)m +	ı + (68)m ·	+ (69)m +	(70)m + (7	'1)m + (72) +	m		
(73)m=	327.27	325.42	315.45	299.63	283.96	268.6	258.49	263.62	271.63	287.64	305.96	319.32		(73)
6. So	lar gain	s:												
Solar g	ains are	calculated	using sola -	ar flux from	Table 6a a	and assoc	iated equa	tions to co	onvert to th	e applicat	ole orientat	ion.		
Orienta	ation:	Access F Table 6d	actor	Area		Flu Ta	IX hle 6a	т	g_ able 6b	т	FF able 6c		Gains	
								, L		, , ,			(**)	-
North	0.9x	0.77	X	3.3	33	×	10.63	×	0.4		0.7	=	6.87	(74)
North	0.9x	0.77	X	5.0	01	×	10.63	×	0.4		0.7	=	10.34	(74)
North	0.9x	0.77	X	3.3	33	×	20.32	×	0.4		0.7	=	13.13	(74)
North	0.9x	0.77	x	5.0	01	×:	20.32	x	0.4	×	0.7	=	19.75	(74)
North	0.9x	0.77	x	3.3	33	x :	34.53	x	0.4	x	0.7	=	22.31	(74)

North	0.9x	0.77)	(5.01	×		34.53	x	0.4	x	0.7	=	33.57	(74)
North	0.9x	0.77)] ،	3.33	×		55.46	x	0.4	x	0.7	=	35.84	(74)
North	0.9x	0.77)] ،	5.01	×		55.46	x	0.4	x	0.7	=	53.92	(74)
North	0.9x	0.77)] ،	3.33	×		74.72	x	0.4	x	0.7	=	48.28	(74)
North	0.9x	0.77)] ،	5.01	×		74.72	x	0.4	x	0.7	=	72.63	(74)
North	0.9x	0.77)] ،	3.33	×		79.99	x	0.4	x	0.7	=	51.68	(74)
North	0.9x	0.77)] ،	5.01	×		79.99	x	0.4	x	0.7	=	77.76	(74)
North	0.9x	0.77)	۲	3.33	×		74.68	x	0.4	x	0.7	=	48.25	(74)
North	0.9x	0.77)] ،	5.01	×		74.68	x	0.4	x	0.7	=	72.6	(74)
North	0.9x	0.77	>	، [3.33	×		59.25	x	0.4	x	0.7	=	38.28	(74)
North	0.9x	0.77)	(5.01	x		59.25	x	0.4	x	0.7	=	57.6	(74)
North	0.9x	0.77	>	۰ [3.33	x		41.52	x	0.4	x	0.7	=	26.83	(74)
North	0.9x	0.77)	(5.01	×		41.52	x	0.4	x	0.7	=	40.36	(74)
North	0.9x	0.77)	(3.33	×		24.19	x	0.4	x	0.7	=	15.63	(74)
North	0.9x	0.77)	٠ [5.01	×		24.19	x	0.4	x	0.7	=	23.52	(74)
North	0.9x	0.77)	<u>،</u>	3.33	×		13.12	x	0.4	x	0.7	=	8.48	(74)
North	0.9x	0.77	>	<u>،</u>	5.01	×		13.12	x	0.4	x	0.7	=	12.75	(74)
North	0.9x	0.77)	< [3.33	×		8.86	x	0.4	x	0.7	=	5.73	(74)
North	0.9x	0.77	,	< [5.01	×		8.86	x	0.4	×	0.7	=	8.62	(74)
Solar (gains in	watts, <mark>ca</mark>	alculate	d 1	for each mo	nth			(83)m	n = Sum(74)m	(8 <mark>2)m</mark>			,	(22)
(83)m=	17.21	32.89	55.88		89.76 120.	91	129.44	120.85	95.	88 67.19	39.15	21.23	14.35		(83)
Total (jains – I	nternal a		ar ((84)m = (73)	$m + \frac{1}{2}$	(83)m	, watts	050	40 000000	000 7	0.007.40	000.07		(0.4)
(84)m=	344.48	358.31	371.33	L	389.38 404.	8/	398.04	379.33	359	.49 338.82	326.7	8 327.19	333.67		(04)
7. Me	ean inter	nal temp	erature	e (I	heating seas	son)								r	
Temp	perature	during h	eating	pe	eriods in the	living) area	from Tal	ble 9	, Th1 (°C)				21	(85)
Utilis	ation fac	tor for ga	ains for	' liv	ving area, h	1,m (see T	able 9a)	.					7	
()	Jan	Feb	Mar	╇	Apr M	ay	Jun	Jul	A	ug Sep	Oc	t Nov	Dec	_	(00)
(86)m=	0.99	0.99	0.97		0.89 0.7	2	0.51	0.37	0.	4 0.64	0.9	0.98	0.99		(86)
Mear	n interna	l temper	ature in	ı li	ving area T1	(foll	ow ste	eps 3 to 7	7 in T	able 9c)	-	-		-	()
(87)m=	20.56	20.63	20.76		20.91 20.9	99	21	21	2	1 21	20.92	2 20.73	20.55		(87)
Temp	perature	during h	eating	pe	eriods in rest	of d	welling	g from Ta	able	9, Th2 (°C)				-	
(88)m=	20.38	20.38	20.38		20.39 20.3	39	20.4	20.4	20.	41 20.4	20.39	20.39	20.38		(88)
Utilis	ation fac	tor for g	ains for	re	est of dwellir	ng, hź	2,m (s	ee Table	9a)						
(89)m=	0.99	0.98	0.96		0.87 0.6	8	0.46	0.32	0.3	35 0.59	0.88	0.97	0.99]	(89)
Mear	n interna	l temper	ature in	n th	ne rest of dw	/ellin	g T2 (follow ste	eps 3	to 7 in Tab	ole 9c)			_	
(90)m=	19.79	19.9	20.07	Т	20.29 20.3	38	20.4	20.4	20.	41 20.4	20.3	20.05	19.78]	(90)
	·			-	1				-		fLA = Li	ving area ÷ (4) =	0.48	(91)
Mear	n interna	l temper	ature (f	or	the whole d	welli	na) = 1	fLA x T1	+ (1	– fLA) x T2	2			•	
(92)m=	20.16	20.25	20.4	T	20.59 20.6	57	20.69	20.69	20.	69 20.68	20.6	20.37	20.15]	(92)
	L	1						1	1		1			-	

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

(93)m=	20.16	20.25	20.4	20.59	20.67	20.69	20.69	20.69	20.68	20.6	20.37	20.15		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti the ut	to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	e obtair Ible 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm											
(94)m=	0.99	0.98	0.96	0.88	0.7	0.48	0.34	0.38	0.62	0.89	0.97	0.99		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	340.44	351.66	356.24	342.03	284.08	192.67	129.55	135.39	208.62	289.49	318.24	330.44		(95)
Month	ly 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=	527.4	508.44	458.81	378.7	289.58	192.9	129.57	135.42	210.16	322.74	431.71	522.66		(97)
Space	e heating	g require	ement fo	r each n	nonth, k	Nh/mon	th = 0.02	4 x [(97])m – (95)m] x (4	1)m			
(98)m=	139.09	105.35	76.31	26.41	4.09	0	0	0	0	24.74	81.7	143.01		
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	600.7	(98)
Space	e heating	g require	ement in	kWh/m²	/year								11.94	(99)
9b. Ene	ergy req	luiremen	nts – Cor	nmunity	heating	scheme)							
This pa	nt is use	ed for sp	ace hea	iting, spa		ing or wa	ater heat	ing prov	ided by a	a c <mark>omm</mark>	unity sch	neme.	0] (301)
	n or spe		nom se	condary/	Supplet				1) 0 11 11	one			0	
Fractio	n of spa	ice heat	from co	mmunity	system	$1 - (30^{\circ})$	1) =						1	(302)
The com	munity so	heme m <mark>ay</mark>	/ obtain he	eat from se	everal soul	ces. The p	procedure a	allows for	CHP and u	up t <mark>o four (</mark>	other heat	sources; ti	he latter	
<i>includes</i> Fractio	<i>boilers, h</i> n of hea	eat pumps at from C	s, geothern Commun	^{mal and wa} ity CHP	aste heat f	rom powei	r stations. S	See Appei	ndix C.				0.6	(303a)
Fractio	n of con	nmunity	heat fro	m heat s	ource 2								0.4	(303b)
Fractio	n of tota	al space	heat fro	m Comn	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fractio	n of tota	al space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor	for cont	rol and o	charging	method	(Table	4c(3)) fo	r commu	inity hea	ting syst	tem			1	(305)
Distribu	ution los	s factor	(Table 1	2c) for c	commun	ity heatii	ng syster	m					1.1	(306)
Space	heating	9										i	kWh/year	-
Annual	space	heating	requirem	nent									600.7	
Space	heat fro	m Comr	nunity C	ΉP					(98) x (30	04a) x (30	5) x (306) :	=	396.46	(307a)
Space	heat fro	m heat s	source 2						(98) x (30	04b) x (30	5) x (306) :	=	264.31	(307b)
Efficier	icy of se	econdary	//supple	mentary	heating	system	in % (fro	m Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/su	oplemen	tary syst	em	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water Annual	heating water h	l neating r	equirem	ent									1885.76	
If DHW Water I	from concern	ommunit m Comn	y schen nunitv C	ne: HP					(64) x (30	03a) x (30	5) x (306) :	=	1244.6	(310a)
Water I	neat fro	m heat s	source 2						(64) x (30)3b) x (30	5) x (306) :	=	829.74	(310b)
Electric	city used	d for hea	t distribu	ution				0.01	× [(307a).	(307e) +	· (310a)([310e)] =	27.35	(313)

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter	er 0) = (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input	t from outside	136	.21 (330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	136	.21 (331)
Energy for lighting (calculated in Appendix L)		248	3.2 (332)
Electricity generated by PVs (Appendix M) (negative quan	ntity)	-176	.61 (333)
Electricity generated by wind turbine (Appendix M) (negati	ive quantity)	0	(334)
12b. CO2 Emissions – Community heating scheme			
Electrical efficiency of CHP unit		32	2 (361)
Heat efficiency of CHP unit		64	4 (362)
	Energy Emission fact kWh/year kg CO2/kWh	or Emissio kg CO2/	ons /year
Space heating from CHP) $(307a) \times 100 \div (362) =$	619.47 × 0.22	13	3.81 (363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	198.23 × 0.52	-10	2.88 (364)
Water heated by CHP (310a) × 100 ÷ (362) =	1944.69 × 0.22	42	0.05 (365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	622.3 × 0.52	-32	2.97 (366)
Efficiency of heat source 2 (%) If there is CH	IP using two fuels repeat (363) to (366) for the second	fuel	96 (367b)
CO2 associated with heat source 2	(307b)+(310b)] x 100 ÷ (367b) x 0.22	= 24	6.16 (368)
Electrical energy for heat distribution	[(313) x 0.52	= 1	4.2 (372)
Total CO2 associated with community systems	(363)(366) + (368)(372)	= 38	8.36 (373)
CO2 associated with space heating (secondary)	(309) x 0	=	0 (374)
CO2 associated with water from immersion heater or insta	antaneous heater (312) x 0.22	=	0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =	38	8.36 (376)
CO2 associated with electricity for pumps and fans within	dwelling (331)) x 0.52	= 70).69 (378)
CO2 associated with electricity for lighting	(332))) x 0.52	= 12	8.81 (379)
Energy saving/generation technologies (333) to (334) as a Item 1	applicable	=9	1.66 (380)
Total CO2, kg/year sum of (376)(382) =	=	49	6.21 (383)
Dwelling CO2 Emission Rate (383) ÷ (4) =		9	.86 (384)
El rating (section 14)		93	3.02 (385)

			User D	etails:									
Assessor Name: Software Name:	Stroma FSAP 2	012		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.1.24				
		Pr	roperty A	Address:	Flat 3								
Address :													
1. Overall dwelling dim	ensions:			()									
One word file an			Area	a(m²)		Av. He	ight(m)	1	Volume(m ³)	٦			
			6	6.88	(1a) x	2	2.5	(2a) =	167.2	(3a)			
Total floor area TFA = (1	la)+(1b)+(1c)+(1d)+((1e)+(1n) 6	6.88	(4)					_			
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	167.2	(5)			
2. Ventilation rate:													
	main heating	secondary heating	у	other		total			m ³ per hour				
Number of chimneys	0 +	0	+	0] = [0	X 4	40 =	0	(6a)			
Number of open flues	0 +	0	<u> </u> + [0] = [0	x	20 =	0	(6b)			
Number of intermittent fa	ans				Ē	0	x ′	10 =	0	(7a)			
Number of passive vents	6					0	x ′	10 =	0	(7b)			
Number of flueless gas	fires				Г	0	X 4	40 =	0	(7c)			
Jumber of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour													
Infiltration due to chimne	eys, flues and fans =	(6a)+(6b)+(7a	a)+(7b)+(7	7c) =	Ę	0		÷ (5) =	0	(8)			
If a pressurisation test has	been carried out or is inte	nded, proceed	d to (17), c	otherwise c	ontinue fre	om (9) to ((16)						
Additional infiltration	ine dwennig (iis)						[(9)	-1]x0.1 =	0	(10)			
Structural infiltration: ().25 for steel or timb	er frame or	0.35 for	masonr	y constr	uction			0](11)			
if both types of wall are µ deducting areas of open	present, use the value cor ings); if equal user 0.35	responding to	the greate	er wall area	a (after					_ ``			
If suspended wooden	floor, enter 0.2 (unse	ealed) or 0.	1 (seale	d), else	enter 0				0	(12)			
If no draught lobby, er	nter 0.05, else enter	0							0	(13)			
Percentage of window	s and doors draugh	stripped							0	(14)			
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00	(45)		0	(15)			
Infiltration rate	50 1			(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)			
Air permeability value	, q50, expressed in a		s per ho	our per so	quare m	etre of e	envelope	area	3	(17) 			
Air permeability value appli	$\frac{1}{10} = \frac{1}{10}$	$[(17) \div 20] \div (0)$	e or e dec	se(10) = (meehility	is hoing u	sod		0.15	(18)			
Number of sides shelter	ed				measinty	s being u	300		3] (19)			
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.78	(20)			
Infiltration rate incorpora	ting shelter factor			(21) = (18)	x (20) =				0.12	(21)			
Infiltration rate modified	for monthly wind spe	ed								-			
Jan Feb	Mar Apr Ma	iy Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind s	peed 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 $	22)m ∸ 4												
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18					
	I								I				

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_		
Calculate effective air charge fate for the applicable case If mechanical ventilation: If exhaust air heat pump using Appendix N. (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) $\frac{1}{23}$ (23b) If balanced with heat recovery (MV/N (24b) m = (22b) m + (23b) × [1 - (23c) ± 100] (24a)m $\frac{1}{0.2}$ $$	~ ' '	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14			
$ \begin{array}{c} 0.1 \\ \mbox{true} the structure using the structure using dependent N, (23b) = (23a) \times Fmv (equation (NS)), otherwise (23b) = (23a) \\ \mbox{true} the structure use using dependent N, (23b) = (23a) \times Fmv (equation (NS)), otherwise (23b) = (23a) \\ \mbox{true} the structure use using dependent N, (23b) = (23a) \times Fmv (equation (NS)), otherwise (23b) = (23a) \\ \mbox{true} the structure use using dependent N, (23b) = (23a) \times Fmv (equation (NS)), otherwise (23b) = (23a) \\ \mbox{true} the structure use using dependent N, (23b) \times (1 - (23c) \times 100) \\ \mbox{true} the structure use using dependent N, (23b) \times (1 - (23c) \times 100) \\ \mbox{true} the structure use using dependent N, (23b) \times (1 - (23c) \times 100) \\ \mbox{true} the structure use using dependent N, (23b) \mbox{true} the structure use use use use use use use use use us$	Calcul If me	ate etter	ctive air al ventila	change	rate for t	ne appli	cable ca	se						0.5	(23a)	
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = (24) m $\frac{1}{26}$ $\frac{1}{26}$ $\frac{1}{26}$ $\frac{1}{26}$ $\frac{1}{26}$ $\frac{1}{24}$ $\frac{1}{22}$ $\frac{1}{2$	lf exh	aust air h	eat pump	using App	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	N5)), othei	wise (23b) = (23a)			0.5	(23b)	
a) If balanced mechanical ventilation with heat recovery (MV/HR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] (24a)m 028 026 026 024 024 022 022 022 022 023 024 024 025 (24a) b) If balanced mechanical ventilation without heat recovery (MV/(24b)m = (22b)m + (23b) c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24b)m 0 0 0 0 0 0 0 0 0 0	If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (from	n Table 4h) =	, (,			77.25	(23c)	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	a) If	balance	d mech:	, anical ve	entilation	with he	at recove	erv (MV/	- - - - - - - - - - - - - - - - - - -	m = (22)	2b)m + (23h) x [1	l – (23c)	<u> </u>	(200)	
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24c)m 0 0 0 0 0 0 0 0 0 0	(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(24a)	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	b) If	balance	d mecha	I anical ve	entilation	without	heat rec	L Coverv (N	I //V) (24b)m = (22	L 2b)m + (;	23b)		I		
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 0 0 0 0 0 0 0 0 0	(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)	
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)	c) If	whole h	use ex	tract ver	ntilation of	or positiv	e input v	ventilatio	n from c	outside				1		
$ \begin{array}{c c} (24c)m = & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 &$		if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	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 + [(22b)m ² x 0.5] (24d)m = $\overline{0}$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)	
$ \begin{array}{c c} (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + ((22b)m^2 \times 0.5] \\ \hline (24d)m \hline 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0$	d) If	natural	ventilatio	on or wh	ole hous	se 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	0.5 + [(2	2b)m² x	0.5]			1	(N	
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25) (26)m= 0.26 0.26 0.26 0.24 0.22 0.22 0.23 0.24 0.25 (25) 3. Heat losses and heat loss parameter: ELEMENT Gross area (m²) Openings Net Area A, m² U-value A X U k-value A X k Doors 2.1 \times 2 = 4.2 (26) (27) Windows Type 1 9.5.5 51.44 9.5.5 (21) (27) Windows Type 3 20.61 $\times 111/(0.8) + 0.04$] = 14.31 (27) Windows and rool windows, use effective window U-value calculated using formula $1/(1/U-value) + 0.04$] as given in paragraph 3.2 ** (29) (31) * for windows and rool windows, use effective window U-value calculated using formula $1/(1/U-value) + 0.04$] as given in paragraph 3.2 * * (33) * include the areas on bach sides of internal walls and partitions Eabric heat loss, W/K = S (A × L) (28)(30) + (32) = (48) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precise	(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)	
	Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)	r	1		1		
3. Heat losses and heat loss parameter: ELEMENT Gross area (m ²) Openings m ² Net Area A, m ² U-value W/m2K A X U (W/K) k-value KJ/K A X k KJ/K Doors 2.1 2 4.2 (U/K) KJ/M ² -K (26) Windows Type 1 9.5 51.44 9.5 (27) (27) Windows Type 3 20.61 x1/1/(0.8) + 0.04] 15.98 (27) Walls 95.5 51.44 44.06 x 0.13 5.73 (29) Total area of elements, m ² 95.5 (31) * 10.04] as given in paragraph 3.2 (31) * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 48.18 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = 48.18 (33) For design assessments where the details of the atel is	(25)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(25)	
ELEMENT Gross area (mt) Openings m ² Net Area A, m ² U-value W/m2K A X U (W/K) k-value kJ/m ² .K A X k kJ/K Doors 2.1 \times 2 = 4.2 (26) Windows Type 1 19.23 $\times 11(11(0.8) + 0.04]$ = 14.91 (27) Windows Type 3 20.61 $\times 11(11(0.8) + 0.04]$ = 7.36 (27) Walls 95.5 51.44 44.06 \times 0.13 = 5.73 (29) Total area of elements, m ² 95.5 (31) (26)(30) + (32) = (48.18 (33) Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (48.18 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = (34) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) cabe used instead of a detailed calculated using Appendix K (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38	3. He	at l <mark>osse</mark>	s and he	eat loss	paramet	er:										
area (mt) m² A, m² W/m2K (W/k) kJ/m²-K KJ/K Doors 2.1 x 2 = 4.2 (26) Windows Type 1 19.23 x1/1/(0.8) + 0.04] = 14.91 (27) Windows Type 3 20.61 x1/1/(0.8) + 0.04] = 7.36 (27) Walls 95.5 51.44 44.06 x 0.13 = 5.73 (29) Total area of elements, m² 95.5 (31) (31) * * (31) * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (48.18) (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = (48.18) (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. Thermal bridges : S (L x Y) calculated using Appendix K (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m = 0.33 x (25)m x (5) (38)m = 0.33 x (25)m x (5) (38)m = 0.77 (36)m = 0.77 (36)m = 0.77	ELEN	/IENT	Gros	ss	Openin	gs	Net Ar	ea	U-valu	Je	AXU		k-value	e i	AXk	
Dools 2.1 \times 2 = 4.2 (26) Windows Type 1 19.23 $\times t1[1/(0.8) + 0.04]$ = 14.91 (27) Windows Type 3 20.61 $\times 1/[1/(0.8) + 0.04]$ = 7.36 (27) Windows Type 3 20.61 $\times 1/[1/(0.8) + 0.04]$ = 15.98 (27) Walls 95.5 51.44 44.06 \times 0.13 = 5.73 (29) Total area of elements, m ² 95.5 (31) (31) * * (31) * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (48.18) (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = (48.18) (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. 8.1 (36) Thermal bridges : S (L x Y) calculated using Appendix K (33) + (36) = 56.28 (37) Youtilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38) (38) Wentilation heat loss calculated monthly </td <td>Deere</td> <td></td> <td>area</td> <td>(m²)</td> <td>m</td> <td>12</td> <td>A ,r</td> <td>n²</td> <td>VV/m2</td> <td>K T</td> <td>(VV/I</td> <td>K)</td> <td>kJ/m²·I</td> <td>K</td> <td>kJ/K</td>	Deere		area	(m²)	m	12	A ,r	n²	VV/m2	K T	(VV/I	K)	kJ/m ² ·I	K	kJ/K	
Windows Type 1 19.23 x1111/0.8 ± 0.041 14.91 (27) Windows Type 2 9.5 x11/1/0.8 ± 0.041 7.36 (27) Windows Type 3 20.61 x1/1/1/(0.8) ± 0.041 15.98 (27) Walls 95.5 51.44 44.06 x 0.13 = 5.73 (29) Total area of elements, m ² 95.5 (31) * (31) * (31) * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 48.18 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = 48.18 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = 48.18 (33) For design assessments where the details of the construction are not known precisely the indicative Value: Medium 250 (35) For design assessments where the detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K 8.1 (36) (31) Total fabric heat loss (33) + (36) = 56.28 (37) <td colspa<="" td=""><td>Doors</td><td>. .</td><td></td><td></td><td></td><td></td><td>2.1</td><td></td><td>2</td><td></td><td>4.2</td><td>=</td><td></td><td></td><td>(26)</td></td>	<td>Doors</td> <td>. .</td> <td></td> <td></td> <td></td> <td></td> <td>2.1</td> <td></td> <td>2</td> <td></td> <td>4.2</td> <td>=</td> <td></td> <td></td> <td>(26)</td>	Doors	. .					2.1		2		4.2	=			(26)
Windows Type 2 9.5 $x^{11}(1/0.8) + 0.04] = 7.36$ (27) Windows Type 3 20.61 $x^{11}(1/0.8) + 0.04] = 15.98$ (27) Walls 95.5 51.44 44.06 x 0.13 = 5.73 (29) Total area of elements, m ² 95.5 (27) (31) * * (27) ** include the areas on both sides of internal walls and partitions (29) (31) * * (31) ** include the areas on both sides of internal walls and partitions (26)(30) + (32) = (48.18) (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = (48.18) (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 Values of TMP in Table 1f (250) (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) (37) Youtilation heat loss (L X Y) calculated using Appendix K (31) + (36) = (56.28) (37) Ventilation heat loss calculated monthly (38) = 0.33 × (25)m × (5) (38) (38) (38)	vvindo	ws Type	9.1				19.23	3 x1/	/[1/(0.8)+	0.04] =	14.91				(27)	
Windows Type 3 20.61 $x1/(1/(0.8) + 0.04) = 15.98$ (27) Walls 95.5 51.44 44.06 x 0.13 = 5.73 (29) Total area of elements, m ² 95.5 (31) * (29) (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 ** (31) ** include the areas on both sides of internal walls and partitions (26)(30) + (32) = (48.18) (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K Indicative Value: Medium 250 (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) = (56.28) (37) Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5) (38)m = (38)m = (37) (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.18 12.66 13.14 13.	Windo	ws Type	e 2				9.5	X ^{1,}	/[1/(0.8)+	0.04] =	7.36	Ľ			(27)	
Walls95.551.4444.06X0.13=5.73(29)Total area of elements, m295.5(31)* include the area of elements, m295.5(31)* include the areas on both sides of internal walls and partitionsFabric heat loss, W/K = S (A x U)(26)(30) + (32) =48.18(33)Heat capacity Cm = S(A x k)(26)(30) + (32) =0(34)Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²KIndicative Value: Medium250(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 K8.1(36)(33) + (36) =56.28(37)Ventilation heat loss calculated monthly(38)m = 0.33 × (25)m × (5)(38)m = (37) + (38)m(39)m = $(70.7 \ 70.54 \ 70.38 \ 69.42 \ 69.42 \ 68.62 \ 68.62 \ 68.46 \ 68.94 \ 69.42 \ 69.74 \ 70.06 \ Average = Sum(39)_{1-y}/12=69.54(39)$	Windo	ws Type	93 				20.61	x1,	/[1/(0.8)+	0.04] =	15.98				(27)	
Total area of elements, m295.5(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 partitionsFabric heat loss, W/K = S (A x U)(26)(30) + (32) =(48.18)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) =0(34)Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²KIndicative Value: Medium250(35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11(36)(36)can be used instead of a detailed calculation.8.1(36)(37)Thermal bridges : S (L x Y) calculated using Appendix K8.1(36)if details of thermal bridging are not known (36) = 0.15 x (31)(38)m = 0.33 x (25)m x (5)Total fabric heat loss(33) + (36) =56.28(37)(38)m =13.1412.3412.1812.66(38)m=14.4314.2714.1113.313.1412.3412.18(39)m=70.770.5470.3869.5869.4268.6268.6468.9469.4269.7470.06Average Sum(39)y /12=69.54(39)	Walls		95.	5	51.4	4	44.06	3 X	0.13	=	5.73				(29)	
* 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) = (48.18)(33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32)(32e) = 0 (34) Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K Indicative Value: Medium 250 (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) = 56.28 (37) Total fabric heat loss (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.34 12.34 12.18 12.66 13.14 13.46 13.79 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 70.7 70.54 70.38 69.58 69.42 68.62 68.62 68.64 68.94 69.42 69.74 70.06 Average = Sum(39)y/12= 69.54 (39)	Total a	area of e	lements	, m²			95.5								(31)	
Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 48.18 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 0 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f 250 (35) Thermal bridges : S (L x Y) calculated using Appendix K 8.1 (36) if details of thermal bridging are not known (36) = 0.15 x (31) 56.28 (37) Total fabric heat loss (33) + (36) = 56.28 (37) 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) Heat transfer coefficient, W/K (39)m = (37) + (38)m (38) (39)m = (37) + (38)m (38)	* for win	idows and le the area	roof winde	ows, use e sides of ir	effective wi	ndow U-va Is and part	alue calcul titions	ated using	formula 1,	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2		
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: Medium 250 (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 8.1 (36) if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.34 12.18 12.66 13.14 13.46 13.79 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 70.7 70.54 70.38 69.58 69.42 68.62 68.62 68.46 68.94 69.42 69.74 70.06 Average = Sum(39)_{1.12}/12 = 69.54 (39)	Fabric	heat los	s. W/K :	= S (A x	U)	io una pun			(26)(30)	+ (32) =				48 18	(33)	
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K Indicative Value: Medium 250 (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 8.1 (36) if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.34 12.18 12.66 13.14 13.46 13.79 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 70.7 70.54 70.38 69.58 69.42 68.62 68.62 68.46 68.94 69.42 69.74 70.06 Average = Sum(39) ₁₋₁₂ /12= 69.54 (39)	Heat c	apacity	Cm = S((Axk)	-,					((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 = $0.33 \times (25)m \times (5)$ Ventilation heat loss calculated monthly (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.34 12.18 12.66 13.14 13.46 13.79 Heat transfer coefficient, W/K (39)m = 70.7 70.54 70.38 69.58 69.42 68.62 68.62 68.46 68.94 69.42 69.74 70.06 Average = Sum(39) ₁₋₁₂ /12= 69.54 (39)	Therm	al mass	parame	ter (TMI	⁻ = Cm -	- TFA) ir	∩ kJ/m²K			Indica	tive Value	: Medium		250	(35)	
can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K 8.1 (36) if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.18 12.66 13.14 13.79 (38) Heat transfer coefficient, W/K (39)m = $(37) + (38)m$ (39)m = 70.7 70.54 70.8 69.58 69.42 68.62 68.46 68.94 69.74 70.06 Average = Sum(39) ₁₋₁₂ /12 = 69.54 (39)	For desi	ign assess	' sments wh	ere the de	tails of the	, constructi	ion are noi	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		()	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 14.43 14.27 14.11 13.3 13.14 12.34 12.34 12.18 12.66 13.14 13.46 13.79 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m Average = Sum(39)t12 / 12= 69.54 (39)	can be ι	used inste	ad of a de	tailed calc	ulation.											
if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss (33) + (36) = 56.28 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = $0.33 \times (25)m \times (5)$ (38)m = 14.43 14.27 14.11 13.3 13.14 12.34 12.18 12.66 13.14 13.46 13.79 (38) Heat transfer coefficient, W/K (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$ (39)m = $(37) + (38)m$	Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	<						8.1	(36)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 14.43 14.27 14.11 13.3 13.14 12.34 12.34 12.18 12.66 13.14 13.46 13.79 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 70.7 70.54 70.38 69.58 69.42 68.62 68.46 68.94 69.42 69.74 70.06 Average = Sum(39) ₁₁₂ /12= 69.54 (39)	if details	of therma	al bridging at loss	are not kr	10wn (36) =	= 0.15 x (3	1)			(33) +	(36) -			50.00	(27)	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Ventila	ablic he	at loss of	alculator	1 monthly					(38)m	(00) =	25)m x (5)		56.28	(37)	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ventile		Foh	Mar		y May	lun	lul	Διια	Sen			Dec	1		
Heat transfer coefficient, W/K $(39)m = (37) + (38)m$ (39)m= 70.7 70.54 70.38 69.58 69.42 68.62 68.62 68.46 68.94 69.42 69.74 70.06 Average = Sum(39) ₁₁₂ /12= 69.54 (39)	(38)m=	14.43	14.27	14.11	13.3	13.14	12.34	12.34	12.18	12.66	13.14	13.46	13.79		(38)	
$(39)m = \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Hoot to							I		(20)~	_ (27)	28)m		1		
$Average = Sum(39)_{112} / 12= 69.54 (39)$	(39)m-			70.38	69 58	69 42	68 62	68 62	68 46	68 94	- (37) + (. 69 42	69 74	70.06	1		
	(00)///-	L	. 0.04			<i>E</i>	00.02				Average =	Sum(39)1.		69.54	(39)	

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05		
Numbo	r of dov		th (Tab					1	,	Average =	Sum(40)1.	12 /12=	1.04	(40)
	lan	Feb	Mar		May	lun	6.1	Δυσ	Sen	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 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	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	17		(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 a vater use, l	ay Vd,av Iwelling is not and co	erage = designed : ld)	(25 x N) to achieve	+ 36 a water us	se target o	90 f).2		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					-	
(44)m=	99.22	95.61	92.01	88.4	84.79	81.18	81.18	84.79	88.4	92.01	95.61	99.22		_
Energy c	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)	1082.42	(44)
(45)m=	147.14	128.69	132.8	115.78	111.09	<mark>9</mark> 5.86	88.83	101.94	103.15	12 <mark>0.21</mark>	131.22	142.5		_
lf instanta	aneous w	vater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	-	1419.22	(45)
(46)m=	<mark>2</mark> 2.07	19.3	19.92	17. <mark>37</mark>	16.66	14.38	13.32	15.29	15.47	18.03	19.68	21.38		(46)
Water s	storage	loss:	ingludir				etorogo	within or						(47)
Storage	e volum	e (intres)		ig any so		ntor 110	storage		arrie ves	sei		0		(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			(48) x (49)) =		1	10		(50)
b) If ma	anufact	urer's de	eclared of factor fr	cylinder l	oss fact	or is not	known:							(54)
If comm	nunitv h	eating s	ee secti	on 4.3		1/1110/02	iy)				0.	02		(51)
Volume	factor	from Ta	ble 2a								1.	03		(52)
Tempe	rature f	actor fro	m Table	2b							0	.6		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter ((50) or ((54) in (5	5)	·							1.	03		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(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	i lix H	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary	/ circuit	loss (an	nual) fro	om Table	e 3							0		(58)
Primary	/ circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	lified by	factor fi	om Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	stat)		1	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(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	quired for	water h	neating c	alculated	d fo	r each	n month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	202.42	178.62	188.08	169.27	166.37	14	49.36	144.11	157.21	156.65	175.49	184.72	197.78]	(62)
Solar DI	HW input	calculated	using Ap	pendix G o	r Appendix	(Н (negativ	e quantity	/) (enter	0' if no sola	r contribu	tion to wate	er heating)	-	
(add a	ddition	al lines if	FGHRS	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 v	vater hea	ter												
(64)m=	202.42	178.62	188.08	169.27	166.37	14	49.36	144.11	157.21	156.65	175.49	184.72	197.78		
			-						Ou	tput from w	ater heate	er (annual)	112	2070.06	(64)
Heat g	jains fro	om water	heating	, kWh/m	onth 0.2	5 ′	[0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	ı + (57)m	+ (59)m]	
(65)m=	93.15	82.73	88.38	81.29	81.16	7	4.67	73.76	78.11	77.09	84.19	86.43	91.6		(65)
inclu	ude (57)m in calo	ulation	of (65)m	only if c	ylir	nder is	s in the c	dwelling	, g or hot w	vater is f	rom com	munity h	neating	
5. In	ternal o	ains (see	Table	5 and 5a):										
Metab	olic dai	ns (Table	5) Wa	otts											
motab	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	108.4	108.4	108.4	108.4	108.4	1	08.4	108.4	108.4	108.4	1 <mark>08.4</mark>	108.4	108.4		(66)
Lightin	g gains	s (calcula	ted in A	ppendix	L, equat	ion	L9 or	· L9a), a	lso see	Table 5					
(67)m=	16.93	15.04	12.23	9.26	6.92	5	5.84	6.31	8.21	11.01	13.99	16.32	17.4	1	(67)
Applia	nces a	ains (calc	ulated i	n Appen	dix Lea	uat	ion I 1	13 or 1	3a) als	o see Ta	ble 5				
(68)m=	189.91	191.88	186.91	176.34	163	15	50.45	142.07	140.1	145.07	155.64	168.99	181.53	1	(68)
Cookir		s (calcula	ted in A	Appendix		tion		or 15a)			5			J	
(69)m=	33.84	33.84	33.84	33 84	23 84		3.84	33.84	33 84	33.84	33.84	33.84	33.84	1	(69)
Dump				50)	00.01		0.01	00.01	00.01	00.01	00.01	00.01	00.01		()
(70)m-				5a)	0	1	0	0	0		0		0	1	(70)
								0	0	0	0	0	0	J	()
(71)m-	s e.g. e						5) 26.72	96 70	96 70	96 70	06 70	96 70	06 70	1	(71)
(71)m=	-00.72	-00.72	-00.72	-80.72	-00.72		50.72	-00.72	-00.72	-00.72	-00.72	-00.72	-00.72	J	(71)
vvater	neating	g gains (i		140.0	400.00		00.74	00.44	404.00	407.07	440.40	400.04	400.40	1	(72)
(72)m=	125.2	123.11	118.79	112.9	109.08		J3.71	99.14	104.99	107.07	(70)	120.04	123.12	J	(72)
Total	Interna	l gains =		054.00	00450		(66)	m + (67)m	i + (68)m	+ (69)m +	(70)m + ((1)m + (72))m 1	1	(70)
(73)m=	387.56	385.55	373.45	354.02	334.52	3'	15.52	303.05	308.82	318.68	338.31	360.87	377.57		(73)
6. 50 Solar (lar gair	IS:		ar flux from	Tabla 6a	and	accodi	atod ogua	tions to (convort to th		blo orionta	tion		
	ation.		actor			anu	Flux	aleu equa			ie applica		uon.	Gains	
Onenta	auon.	Table 6d	aciói	m ²	L		Tab	^ ole 6a		9_ Table 6b	٦	able 6c		(W)	
Fast	0.0v	1	、	(10	22	v	1	0.64		0.4	_ ↓ Γ	0.7		51 4	7(76)
Fast	0.9%		<u> </u>		.20			9.40		0.4	╡┊╏	0.7		D1.4	$\int_{(76)}^{(70)}$
Faet	0.9X		<u> </u>		.23	* _	3	0.42		0.4		0.7	=	100.54	$\int_{(76)}^{(70)}$
East	0.9X		`		.23	×	6	3.27		0.4		0.7	=	165.57	」 ⁽⁷⁰⁾ □(70)
East	0.9x	1	`	(19	.23	X	93	2.28		0.4		0.7	=	241.48	_(76) _(76)
⊏ast	0.9x	1	>	(19	.23	x	11	3.09	x	0.4	×	0.7	=	295.94	(76)

East	0.9x	1		x	19.3	23	x	1	15.77	x		0.4	×	0.7		= [302.95	(76)
East	0.9x	1		x	19.2	23	x	1	10.22	x		0.4	- ×	0.7		= [288.42	(76)
East	0.9x	1		x	19.2	23	x	9	94.68	x		0.4	×	0.7	-	- [247.75	(76)
East	0.9x	1		x	19.2	23	x	7	73.59	x		0.4	- ×	0.7	-	- [192.57	(76)
East	0.9x	1		x	19.2	23	x	4	15.59	x		0.4	ا × آ	0.7	-	= [119.3	(76)
East	0.9x	1		x	19.2	23	x	2	24.49	x		0.4	×	0.7	-	- [64.08	(76)
East	0.9x	1		x	19.2	23	x	1	6.15	x		0.4	×	0.7		= [42.26	(76)
South	0.9x	0.54		x	9.5	5	x	4	16.75) x		0.4	×	0.7		= [60.44	(78)
South	0.9x	0.54		x	9.5	5	x	7	76.57	x		0.4	×	0.7		= [98.98	(78)
South	0.9x	0.54		x	9.5	5	x	9	97.53	x		0.4	×	0.7		= [126.09	(78)
South	0.9x	0.54		x	9.5	5	x	1	10.23	x		0.4	×	0.7		= [142.51	(78)
South	0.9x	0.54		x	9.5	5	x	1	14.87	x		0.4	×	0.7		= [148.5	(78)
South	0.9x	0.54		x	9.5	5	x	1	10.55	x		0.4	×	0.7		= [142.91	(78)
South	0.9x	0.54		x	9.5	5	x	1	08.01	x		0.4	×	0.7		= [139.63	(78)
South	0.9x	0.54		x	9.5	5	x	1	04.89	x		0.4	x	0.7		= [135.6	(78)
South	0.9x	0.54		x	9.5	5	x	1	01.89	x		0.4	×	0.7		= [131.71	(78)
South	0.9x	0.54		x	9.5	5	x	8	32.59	x		0.4	×	0.7		= [106.76	(78)
South	0.9x	0.54		x	9.8	5	X	5	55.42	х		0.4	x	0.7		= [71.64	(78)
South	0.9x	0.54		x	9.5	5	x		40.4) x		0.4	x	0.7	-	- [52.23	(78)
West	0.9x	0.54		x	20.0	61	x		9.64] ×		0.4	x	0.7		= [55.08	(80)
West	0.9x	0.54		x	20.0	61	x	3	38.42	x		0.4	x	0.7	-	= [107.75	(80)
West	0.9x	0.54		x	20.	61	x	6	63.27	x		0.4	x	0.7	-	= [177.46	(80)
West	0.9x	0.54		x	20.0	61	x	9	92.28	x		0.4	x	0.7		= [258.81	(80)
West	0.9x	0.54		x	20.0	61	x	1	13.09	x		0.4	x	0.7	:	= [3 <mark>17.18</mark>	(80)
West	0.9x	0.54		x	20.0	61	x	1	15.77	x		0.4	×	0.7		= [324.69	(80)
West	0.9x	0.54		x	20.0	61	x	1	10.22	x		0.4	×	0.7	:	= [309.12	(80)
West	0.9x	0.54		x	20.0	61	x	ę	94.68	x		0.4	×	0.7	:	= [265.53	(80)
West	0.9x	0.54		x	20.0	61	x	7	73.59	x		0.4	×	0.7	:	= [206.39	(80)
West	0.9x	0.54		x	20.0	61	x	4	15.59	x		0.4	×	0.7	:	= [127.86	(80)
West	0.9x	0.54		x	20.0	61	x	2	24.49	x		0.4	×	0.7	:	= [68.68	(80)
West	0.9x	0.54		x	20.0	61	x	1	6.15	x		0.4	×	0.7	:	= [45.3	(80)
Solar	gains in	watts, ca	alculat	ed	for each	h mon	th		1	(83)m	1 = Si	um(74)m	.(82)m	-i				(00)
(83)m=	166.92	307.28	469.1	2 or	642.8	761.62	2	770.55	737.17	648	8.88	530.67	353.92	2 204.41	139.7	9		(83)
10tal ((04)111 =	= (73)		(03)11		057	. 74	0.40.05		505.07	5470			(94)
(04)m=	554.47	092.03	642.5	<u>'</u>	990.62	1096.1	5 I	086.08	1040.22	957	./ 1	649.30	092.23	5 565.27	517.3	0		(04)
7. Me	ean inter	nal temp	peratu	re (heating	seaso	on)		·			(())				г		1
lemp	berature	during h	neating) pe	eriods ir	the lr	ving	area	from Tak	ole 9	, Ih	1 (°C)				l	21	(85)
Utilis	ation fac	tor for g	ains to	r li	ving are	ea, h1,	m (s					600 I	0~*	Nov				
(86)m-		1 FeD		<u>'</u>	Apr 0.77		y	Jun			ug 33	0.55	UCL			U		(86)
	0.99	0.97	0.91		0.77	0.58		0.4	0.29			0.00	0.00	0.98	0.99			(00)
Mear	n interna	I temper	ature	in li	iving are	ea T1	(follo	ow ste	ps 3 to 7	7 in T		9c)	00.00		00.07			(07)
(87)m=	20.1	20.34	20.64	ł	20.89	20.98		21	21	2	1	20.99	20.82	20.4	20.05	D I		(87)

Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.96	0.89	0.72	0.52	0.34	0.23	0.26	0.48	0.82	0.97	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to	7 in Tabl	e 9c)	-			
(90)m=	18.85	19.2	19.62	19.93	20.03	20.06	20.06	20.06	20.05	19.87	19.3	18.79		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.56	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.55	19.84	20.19	20.47	20.56	20.59	20.59	20.59	20.58	20.4	19.92	19.5		(92)
Apply	adjustn	nent to t	he mear	n internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.55	19.84	20.19	20.47	20.56	20.59	20.59	20.59	20.58	20.4	19.92	19.5		(93)
8. Sp	ace hea	ting requ	uirement											
Set T	i to the r ilisation	nean int	ernal ter	mperatur	e obtair	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	.Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm):	may	Udit	Uui	7.03	000	000	1107	200		
(94)m=	0.99	0.96	0.89	0.74	0.55	0.38	0.26	0.3	0.52	0.84	0.97	0.99		(94)
Us <mark>efu</mark>	Il gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	546.84	666.24	753.59	740.37	603.47	409.52	273.48	286.45	440.1	58 <mark>0.01</mark>	547.16	512.14		(95)
Mo <mark>ntl</mark>	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	<mark>4</mark> .2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1078.33	1053.8	963.52	804.96	615.28	410.72	273.61	286.71	446.39	680.48	894.03	1071.8		(97)
Space	305 / 3	260.44		16 51	10ntn, K		n = 0.02	24 X [(97])m – (95 I)m] x (4 74 75)m 249.75	/16 38		
(50)11-	000.40	200.44	100.10	40.01	0.75	0	0	Tota		(k)//b//ear	2 + 5.75	8)	1608 23	(98)
Casa	. h tin			L(\ \ /b /m ?	lucor.			1010	ii per year	(KWIII)yeai) = 0um(3	0)15,912 -	1000.20	
Space	e neatin	g require	ement in	KVVN/m²	/year								24.05	(99)
9b. En	ergy rec	luiremer	nts – Coi	mmunity	heating	scheme					• •			
This pa Fractio	art is use on of spa	ed for sp ace heat	ace hea from se	iting, spa condarv/	ace cool /supplen	ing or wa nentary l	ater heat heating (ting prov (Table 1 ⁻	rided by : 1) '0' if n	a comm one	unity sch	neme.	0	(301)
Fractio	n of spa	ace heat	from co	mmunity	system	1 - (301	1) =	(.,				1	(302)
The con			v obtoin b	not from co	woral sour	roos Tho r	rocoduro	allows for	CUD and	un to four	othor hoot	sourcos: f	ho lottor	()
includes	boilers, h	eat pump	s, geotheri	mal and wa	aste heat f	rces. The p from power	r stations.	See Appel	ndix C.		olinei neal	sources, u		
Fractio	n of hea	at from C	Commun	ity CHP									0.6	(303a)
Fractio	n of cor	nmunity	heat fro	m heat s	ource 2								0.4	(303b)
Fractio	n of tota	al space	heat fro	m Comm	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fractio	n of tota	al space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor	for cont	rol and	charging	method	(Table	4c(3)) fo	r commu	unity hea	ating sys [.]	tem			1	(305)
Distrib	ution los	s factor	(Table '	I2c) for c	commun	ity heatir	ng syste	m					1.1	(306)
Space	heating	9											kWh/ye	ar
Annua	l space	heating	requiren	nent									1608.23	

Space heat from Community CHP	(98) x (304a)	x (305) x (306) =		1061.43	(307a)
Space heat from heat source 2	(98) x (304b)	x (305) x (306) =		707.62	(307b)
Efficiency of secondary/supplementary heating system in % (fro	m Table 4a or Appe	endix E)		0	(308
Space heating requirement from secondary/supplementary syst	em (98) x (301) x	: 100 ÷ (308) =		0	(309)
Water heating Annual water heating requirement				2070.06	1
If DHW from community scheme: Water heat from Community CHP	(64) x (303a)	x (305) x (306) =		1366.24	(310a)
Water heat from heat source 2	(64) x (303b)	x (305) x (306) =		910.83	(310b)
Electricity used for heat distribution	0.01 × [(307a)(30	07e) + (310a)…(310e)] =	=	40.46	(313)
Cooling System Energy Efficiency Ratio				0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (31	4) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from	outside			234.58	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (33	30b) + (330g) =		234.58	(331)
Energy for lighting (calculated in Appendix L)				299	(332)
Electricity generated by PVs (Appendix M) (negative quantity)			-	·176.61	(333)
Electricity generated by wind turbine (Appendix M) (negative qu	antity)			0	(334)
12b. CO2 Emissions – Community heating scheme					_
Electrical efficiency of CHP unit				32	(361)
Heat efficiency of CHP unit				64	(362)
	Energy kWh/year	Emission facto kg CO2/kWh	r Emis kg C	sions O2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	1658.49 ×	0.22		358.23	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	530.72 ×	0.52		-275.44	(364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2134.75 ×	0.22		461.11	(365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	683.12 ×	0.52		-354.54	(366)
Efficiency of heat source 2 (%) If there is CHP using	two fuels repeat (363) t	to (366) for the second f	uel	96	(367b)
CO2 associated with heat source 2 [(307b)+	(310b)] x 100 ÷ (367b) x	0.22	=	364.15	(368)
Electrical energy for heat distribution	(313) x	0.52	=	21	(372)
Total CO2 associated with community systems	(363)(366) + (368)(3	72)	=	574.51	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantane	ous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			574.51	(376)
CO2 associated with electricity for pumps and fans within dwelli	ng (331)) x	0.52	=	121.75	(378)





			User D	etails:									
Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.1.24 Property Address: Flat 4 Address : 1. Overall dwelling dimensions:													
		Р	roperty /	Address:	Flat 4								
Address :													
1. Overall dwelling dim	iensions:		-	()									
Cround floor			Area	a(m²)	(4 -)	Av. He	ight(m)		Volume(m ³)				
				1.18	(1a) x	2	2.5	(2a) =	177.95	(3a)			
Total floor area TFA = (1a)+(1b)+(1c)+(1	d)+(1e)+(1r	1) 7	1.18	(4)					-			
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	177.95	(5)			
2. Ventilation rate:													
	main heating	secondar heating	у	other		total			m ³ per hour				
Number of chimneys	0	+ 0	+	0] = [0	X 4	40 =	0	(6a)			
Number of open flues	0	+ 0	¯ + ¯	0] = [0	x	20 =	0	(6b)			
Number of intermittent f	ans				Ē	0	× ′	10 =	0	(7a)			
Number of passive vent	S				Γ	0	x ′	10 =	0	(7b)			
Number of flueless gas	fires					0	X 4	40 =	0	(7c)			
Jumber of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour													
Air changes per Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 0 \div (5) = 0 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) 0 Number of storeys in the dwelling (ns) 0													
Number of storeys in	the dwelling (ns)	intended, proceed	<i>a io</i> (<i>17)</i> , c	ourierwise c	onunue no	0111 (9) 10 (10)		0] (9)			
Additional infiltration							[(9)	-1]x0.1 =	0	(10)			
Structural infiltration:	0.25 for steel or ti	mber frame or	0.35 for	masonr	y constr	uction			0	(11)			
if both types of wall are deducting areas of oper	present, use the value nings); if equal user 0.	e corresponding to 35	the greate	er wall area	a (after					-			
If suspended wooden	floor, enter 0.2 (u	unsealed) or 0.	1 (seale	d), else	enter 0				0	(12)			
lf no draught lobby, e	nter 0.05, else en	ter 0							0	(13)			
Percentage of window	vs and doors drau	ught 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	, q50, expressed	in cubic metre	s per ho	our per so	quare mo	etre of e	nvelope	area	3	(17)			
If based on air permeab	bility value, then ($(8) = [(17) \div 20] + (8)$	s), otherwi	se(18) = (io) moobilituu	ia haina u	and		0.15	(18)			
Number of sides shelter	ed	lesi nas been don	le ol a deg	liee all pei	ineability i	is being us	seu		3] (19)			
Shelter factor	00			(20) = 1 - [0.075 x (1	9)] =			0.78	(20)			
Infiltration rate incorpora	ating shelter facto	r		(21) = (18)	x (20) =				0.12	(21)			
Infiltration rate modified	for monthly wind	speed								-			
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Monthly average wind s	peed 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 $(22a)m = 0$	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					
	I								I				

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
<u> </u>	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calcul If me	ate etter	ctive air al ventila	change	rate for t	ne appli	cable ca	se						0.5	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	3b) = (23a	a) × Fmv (e	equation (1	N5)) . othei	wise (23b) = (23a)			0.5	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use fa	actor (from	n Table 4h) =	, (,			77.25	(23c)
a) If	balance	d mech	anical ve	entilation	with he	at recove	erv (MVI	- - - - - - - - - - - - - - - - - - -	n)m = (22)	2h)m + (23h) x [1	l – (23c)	<u> </u>	(200)
(24a)m=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(24a)
b) If	balance	d mech	ı anical ve	entilation	without	heat rec	L Coverv (N	I //V) (24b)m = (22	1 2b)m + ()	23b)		I	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	ract ver	ntilation of	or positiv	re input v	ventilatio	n from c	outside				1	
	if (22b)n	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	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from I	oft	-	-	-		
	if (22b)n	n = 1, th	en (24d) I	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(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=	0.26	0.26	0.26	0.24	0.24	0.22	0.22	0.22	0.23	0.24	0.24	0.25		(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	e la la la la la la la la la la la la la	AXk
Deero		area	(m²)	m	12	A ,r	n²	VV/m2	K T	(VV/	K)	KJ/M ² ·I	ĸ	KJ/K
Doors	. .					2.1	X	2	=	4.2	=			(26)
vvindo	ws Type	9.1				8.25	x1.	/[1/(0.8)+	0.04] =	6.4				(27)
Windo	ws Type	e 2				15.71	x1.	/[1/(0.8)+	0.04] =	12.18	Ľ,			(27)
Walls		91.	8	26.0	6	65.74	1 X	0.13	= [8.55	_ L			(29)
Roof		71.1	8	0		71.18	3 X	0.12	=	8.54				(30)
Total a	area of e	lements	, m²			162.9	8							(31)
* for win	idows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	formula 1,	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)	io ana par			(26)(30)	+ (32) =				39.86	(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	: Medium		250	(35)
For desi can be i	ign assess used inste	sments wh ad of a de	ere the de	etails of the	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated (using Ap	pendix ł	<						13.8	(36)
if details	s of therma	al bridging	, are not kr	10wn (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			53.66	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	15.35	15.18	15.01	14.16	13.99	13.14	13.14	12.97	13.48	13.99	14.33	14.67		(38)
Heat tr	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (38)m		_	
(39)m=	69.02	68.85	68.67	67.82	67.65	66.8	66.8	66.63	67.14	67.65	67.99	68.33		
										Average =	Sum(39)1	12 /12=	67.78	(39)

Heat lo	ss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)				
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.96	0.96			
								ļ	,	Average =	Sum(40)1.	12 /12=	0.95	(40)	
Numbe	r of day	/s in moi	nth (Tab		Mov	lun		<u> </u>	Son	Oct	Nov	Dee			
(11)m-	Jan 21	29 29	21	20	1VIAY	Jun	31 21	Aug	Sep 20	21	20	21		(41)	
(41)11=	31	20	31	30	31	30	31	51	30	31	30	31		(41)	
4. Wa	ter hea	ting ene	rgy regu	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 ×	: [1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	27		(42)	
Annual Reduce t not more	averag the annua that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c 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	92 f	.86		(43)	
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wate	r usage i	n litres per	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)							
(44)m=	102.15	98.43	94.72	91	87.29	83.57	83.57	87.29	91	94.72	98.43	102.15		_	
Ener <mark>gy c</mark>	ontent of	hot water	used - ca	lculated m	onthly $= 4$.	190 x Vd,ı	m x nm x L	OTm / 3600) kWh/mor	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1114.33	(44)	
(45)m=	1 <mark>5</mark> 1.48	132.49	136.71	119.19	114.37	<mark>9</mark> 8.69	91.45	104.94	106.19	123.76	135.09	146.7		_	
lf instanta	aneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1461.06	(45)	
(46)m=	<mark>2</mark> 2.72	19.87	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22.01		(46)	
Water a	storage	loss:													
Storage	e volum	ie (litres)	rinciuair	ng any so	biar or v	WHRS	storage		ame ves	sei		0		(47)	
If comn Otherw	nunity r ise if no	eating a	and no ta hot wate	ank in dw er (this ir	/elling, e ocludes i	nter 110 nstantar) litres in Decus co	1 (47) Smbi boil	ers) ente	er 'O' in <i>(</i>	(47)				
Water s	storage	loss:	not wat			notantai	10000 00								
a) If m	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	r storage	e, kWh/ye	ear			(48) x (49)) =		1	10		(50)	
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:						1		
Hot wa	ter stor	age loss	actor fi	rom Tabl	le 2 (kW	h/litre/da	ay)				0.	02		(51)	
Volume	e factor	from Ta	ble 2a	011 4.5							1	03		(52)	
Tempe	rature f	actor fro	m Table	2b							0	.6		(53)	
Enerav	lost fro	om water	r storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =	1	03		(54)	
Enter ((50) or	(54) in (5	55)	,,						,	1.	03		(55)	
Water s	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m					
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)	
If cylinde	r contain	s dedicate	d solar sto	l orage, (57)	I m = (56)m	x [(50) – (I (H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l lix H		
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)	
Primary	/ circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)	
Primary	/ circuit	loss cal	culated	for each	month (59)m =	(58) ÷ 36	65 × (41)	m				-		
(mod	lified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)		L		
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)	
Combi	loss ca	alculated	for eac	h month	(61)m =	(60)) ÷ 36	5 × (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	neating c	alculated	l for	each	month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	206.76	182.41	191.99	172.68	169.64	15	2.18	146.73	160.22	159.69	179.04	188.59	201.98		(62)
Solar DI	-IW input	calculated	using Ap	pendix G o	r Appendix	H (r	negativ	e quantity	/) (enter 'C)' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHR	S and/or	WWHRS	ар	plies,	see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter												
(64)m=	206.76	182.41	191.99	172.68	169.64	15	2.18	146.73	160.22	159.69	179.04	188.59	201.98		
			-						Out	put from w	ater heate	er (annual)₁	12	2111.9	(64)
Heat g	ains fro	m water	heating	g, kWh/m	onth 0.2	5´[0.85 :	× (45)m	+ (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	94.59	83.99	89.68	82.43	82.25	75	5.61	74.63	79.11	78.1	85.37	87.71	93		(65)
inclu	de (57)	m in calo	ulation	of (65)m	only if c	ylin	der is	in the c	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. In	ternal g	ains (see	e Table	5 and 5a):	-			-				-	-	
Metab	olic gai	ns (Table	5) Wa	atts											
motab	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	113.72	113.72	113.72	113.72	113.72	11	3.72	113.72	113.72	113.72	113.72	113.72	113.72		(66)
Liahtin	a dains	(calcula	ted in A		L. equat	ion	L9 or	L9a), a	lso see	Table 5					
(67)m=	17.83	15.84	12.88	9.75	7.29	6	.15	6.65	8.64	11.6	14.73	17.19	18.33	1	(67)
Applia	nces da	ins (calc	ulated i	n Appen	dix Lea	uati	on I 1	3 or 1:	3a) also	see Ta	ble 5	!			
(68)m=	200.04	202.11	196.88	185.74	171.69	15	8.48	149.65	147.57	152.81	163.94	178	191.21	1	(68)
Cookir			ted in 4	Appendix		ion	115 0	or 15a)		e Table	5			J	
(69)m=	34.37	34.37	34.37	34.37	34.37	34	37	34.37	34.37	34.37	34.37	34.37	34.37	1	(69)
Dump	and fa	ne gaine	(Table	52)											
(70)m-				$\frac{3a}{1}$	0		0	0	0	0	0	0	0	1	(70)
							<u> </u>	v	Ū	Ů	Ŭ	Ů	Ŭ]	(
(71)m-) 0 00	00.08	00.08	00.08	00.08	00.08	00.08	1	(71)
(/ I)III-	-30.30		-30.30	-90.90	-30.30	-3	0.30	-30.30	-30.30	-90.90	-30.30	-30.30	-30.30]	()
vvater	neating	gains (1	able 5)	111 40	110 55	10	5 01	100.21	106.24	100.40	111 75	101.00	105	1	(72)
(72)11=	127.14	124.99	120.34	114.40	110.55	10	(00)	100.31	100.34	100.40	(70) - (7	121.02	125	J	(12)
I otal	nterna	i gains =	007.44	007.00	040.04	00		040.70		+ (69)11 + 1	(70)m + (1	$\frac{1}{1}$ $\frac{1}$		1	(72)
(73)m=	402.12	400.06	367.41	367.09	340.04	32	.0.76	313.72	319.07	330	350.53	374.13	391.05		(13)
Solar o	iai gain nains are	s. calculated	usina sol	ar flux from	Table 6a :	and :	associa	ated equa	tions to co	onvert to th	e annlica	ble orientat	ion		
Orient	ation:	Access F		Area			Flux	((n		FF		Gains	
Onorm		Table 6d	aotor	m²	L		Tab	le 6a	Г	able 6b	Т	able 6c		(W)	
North	0.9x	0.5/	,	(15	71	×Г	10) 63	×	04	<u> к</u> г	0.7		22 73	7(74)
North	0.94	0.54			71	ΩL γΓ		1.32		0.4	╡╻╷	0.7	=	12 11	」 ^(***)] ₍₇₄₎
North	0.0A	0.54			71	ΩL γΓ	20	1.53		0.4	╡ᆠ┟	0.7	=	72.00	」 ^{(,, ,,})] ₍₇₄₎
North	0.04	0.54	(71	ι Γ	34 			0.4	╡╏╏	0.7		110 57	」(' ^{™)}](74)
North	0.9X	0.54	<u> </u>		74	^ L _ Г	50	1.70		0.4	╡゜┝	0.7		450.70	
North	0.9X	0.54)	15	.71	^ L	74	1.72	×	0.4	×	0.7	=	159.73	(74)

North	0.9x	0.54		x	15.	71	x	7	79.99	x	(0.4	×	0.7		=	170.99	(74)
North	0.9x	0.54		x	15.	71	x	7	74.68	x	(0.4	_ × [0.7		=	159.64	(74)
North	0.9x	0.54		x	15.	71	x	5	59.25	x	(0.4	×	0.7		=	126.66	(74)
North	0.9x	0.54		x	15.	71	x	4	11.52	x	(0.4	×	0.7		=	88.75	(74)
North	0.9x	0.54		x	15.	71	x	2	24.19	x	(0.4	×	0.7		= [51.71	(74)
North	0.9x	0.54		x	15.	71	x	1	3.12	x	(0.4	×	0.7		= [28.04	(74)
North	0.9x	0.54		x	15.	71	x		8.86	x	(0.4	×	0.7		= [18.95	(74)
West	0.9x	0.54		x	8.2	5	x	1	9.64	x	(0.4	×	0.7		= [22.05	(80)
West	0.9x	0.54		x	8.2	5	x	3	38.42	x	(0.4	×	0.7		= [43.13	(80)
West	0.9x	0.54		x	8.2	5	x	6	63.27	x	(0.4	x	0.7		=	71.03	(80)
West	0.9x	0.54		x	8.2	5	x	9	92.28	x	(0.4	×	0.7		= [103.6	(80)
West	0.9x	0.54		x	8.2	5	x	1	13.09	x	(0.4	×	0.7		= [126.96	(80)
West	0.9x	0.54		x	8.2	5	x	1	15.77	x	(0.4	×	0.7		=	129.97	(80)
West	0.9x	0.54		x	8.2	5	x	1	10.22	x	(0.4	×	0.7		= [123.74	(80)
West	0.9x	0.54		x	8.2	5	x	9	94.68	x	(0.4	x	0.7		= [106.29	(80)
West	0.9x	0.54		x	8.2	5	x	7	73.59	x	(0.4	×	0.7		= [82.62	(80)
West	0.9x	0.54		x	8.2	5	x	4	15.59	x	(0.4	x	0.7		= [51.18	(80)
West	0.9x	0.54		x	8.2	5	x	2	24.49	х		0.4	x	0.7		=	27.49	(80)
West	0.9x	0.54		x	8.2	5	x	1	6.15	x		0.4	×	0.7		- [18.13	(80)
Solar g	<mark>gain</mark> s in	watts, <mark>ca</mark>	I <mark>lcu</mark> lat	ed	for eacl	n mont	th			(83)m	n = Sum	ı(74)m	. <mark>(8</mark> 2)m		_			
(83)m=	44.78	86.58	144.8	5	222.17	286.69	3 3	00.96	283.38	232	.95 1	71.37	102.89	55.54	37.	08		(83)
Total (gains – i	nternal a	nd sol	ar	(84)m =	: (73)n	ו + (ד	83)m	, watts	-	_			_	-			
(84)m=	446.9	486.63	532.2	7	589.27	633.3	4 6	27.72	597.11	552	.62 5	501.37	453.43	429.67	428	5.74		(84)
7. Me	ean inter	nal temp	eratur	e (heating	seasc	on)											
Temp	perature	during h	eating	pe	eriods ir	the liv	ving	area	from Tal	ble 9	, Th1 ((°C)					21	(85)
Utilis	ation fac	tor for ga	ains fo	or li	ving are	a, h1,	m (s	ee Ta	ble 9a)	·								
	Jan	Feb	Ma	r	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	D	ec		
(86)m=	1	1	0.99		0.95	0.85		0.66	0.49	0.5	55	0.82	0.97	0.99	1			(86)
Mear	n interna	l tempera	ature i	n li	iving are	ea T1 ((follo	ow ste	ps 3 to 7	7 in T	able 9	9c)		-				
(87)m=	20.04	20.15	20.36	;	20.65	20.88	2	20.98	21	20.	99 2	20.93	20.64	20.29	20.	02		(87)
Tem	perature	during h	eating	pe	eriods ir	rest o	of dw	velling	from Ta	able 9	9, Th2	: (°C)						
(88)m=	20.11	20.11	20.11		20.12	20.12	2	20.13	20.13	20.	14 2	20.13	20.12	20.12	20.	12		(88)
Utilis	ation fac	tor for a	ains fo	or re	est of d	velling	. h2	.m (se	ee Table	9a)	•			•				
(89)m=	1	0.99	0.98	T	0.94	0.81		0.58	0.39	0.4	45	0.75	0.96	0.99	1	I		(89)
Moor		l temper	aturo i	_ t	ho rost	of dwe		T2 (f	l ollow ste		to 7 i	n Table						
(90)m=	18.82	18.98	19.29		19.71	20.01		20.12	20.13	20.	13	20.07	19.7	19.2	18	.8		(90)
x/											_	fL	A = Liv	ing area ÷ (4) =	-	0.33) (91)
N4	, into	1 to me		f		ole de	ر مالاند	a) (۱۸ ۲۷	. /4	£1 A \	т о		·		L		` `
		1 temperative		ror	20.02			(g) = f	LA X 11	+ (1	- TLA)) × 12 20.36	20.01	10.56	10	2		(02)
(52)11=	1 10.22	1 10.07	13.04	· •	20.02	20.29	1 4	_0.41	1 20.42	1 20.	74 4	20.00	20.01	1 19.00	1 19	. 1		(02)

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

(93)m=	19.22	19.37	19.64	20.02	20.29	20.41	20.42	20.42	20.36	20.01	19.56	19.2		(93)
8. Spa	ice heat	ting requ	iirement											
Set Ti the uti	to the r lisation	nean inte factor fo	ernal ter or gains	nperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of ⁻	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Γ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for ga	ains, hm	:										
(94)m=	1	0.99	0.98	0.94	0.82	0.6	0.43	0.48	0.77	0.96	0.99	1		(94)
Usefu	gains,	hmGm ,	W = (94	1)m x (84	4)m									
(95)m=	444.86	482.66	521.77	552.04	516.52	379.01	254.24	265.96	386.14	433.76	425.63	427.17		(95)
Month	ly 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 l	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m ×	‹ [(93)m-	– (96)m]				
(97)m=	1029.9	996.22	902.68	754.08	581.44	387.84	255.19	267.84	420.1	636.93	847.41	1025.04		(97)
Space	heating	g require	ement fo	r each m	nonth, k	Nh/mont	th = 0.02	4 x [(97))m – (95)m] x (4	1)m			
(98)m=	435.27	345.11	283.4	145.46	48.3	0	0	0	0	151.16	303.68	444.81		_
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	2157.19	(98)
Space	heating	g require	ement in	kWh/m²	/year								30.31	(99)
9b. Ene	ergy req	uiremen	ts – Cor	nmunity	heating	scheme	;							
This pa Fraction	rt is use h of spa	ed for sp	ace hea from se	ting, spa	ace cooli (supplen	ing or wa	ater heati heating (ing prov Table 11	ided by a 1) '0' if n	a c <mark>omm</mark> one	unity sch	neme.	0] (301)
Fraction			(ouppion	4 (004	4)		., •	0110				
Fraction	n or spa	ce neat	from co	mmunity	system	1 – (30)	1) =						1	(302)
The com	munity sc	heme may	obtain he	eat from se	everal sour	ces. The p	procedure a	allows for	CHP and u	up to four o	other heat	sources; ti	he latter	
Fraction	n of hea	it from C	ommun	ity CHP	iste neat i	rom power	r stations. c	see Apper	idix C.				0.6	(303a)
Fractio	n of con	nmunity	heat fro	m heat s	ource 2								0.4	(303b)
Fractio	n of tota	I space	heat fro	m Comm	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fraction	n of tota	I space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commu	nity hea	ting syst	tem			1	(305)
Distribu	ition los	s factor	(Table 1	2c) for c	commun	ity heatir	ng syster	n					1.1	(306)
Space	heating	J											kWh/year	-
Annual	space I	neating I	requirem	nent									2157.19	
Space	heat fro	m Comr	nunity C	HP					(98) x (30	04a) x (30	5) x (306) :	=	1423.75	(307a)
Space	heat fro	m heat s	source 2						(98) x (30	04b) x (30	5) x (306) :	=	949.17	(307b)
Efficien	cy of se	econdary	/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space	heating	requirer	nent froi	m secon	dary/su	oplemen	tary syste	em	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water I Annual	h eating water h	eating r	equirem	ent									2111.9]
lf DHW Water h	from concept	ommunit n Comm	y schem nunity C	ne: HP					(64) x (30)3a) x (30!	5) x (306) :	- -	1393.85	(310a)
Water h	neat from	n heat s	ource 2						(64) x (30)3b) x (30	5) x (306) :	=	929.24](310b)
Electric	ity used	for hea	t distribu	ution				0.01	× [(307a).	(307e) +	(310a)([310e)] =	46.96](313)

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter	er 0) = (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input	t from outside	249.66	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	249.66	(331)
Energy for lighting (calculated in Appendix L)		314.94	(332)
Electricity generated by PVs (Appendix M) (negative quan	ntity)	-176.61	(333)
Electricity generated by wind turbine (Appendix M) (negative	ive quantity)	0	(334)
12b. CO2 Emissions – Community heating scheme			
Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		64	(362)
	Energy Emission fact kWh/year kg CO2/kWh	or Emissions kg CO2/yea	r
Space heating from CHP) (307a) × 100 ÷ (362) =	2224.61 × 0.22	480.52	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	711.87 × 0.52	-369.46	(364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2177.9 × 0.22	470.43	(365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	696.93 × 0.52	-361.71	(366)
Efficiency of heat source 2 (%) If there is CH	P using two fuels repeat (363) to (366) for the second	fuel 96	(367b)
CO2 associated with heat source 2	307b)+(310b)] x 100 ÷ (367b) x 0.22	= 422.64	(368)
Electrical energy for heat distribution	[(313) x 0.52	= 24.37	(372)
Total CO2 associated with community systems	(363)(366) + (368)(372)	= 666.79	(373)
CO2 associated with space heating (secondary)	(309) x 0	= 0	(374)
CO2 associated with water from immersion heater or insta	antaneous heater (312) x 0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =	666.79	(376)
CO2 associated with electricity for pumps and fans within	dwelling (331)) x 0.52	= 129.58	(378)
CO2 associated with electricity for lighting	(332))) × 0.52	= 163.45	(379)
Energy saving/generation technologies (333) to (334) as a Item 1	applicable	= -91.66	(380)
Total CO2, kg/year sum of (376)(382) =	=	868.16	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =		12.2	(384)
El rating (section 14)		89.99	(385)

				User D	etails:										
Assessor Name: Software Name:	Stroma FSA	AP 201	2		Strom Softwa	a Num are Vei	ber: rsion:		Versic	on: 1.0.1.24					
			Р	roperty	Address	: Flat 5									
Address :															
1. Overall dwelling dimen	sions:														
				Are	a(m²)		Av. Hei	ight(m)	-	Volume(m ³)	_				
Ground floor				4	2.57	(1a) x	2	2.5	(2a) =	106.42	(3a)				
First floor				3	32.51	(1b) x	2	2.5	(2b) =	81.27	(3b)				
Second floor				3	31.06	(1c) x	2	2.5	(2c) =	77.65	(3c)				
Total floor area TFA = (1a)	+(1b)+(1c)+(1	ld)+(1e	e)+(1r	ı) <u> </u>	06.14	(4)			-						
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	265.35	(5)				
2. Ventilation rate:															
	m ³ per hour														
Number of chimneys	nber of chimneys 0 + 0 = 0 $x 40 =$ nber of open flues 0 + 0 + 0 = 0 $x 20 =$ nber of intermittent fans														
Number of open flues	0	+	0	+	0	_ = _	0	x :	20 =	0	(6b)				
Number of intermittent fans	3						0	x	10 =	0	(7a)				
Number of passive vents							0	x	10 =	0	(7b)				
Number of flueless gas fire	s						0	X	40 =	0	(7c)				
									Air ch	nanges per hou	ır				
Infiltration due to chimneys	, flu <mark>es and fa</mark>	ns = (6	a)+(6b)+(7	a)+(7b)+(7c) =	Г	0		÷ (5) =	0	(8)				
If a pressurisation test has bee	en carried out or i	is intende	ed, procee	d to (17),	otherwise o	continue fr	om (9) to (16)							
Number of storeys in the	dwelling (ns)									0	(9)				
Additional infiltration								[(9)	-1]x0.1 =	0	(10)				
Structural infiltration: 0.2	5 for steel or	timber f	frame or	0.35 fo	r masoni	ry constr	ruction			0	(11)				
if both types of wall are pres	sent, use the values (le corres	ponding to	the great	ter wall are	a (after									
If suspended wooden flo	or, enter 0.2 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	7(12)				
If no draught lobby, ente	r 0.05. else el	nter 0		. (000.11	,	00				0	(12)				
Percentage of windows	and doors dra	uaht st	ripped							0](14)				
Window infiltration		0	••		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)				
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13) +	⊦ (15) =		0	(16)				
Air permeability value, q	50, expressed	d in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	3	(17)				
If based on air permeability	value, then	(18) = [(1	7) ÷ 20]+(8	B), otherw	ise (18) = ((16)		-		0.15	(18)				
Air permeability value applies	if a pressurisatior	n test has	s been don	e or a de	gree air pe	rmeability	is being us	sed							
Number of sides sheltered										2	(19)				
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)				
Infiltration rate incorporation	g shelter facto	or			(21) = (18) x (20) =				0.13	(21)				
Infiltration rate modified for	monthly wind	speed	k I							1					
Jan Feb M	1ar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J					
Monthly average wind spec	ed from Table	e 7					1			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 = $(22)m \div 4$									
(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		
Adjusted infiltration rate (allowing for shelter	and wind s	peed) =	(21a) x	(22a)m					
0.16 0.16 0.16 0.14 0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effective air change rate for the ap	plicable ca	se		-					
If the main call vertilation. If exhaust air heat nump using Appendix N (23b) = (23a) x Emv (e	equation (N	(5)) othe	rwise (23h) = (23a)			0.5	(23a)
If balanced with heat recovery: efficiency in % allowing	na for in-use f	actor (from	n Table 4h) =) = (200)			0.5	(230)
a) If balanced mechanical ventilation with	heat recove	⊃rv (M\/⊦	HR) (24a	/ a)m = (22	2h)m + ('	23h) 🗙 [ʻ	1 – (23c)	03.7 ∸ 1001	(200)
(24a)m= 0.34 0.34 0.34 0.32 0.32	2 0.3	0.3	0.3	0.31	0.32	0.32	0.33	. 100]	(24a)
b) If balanced mechanical ventilation with	ut heat rec	coverv (N	L /IV) (24b	m = (22)	2b)m + (;	23b)			
(24b)m= 0 0 0 0 0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or pos	itive input v	/entilatio	n from o	outside					
if (22b)m < 0.5 × (23b), then (24c) = (2	23b); otherv	vise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m= 0 0 0 0 0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house pos	itive input	ventilatio	on from I	oft					
if (22b)m = 1, then (24d)m = (22b)m o	therwise (2	4d)m = (0.5 + [(2	2b)m² x	0.5]				(244)
(24d)m= 0 0 0 0 0 0	0				0	0	0		(24u)
Effective air change rate - enter (24a) or (2	24b) or (240	c) or (24		(25)	0.22	0.22	0.22		(25)
(25)11= 0.54 0.54 0.54 0.52 0.52	0.3	0.3	0.5	0.51	0.32	0.32	0.33		(23)
3. Heat losses and heat loss parameter:									
ELEMENT Gross Openings area (m ²) m ²	Net Ar A .r	ea n²	U-val W/m2	ue K	A X U (W/ł	<)	k-value kJ/m²·ł	↔ <	A X k kJ/K
Doors	2.1	X	2		4.2	<i>,</i>			(26)
Windows Type 1	6.21	x1/	/[1/(0.8)+	0.04] =	4.81				(27)
Windows Type 2	9.55	x1/	/[1/(0.8)+	0.04] =	7.4				(27)
Windows Type 3	9.82	x1/	/[1/(0.8)+	0.04] =	7.61				(27)
Windows Type 4	5.77		/[1/(0.8)+	0.04] =	4.47				(27)
Windows Type 5	9.55		/[1/(0.8)+	0.04] =	7.4	=			(27)
Windows Type 6	6.5		/[1/(0.8)+	0.04] =	5.04	=			(27)
Windows Type 7	5.24		/[1/(0.8)+	0.04] =	4.06	=			(27)
Windows Type 8	5.57		/[1/(0.8)+	0.04] =	4.32				(27)
Windows Type 9	4 07		/[1/(0.8)+	0.04] =	3 16	=			(27)
Windows Type 10	5.62		/[1/(0.8)+	0.04] =	4.36				(27)
Walls Type1 40.22 25.58	14.64	x	0.13	= [1.9	Ξ r			(29)
Walls Type2 39 17 21 82	17.35		0.13		2.26			4 6	(29)
Walls Type3 39 17 20 5	18.67		0.13		2.20	╡┟		\exists	(29)
Roof 31.06 0	31 06		0.13		2.70	╡┟			(30)
Total area of elements. m ²	151 7	^	0.12	[0.70	L			(31)
Devit all			0		0				(22)
Party wall	631	X			0			1 1	1021

* for wir ** includ	ndows and le the area	roof wind as on both	ows, use e sides of ir	ffective wi	ndow U-va Is and part	alue calcul titions	lated using	formula 1.	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				67.15	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	• = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For des can be i	ign assess used instea	ments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	K						11.1	(36)
if details	s of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)								_
Total f	abric he	at loss							(33) +	(36) =			78.25	(37)
Ventila	ation hea	t loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	30.13	29.85	29.57	28.17	27.9	26.5	26.5	26.22	27.06	27.9	28.45	29.01		(38)
Heat t	ransfer c	oefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	108.38	108.1	107.82	106.42	106.14	104.75	104.75	104.47	105.31	106.14	106.7	107.26		
							1			Average =	Sum(39)1.	12 /12=	106.35	(39)
Heat lo	oss para	meter (H	HLP), W/	′m²K		-			(40)m	= (39)m ÷	· (4)			
(40)m=	1.02	1.02	1.02	1	1	0.99	0.99	0.98	0.99	1	1.01	1.01		_
(40)m= 1.02 1.02 1 1 0.99 0.98 0.99 1 1.01 1.01 Average = Sum(40)112 /12= Number of days in month (Table 1a)														
Numb	er of day	's in moi	nth (Tab	le 1a)					-			_	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ene	rgy <mark>requ</mark>	irement:								kWh/y	ear:	
Accur		nancy	м											(40)
if TF	A > 13.9 A ± 13.9), N = 1), N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0	00 <mark>13 x (</mark>	TFA -13.	9)	79		(42)
Annua	l averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.74		(43)
Reduce	the annua	l average	hot water	usage by a	5% if the a	lwelling is	designed t	to achieve	a water us	se target o	f			
not mor	e that 125	litres per	oerson per I	aay (all w	ater use, r	not and co I	1 1			r			I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage II	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	i able 1c x	(43)					1	
(44)m=	116.31	112.08	107.85	103.62	99.39	95.17	95.17	99.39	103.62	107.85	112.08	116.31		_
Enoraly	contont of	hot wator	used cal	culated m	opthly - 1	100 v Vd r	т v nm v Г)Tm / 2600	kW/b/mor	Total = Su	m(44) ₁₁₂ =	= 0.1d)	1268.87	(44)
Energy		not water	useu - cai		5770779 = 4.	190 x vu,i						<i>c, ru)</i>	I	
(45)m=	172.49	150.86	155.67	135.72	130.23	112.38	104.13	119.49	120.92	140.92	153.83	167.05		-
lf instan	taneous w	ater heati	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1663.69	(45)
(46)m=	25.87	22.63	23.35	20.36	19.53	16.86	15.62	17.92	18.14	21.14	23.07	25.06		(46)
Water	storage	loss:					-							
Storag	je volum	e (litres)) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	ind no ta	nk in dw	velling, e	nter 110) litres in	(47)	`	(0) -	(-)			
Other	vise it no	stored	not wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
a) If m	siorage	urer'e di	eclared I	oss facto	or is kno	wn (k\//	n/dav).					0	l	(48)
Tomo	andiaol	actor fro	m Toble	255 18010 26		**** (12.841	"uuy).					0		(40)
rembe	siature la		in rable	20								υ		(49)

Energy b) If m Hot wa	y lost fro nanufact ater stor	m water urer's de age loss	r storage eclared o factor fr	, kWh/ye cylinder l com Tabl	ear oss fact e 2 (kWl	or is not h/litre/da	known: ay)	(48) x (49) =		1	10 02		(50) (51)
lf com Volum	munity h	eating s from Ta	see secti ble 2a	on 4.3	- (,					03		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)
Enera	v lost fro	m water	r storage	. kWh/ve	ear			(47) x (51) x (52) x (53) =	1	03		(54)
Enter	(50) or ((54) in (5	55)	, <i>,</i> , .					, (- , (/	1.	03		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m =	32.01	28.92	32.01	30.98	32 01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain:	s dedicate	d solar sto	rage, (57)r	n = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	ix H	()
(57)m-	22.01	28.02	22.01	20.08	32.01	20.08	22.01	22.01	20.08	22.01	20.09	22.01		(57)
(57)11=	32.01	20.92	32.01	30.96	32.01	30.90	32.01	32.01	30.96	32.01	30.96	32.01		(37)
Prima	ry circuit	loss (ar	nnual) fro	om Table	93		()					0		(58)
Primai	ry circuit	loss cal	Iculated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m	r tharma	atat)			
(110												22.26		(50)
(59)m=	23.20	21.01	23.26	22.51	23.20	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(39)
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)
Tota <mark>l h</mark>	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45) <mark>m +</mark>	(46)m +	(57)m +	(59)m + (61)	m
(62)m=	227.77	200.79	210.95	189.21	185.5	165.87	159.41	174.77	174.41	196.2	207.32	222.32		(62)
Solar D	HW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add a	ddi <mark>tiona</mark>	l lines <mark>if</mark>	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)
Outpu	t from w	ater hea	iter					-						
(64)m=	227.77	200.79	210.95	189.21	185.5	165.87	159.41	174.77	174.41	196.2	207.32	222.32		
								Out	out from wa	ater heate	r (annual)₁	12	2314.53	(64)
Heat o	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	
(65)m=	101.57	90.1	95.98	87.92	87.52	80.16	78.85	83.95	83	91.08	93.94	99.76	-	(65)
inclu	L Ide (57)	n in calo	L Culation (L of (65)m	only if c	ı vlinder i	s in the o	l dwelling	or hot w	ı ater is fr	i om com	munity h	eating	
5 In	ternal as	nine (soc	Table 5	and 5a	·	ymraer i		unoning	or not n		oni ooni	in an incy in	ouung	
5 . III		/ T		, and 5a										
Metab	olic gain	Eob	<u>5), vvat</u>		May	lup		Δυσ	Son	Oct	Nov	Dec		
(66)m -	130 / 8	130.48	130.48	130.48	130 / 8	130 / 8	139.48	130.48	130.48	139.48	139.48	130.48		(66)
	100.40	(aalaula			100.40		r L Oc) - c			100.40	100.40	100.40		(00)
Lightin	ig gains		ted in Ap		L, equat		r L9a), a L			40.50	00.05			(67)
(67)m=	23.7	21.05	17.12	12.96	9.69	8.18	8.84	11.49	15.42	19.58	22.85	24.36		(07)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also r	see Ta	ble 5		· · · · · ·		()
(68)m=	265.89	268.65	261.7	246.89	228.21	210.65	198.92	196.16	203.11	217.91	236.6	254.16		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95	36.95		(69)
Pumps	s and fa	ns gains	(Table 5	ōa)		_								
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58	-111.58		(71)
							•		•	•	•			

Water	heating	g gains (T	able 5))															
(72)m=	136.52	134.08	129.01		122.11	117.64	1	11.33	105.98	112	.84	115.28	122.4	2 13	0.48	134.09	9		(72)
Total	interna	l gains =						(66)	m + (67)m	n <mark>+ (6</mark> 8	3)m +	(69)m + (70)m +	(71)m	+ (72)r	n			
(73)m=	490.96	488.63	472.67	,	446.81	420.38	3	95.01	378.57	385	.33	398.65	424.7	5 45	4.77	477.46	6		(73)
6. Sc	lar gain	is:																	
Solar	gains are	calculated u	using so	lar	flux from Ta	able 6a	and	assoc	iated equa	tions	to con	vert to th	e appli	cable or	rientati	on.			
Orient	ation:	Access F	actor		Area m ²			Flu Tal	X Ne 6a		Та	g_ ble 6b] Table	FF			Gains	
										1			_		, 00		г	(**)	-
East	0.9x	1		x	6.21		X		9.64	X		0.4	×	<u> </u>	0.7	=	ľ	16.6	(76)
East	0.9x	1		x	9.82		X	1	9.64	X		0.4	×		0.7	=	Ľ	26.25	
East	0.9x	1		x	6.5		х	1	9.64	X		0.4	×		0.7	=	Ľ	17.37	
East	0.9x	1		x	5.62		х	1	9.64	X		0.4	×		0.7	=	Ľ	15.02	(76)
East	0.9x	1		×	6.21		X	3	8.42			0.4	╡ [×]		0.7	=	Ľ	32.47	
East	0.9x	1		x	9.82		х	3	8.42	X		0.4	×		0.7	=	Ľ	51.34	
East	0.9x	1		×	6.5		x	3	8.42	X		0.4			0.7	=	Ľ	33.98	
East	0.9x	1	_	x	5.62		x		8.42	×		0.4			0.7		- L -	29.38	
East	0.9x			x	6.21		X	6	3.27	X		0.4		<u> </u>	0.7	_ ⁼		53.47	
East	0.9x	1		x	9.82		X	6	3.27	x		0.4			0.7		ļ	84.55	$ \begin{bmatrix} (76) \\ (76) \end{bmatrix} $
East	0.9x	1		×	6.5		Х	6	3.27	X		0.4		<u> </u>	0.7	=	Ľ	55.97	
East	0.9x	1		×	5.62		X	6	53.27	X		0.4			0.7		Ľ	48.39	
East	0.9x	1		×	6.21		X	g	2.28	X		0.4		<u> </u>	0.7	=	Ľ	77.98	
East	0.9x	1	4	×	9.82		x	9	2.28	X		0.4		<u>-</u>	0.7	=	Ľ	123.31	
East	0.9x	1		×	6.5		X	9	2.28	X		0.4	X	<u> </u>	0.7	=	Ľ	81.62	
Fast	0.9x	1		x	5.62		x		12.28			0.4	╡ ゚		0.7	=	Ľ	70.57	
Fast	0.9x	1		×	6.21		×		13.09			0.4	╡ Û		0.7		Ľ	95.57	
Fast	0.9x	1		x	9.82		x		13.09	X		0.4			0.7		Ľ	151.13	(70)
Fast	0.9X	1		×	6.5		×	1	13.09			0.4			0.7			100.03	(70)
Fast	0.9X	1		`	5.62		~		13.09			0.4	╡ Û		0.7		Ľ	07.92	$ ^{(70)} _{(76)} $
Fast	0.9X			`	0.21		~		10.77			0.4	╡Ĵ		0.7	=	Ľ	97.03	
Fast	0.3	1	-	`	9.82		Ŷ		15.77			0.4	╡ Û	<u> </u>	0.7	=	: L . T	102.4	(70)
Fast	0.97	1	-	`	5.62		Ŷ		15.77			0.4	╡ Û	<u> </u>	0.7	=	с L . Г	99.54	$\Box_{(76)}^{(70)}$
East	0.04	1		^	6.02		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	02.14	(70)
Fast	0.04	1	=	^	0.21		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	147.20	(70)
East	0.04	1	:	^	9.02		Ŷ		10.22			0.4	╡ Û		0.7	=	. L	07.40	(70)
East	0.3	1	:	`	5.62		Ŷ		10.22			0.4	╡Ĵ		0.7	=	: L . F	97.49	(70)
East	0.30			• •	6.04	\dashv	Ŷ		10.22			0.4	╡ Û		0.7	\dashv	Ĺ	04.29 20.01	$ \Box_{(76)}^{(70)} $
East	0.98			^ ↓	0.21		×		4.00	^ _		0.4	╡ Û		0.7	=	L T	126.52	$\Box_{(76)}^{(70)}$
East	0.98			^ ↓	9.82	=	×		4.00	^ _		0.4	╡ Û	<u> </u>	0.7	\dashv	L	120.02	$\Box_{(76)}^{(70)}$
East	0.97	1		r x	5.62		Ŷ		4.68			0.4	╡ Û		0.7	\dashv	L I	72 /1	$\Box_{(76)}^{(70)}$
	0.07				J.02		~	ı ö		~		UT	· ^	1	J.1			12.71	1,1.97

East	0.9x	1	x	6.21	×	73.59	x	0.4	x	0.7] =	62.19	(76)
East	0.9x	1	x	9.82	x	73.59	x	0.4	x	0.7	=	98.34	(76)
East	0.9x	1	x	6.5	x	73.59	x	0.4	x	0.7	=	65.09	(76)
East	0.9x	1	x	5.62	x	73.59	x	0.4	x	0.7	=	56.28	(76)
East	0.9x	1	x	6.21	x	45.59	x	0.4	x	0.7	=	38.53	(76)
East	0.9x	1	x	9.82	x	45.59	x	0.4	x	0.7	=	60.92	(76)
East	0.9x	1	x	6.5	x	45.59	x	0.4	x	0.7	=	40.32	(76)
East	0.9x	1	x	5.62	x	45.59	x	0.4	x	0.7	=	34.87	(76)
East	0.9x	1	x	6.21	x	24.49	x	0.4	x	0.7	=	20.69	(76)
East	0.9x	1	x	9.82	x	24.49	x	0.4	x	0.7	=	32.72	(76)
East	0.9x	1	x	6.5	x	24.49	x	0.4	x	0.7	=	21.66	(76)
East	0.9x	1	x	5.62	x	24.49	x	0.4	x	0.7	=	18.73	(76)
East	0.9x	1	x	6.21	x	16.15	x	0.4	x	0.7	=	13.65	(76)
East	0.9x	1	x	9.82	x	16.15	x	0.4	x	0.7	=	21.58	(76)
East	0.9x	1	x	6.5	x	16.15	x	0.4	x	0.7	=	14.29	(76)
East	0.9x	1	x	5.62	x	16.15	x	0.4	x	0.7	=	12.35	(76)
South	0.9x	0.54	x	9.55	x	46.75	x	0.4	x	0.7	=	60.76	(78)
South	0.9x	0.54	x	9.55	×	46.75	x	0.4	х	0.7] =	60.76	(78)
South	0.9x	0.54	x	5.57	x	46.75	x	0.4	x	0.7] =	35.44	(78)
South	0.9x	0.54	x	4.07	х	46.75] ×	0.4	x	0.7] =	25.89	(78)
South	0.9x	0.54	x	9.55	x	76.57	x	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	x	9.55	×	76.57	x	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	x	5.57	x	76.57	x	0.4	x	0.7	=	58.04	(78)
South	0.9x	0.54	x	4.07	x	76.57	x	0.4	x	0.7	=	42.41	(78)
South	0.9x	0.54	x	9.55	x	97.53	x	0.4	x	0.7	=	126.75	(78)
South	0.9x	0.54	x	9.55	x	97.53	x	0.4	x	0.7	=	126.75	(78)
South	0.9x	0.54	x	5.57	x	97.53	x	0.4	x	0.7	=	73.93	(78)
South	0.9x	0.54	x	4.07	x	97.53	x	0.4	x	0.7	=	54.02	(78)
South	0.9x	0.54	x	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	x	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	x	5.57	x	110.23	x	0.4	x	0.7	=	83.55	(78)
South	0.9x	0.54	x	4.07	x	110.23	x	0.4	x	0.7	=	61.05	(78)
South	0.9x	0.54	x	9.55	x	114.87	x	0.4	x	0.7	=	149.28	(78)
South	0.9x	0.54	x	9.55	x	114.87	x	0.4	x	0.7	=	149.28	(78)
South	0.9x	0.54	x	5.57	x	114.87	x	0.4	x	0.7	=	87.07	(78)
South	0.9x	0.54	x	4.07	x	114.87	x	0.4	x	0.7	=	63.62	(78)
South	0.9x	0.54	×	9.55	x	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	x	9.55	×	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	×	5.57	×	110.55	x	0.4	x	0.7] =	83.79	(78)
South	0.9x	0.54	×	4.07	×	110.55	×	0.4	x	0.7	=	61.23	(78)
South	0.9x	0.54	×	9.55	x	108.01	x	0.4	x	0.7	=	140.37	(78)

South	0.9x	0.54	x	9.55	x	108.01	x	0.4	x	0.7] =	140.37	(78)
South	0.9x	0.54	x	5.57	×	108.01	×	0.4	x	0.7	j =	81.87	- (78)
South	0.9x	0.54	x	4.07	×	108.01	x	0.4	x	0.7] =	59.82	(78)
South	0.9x	0.54	x	9.55	×	104.89	×	0.4	x	0.7] =	136.32	(78)
South	0.9x	0.54	x	9.55	×	104.89	x	0.4	x	0.7] =	136.32	(78)
South	0.9x	0.54	x	5.57	x	104.89	x	0.4	x	0.7] =	79.51	(78)
South	0.9x	0.54	x	4.07	x	104.89	x	0.4	x	0.7	=	58.1	(78)
South	0.9x	0.54	x	9.55	x	101.89	x	0.4	x	0.7	=	132.41	(78)
South	0.9x	0.54	x	9.55	x	101.89	x	0.4	x	0.7	=	132.41	(78)
South	0.9x	0.54	x	5.57	×	101.89	x	0.4	x	0.7	=	77.23	(78)
South	0.9x	0.54	x	4.07	x	101.89	x	0.4	x	0.7	=	56.43	(78)
South	0.9x	0.54	x	9.55	x	82.59	x	0.4	x	0.7	=	107.33	(78)
South	0.9x	0.54	x	9.55	x	82.59	x	0.4	x	0.7] =	107.33	(78)
South	0.9x	0.54	x	5.57	x	82.59	x	0.4	x	0.7	=	62.6	(78)
South	0.9x	0.54	x	4.07	x	82.59	x	0.4	x	0.7	=	45.74	(78)
South	0.9x	0.54	x	9.55	×	55.42	x	0.4	x	0.7	=	72.02	(78)
South	0.9x	0.54	x	9.55	x	55.42	x	0.4	x	0.7	=	72.02	(78)
South	0.9x	0.54	x	5.57	×	55.42	х	0.4	х	0.7] =	42	(78)
South	0.9x	0.54] ×	4.07	x	55.42] x	0.4	x	0.7	=	30.69	(78)
South	0.9x	0.54	x	9.55	x	40.4] ×	0.4	x	0.7	=	52.5	(78)
South	0.9x	0.54	x	9.55	x	40.4	x	0.4	x	0.7	=	52.5	(78)
South	0.9x	0.54] ×	5.57	×	40.4	x	0.4	x	0.7	=	30.62	(78)
South	0.9x	0.54] ×	4.07	x	40.4	x	0.4	x	0.7	=	22.37	(78)
West	0.9x	0.54	x	5.77	x	19.64	x	0.4	x	0.7	=	15.42	(80)
West	0.9x	0.54	x	5.24	x	19.64	x	0.4	x	0.7	=	14	(80)
West	0.9x	0.54	x	5.77	x	38.42	x	0.4	x	0.7	=	30.17	(80)
West	0.9x	0.54	x	5.24	x	38.42	x	0.4	x	0.7	=	27.4	(80)
West	0.9x	0.54	x	5.77	x	63.27	x	0.4	x	0.7	=	49.68	(80)
West	0.9x	0.54	x	5.24	x	63.27	x	0.4	x	0.7	=	45.12	(80)
West	0.9x	0.54	x	5.77	x	92.28	x	0.4	x	0.7	=	72.46	(80)
West	0.9x	0.54	x	5.24	x	92.28	x	0.4	x	0.7	=	65.8	(80)
West	0.9x	0.54	x	5.77	x	113.09	x	0.4	x	0.7	=	88.8	(80)
West	0.9x	0.54	x	5.24	×	113.09	x	0.4	x	0.7] =	80.64	(80)
West	0.9x	0.54	x	5.77	x	115.77	x	0.4	x	0.7	=	90.9	(80)
West	0.9x	0.54	x	5.24	x	115.77	x	0.4	x	0.7	=	82.55	(80)
West	0.9x	0.54	x	5.77	x	110.22	x	0.4	x	0.7] =	86.54	(80)
West	0.9x	0.54	x	5.24	×	110.22	×	0.4	×	0.7] =	78.59	(80)
West	0.9x	0.54	x	5.77	x	94.68	x	0.4	x	0.7] =	74.34	(80)
West	0.9x	0.54	x	5.24	×	94.68	x	0.4	x	0.7	=	67.51	(80)
West	0.9x	0.54	x	5.77	×	73.59	x	0.4	x	0.7	=	57.78	(80)
West	0.9x	0.54	x	5.24	×	73.59	x	0.4	x	0.7	=	52.47	(80)

West	0.9x	0.54	×	5.7	77	x	4	5.59] x [0.4	x	0.7	-	=	35.8	(80)
West	0.9x	0.54	×	5.2	24	x	4	5.59] × [0.4	×	0.7		-	32.51	(80)
West	0.9x	0.54	×	5.7	77	x	2	4.49	İ×Ī		0.4	x	0.7	-	-	19.23	(80)
West	0.9x	0.54	×	5.2	24	x	2	4.49	x [0.4		0.7	=	-	17.46	(80)
West	0.9x	0.54	×	5.7	77	x	1	6.15	x [0.4		0.7			12.68	(80)
West	0.9x	0.54	×	5.2	24	x	1	6.15	x		0.4	x	0.7			11.52	(80)
	-																
Solar g	gains in	watts, ca	alculate	d for eac	h month	۱			(83)m	= Su	m(74)m .	(82)m		-			
(83)m=	287.51	504.19	718.62	922.87	1051.91	10	949.27	1009.77	914.	75	790.62	565.93	347.23	244.00	6		(83)
Total g	jains – i	nternal a	and sola	r (84)m =	= (73)m	+ (8	83)m	, watts							_		
(84)m=	778.47	992.82	1191.29	1369.68	1472.29	14	44.28	1388.34	1300	.08	1189.27	990.68	802	721.52	2		(84)
7. Me	an inter	nal temp	perature	(heating	seasor	า)											
Temp	erature	during h	eating	periods i	n the liv	ing	area f	from Tab	ole 9,	Th1	(°C)					21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,n	n (s	ee Ta	ble 9a)									
	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Αι	Jg	Sep	Oct	Nov	Dec	;		
(86)m=	0.99	0.98	0.94	0.82	0.65	(0.46	0.33	0.3	7	0.6	0.89	0.99	1			(86)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	7 in Ti	able	9c)						
(87)m=	20.06	20.3	20.59	20.85	20.97		21	21	21		20.98	2 <mark>0.8</mark>	20.37	20.02	2		(87)
Tom		during b				Edu	olling	from To			2 (°C)						
(88)m-		20.07	20.07		20.08			20.09		7, 11 1	20.09	20.08	20.08	20.07			(88)
(00)11-	20.07	20.07	20.01	20.00	20.00		0.05	20.00	20.	<u>' </u>	20.00	20.00	20.00	20.07			(00)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	,m (se	e Table	9a)	<u> </u>				i .	-		(00)
(89)m=	0.99	0.97	0.92	0.78	0.59	1	0.4	0.26	0.3	3	0.52	0.86	0.98	1			(89)
Me <mark>an</mark>	interna	l temper	ature in	the rest	of dwel	ling	T2 (f	o <mark>llow s</mark> te	eps 3	to 7	in Tabl	e 9 <mark>c)</mark>	_		_		
(90)m=	18.82	19.18	19.58	19. <mark>9</mark> 3	20.05	2	20.09	20.0 <mark>9</mark>	20.	1	20.08	1 <mark>9.87</mark>	19.28	18.77	·		(90)
											f	LA = Liv	ing area ÷ (4	4) =		0.19	(91)
Mean	interna	l temper	ature (f	or the wh	ole dwe	ellin	g) = fl	_A × T1	+ (1 -	– fLA	4) × T2						
(92)m=	19.06	19.39	19.78	20.1	20.23	2	20.26	20.27	20.2	27	20.25	20.05	19.49	19			(92)
Apply	[,] adjustr	nent to t	he mea	n interna	l tempe	ratu	ire fro	m Table	e 4e, v	whe	re appro	priate					
(93)m=	19.06	19.39	19.78	20.1	20.23	2	20.26	20.27	20.2	27	20.25	20.05	19.49	19			(93)
8. Sp	ace hea	ting requ	uiremen	t													
Set T	i to the	mean int	ernal te	mperatu	re obtai	ned	at ste	ep 11 of	Table	e 9b	, so tha	t Ti,m=	(76)m an	d re-ca	alcula	ite	
the u			Mor			Т	lum	Iul	۸.		San	Oct	Nev	Dec	7		
l Itilie:	Jan ation fac	reb	ains hr	Apr 	Iviay		Jun	Jui		ug [Sep	Oci	NOV	Dec	;		
(94)m=	0.99	0.97	0.91	0.78	0.6		0.41	0.28	0.3	1	0.54	0.85	0.98	0.99			(94)
Usefu	l gains.	hmGm	W = (9	1)4)m x (8	1 4)m		-										
(95)m=	770.97	962.29	1088.39	1074.27	881.78	5	91.12	383.92	403.	.79	638.2	846.37	782.11	716.6	7		(95)
Montl	nly aver	age exte	rnal ter	nperature	e from T	abl	e 8	L	1	I			1	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	٦		(96)
Heat	loss rate	e for mea	an inter	nal temp	erature,	Lm	ı , W =	=[(39)m :	x [(93	3)m–	- (96)m]					
(97)m=	1599.67	1566.47	1431.35	1192.18	905.28	5	93.34	384.11	404.	14	647.8	1002.9	3 1321.96	1587.9	9		(97)
Space	e heatin	g require	ement f	or each r	nonth, k	Wh	/mont	h = 0.02	24 x [(97)ı	m – (95)m] x (41)m				
(98)m=	616.55	406.01	255.16	84.89	17.48		0	0	0		0	116.49	388.69	648.19	9		

								Tota	l per year	(kWh/year	r) = Sum(9)	8)15,912 =	2533.47	(98)
Space	e heatir	ng require	ement in	n kWh/m²	²/year								23.87	(99)
8c. S	pace co	oling rec	quiremer	nt										-
Calcu	lated fo	or June, .	July and	August.	See Tat	ole 10b	1	1	-	-	1	1	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rat	e Lm (ca	lculated	using 2	5°C inter	nal tem	perature	and exte	ernal ten	nperatur	re from T	able 10)	I	(100)
(100)m=	0	0	0	0	0	984.63	775.13	793.96	0	0	0	0	l	(100)
Utilisa				0	0	0.00	1	0.00	0	0	0	0		(101)
				(100)m)	(101)m	0.99		0.99	0	0	0	0	1	(101)
(102)m=	0					973.69	771.88	788.88	0	0	0	0	1	(102)
Gains	s (solar	dains ca	L Iculated	for appli	cable we	eather re	aion se	e Table	10)	Ů			1	. ,
(103)m=	0		0		0	1916.67	1844.24	1730.45	0	0	0	0		(103)
Space	e cooliri	ng require	ement fo	r month,	whole a	lwelling,	continu	us (kW	(h) = 0.0	L 24 x [(1(1)3)m – (102)m]:	x (41)m	
, set (1	04)m to	zero if ((104)m <	< 3 × (98)m			, 	, 		, (. ,	
(104)m=	0	0	0	0	0	678.95	797.83	700.52	0	0	0	0		_
_									Tota	= Sum(104)	=	2177.31	(104)
Cooled fraction $f C = cooled area \div (4) =$								1.88	(105)					
Interm		factor (1a	able 10b)		0.05	0.05	0.05	0	0	0			
(106)m=	0		0			0.25	0.25	0.25	U Toto		104)	0		
Snace	coolinc		ment for	month -	(104)m	× (105)	× (106)r	m	Tota	r = Sum(104)	=	0	
(107)m=						319.84	375.84	330	0	0	0	0		
									Tota	= Sum(107)	=	1025.68	(107)
Space	coolinc	requirer	ment in l	$\sqrt{h/m^2/m^2}$	vear				(107)	$$ $(4) =$,,		9.66](108)
				mmunit.	booting	achomo			(107)	, (-) -			3.00	
This n	art is us	ed for sr	ns – Co	ating so			ator hoai	ting prov	ided by	a comm	unity sel	heme		
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none								0	(301)					
Fraction of space heat from community system $1 - (301) =$							1] (302)						
The con	amunity s	chomo ma	v obtain h	eat from s	eyeral sour	rees The	nrocedure	allows for	CHP and i	un to four	other heat	sources: t	he latter	Τ, ,
includes	boilers, l	heat pump	s, geother	mal and wa	aste heat fi	rom powe	r stations.	See Appel	ndix C.			3001Ce3, 1		
Fraction of heat from Community CHP								0.6	(303a)					
Fraction of community heat from heat source 2								0.4	(303b)					
Fraction of total space heat from Community CHP (302) × (303a) =							a) =	0.6	(304a)					
Fraction of total space heat from community heat source 2 (302) × (303b) =								b) =	0.4	(304b)				
Factor for control and charging method (Table 4c(3)) for community heating system								1	(305)					
Distribution loss factor (Table 12c) for community heating system									1.1] (306)				
Space heating								kWh/vear	-					
Annual space heating requirement									2533.47]				
Space heat from Community CHP (98) x (304a) x (305) x (306) =								=	1672.09	(307a)				
Space heat from heat source 2 (98) x (304b) x (305) x (306) =									=	1114.73	(307b)			

-

			-
Efficiency of secondary/supplementary heating system in % (from	Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	n (98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement		2314.53]
If DHW from community scheme: Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1527.59	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	1018.39	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	= 53.33	(313)
Cooling System Energy Efficiency Ratio		4	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	256.42	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from ou	267.07	(330a)	
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	267.07	(331)
Energy for lighting (calculated in Appendix L)		418.62	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-176.61	(333)
Electricity generated by wind turbine (Appendix M) (negative quar	ytity)	0	(334)
12b. CO2 Emissions – Community heating scheme			-
Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		64	(362)
	Energy Emission facto kWh/year kg CO2/kWh	r Emissions kg CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	2612.64 × 0.22	564.33	(363)
less credit emissions for electricity $-(307a) \times (361) \div (362) =$	836.04 × 0.52	-433.91	(364)
Water heated by CHP $(310a) \times 100 \div (362) =$	2386.86 × 0.22	515.56	(365)
less credit emissions for electricity $-(310a) \times (361) \div (362) =$	763.79 × 0.52	-396.41	(366)
Efficiency of heat source 2 (%) If there is CHP using the	wo fuels repeat (363) to (366) for the second f	uel 96	
			(367b)
CO2 associated with heat source 2 [(307b)+(31	10b)] x 100 ÷ (367b) x 0.22	= 479.95	(367b) (368)
CO2 associated with heat source 2[(307b)+(31Electrical energy for heat distribution[(3	10b)] x 100 ÷ (367b) x 0.22 13) x 0.52	= 479.95 = 27.68	(367b) (368) (372)
CO2 associated with heat source 2[(307b)+(31)Electrical energy for heat distribution[(3Total CO2 associated with community systems(36)	10b)] x 100 ÷ (367b) x 0.22 13) x 0.52 63)(366) + (368)(372)	= 479.95 = 27.68 = 757.2	(367b) (368) (372) (373)
CO2 associated with heat source 2[(307b)+(31)Electrical energy for heat distribution[(3Total CO2 associated with community systems(36)CO2 associated with space heating (secondary)(36)	$10b$] x $100 \div (367b)$ x 0.22 13) x 0.52 63)(366) + (368)(372) 09) x 0	= 479.95 = 27.68 = 757.2 = 0	(367b) (368) (372) (373) (374)
CO2 associated with heat source 2[(307b)+(31)Electrical energy for heat distribution[(3Total CO2 associated with community systems(36)CO2 associated with space heating (secondary)(30)CO2 associated with water from immersion heater or instantaneous	$10b$] x $100 \div (367b)$ x 0.22 13) x 0.52 63)(366) + (368)(372) 09) x 0 us heater (312) x 0.22	= 479.95 $= 27.68$ $= 757.2$ $= 0$ $= 0$	(367b) (368) (372) (373) (374) (375)
CO2 associated with heat source 2[(307b)+(31)Electrical energy for heat distribution[(3Total CO2 associated with community systems(36)CO2 associated with space heating (secondary)(36)CO2 associated with water from immersion heater or instantaneou(37)Total CO2 associated with space and water heating(37)	$10b$] x $100 \div (367b)$ x 0.22 13) x 0.52 63)(366) + (368)(372) 09) x 0 us heater (312) x 0.22 73) + (374) + (375) =	= 479.95 = 27.68 = 757.2 = 0 = 0 757.2	(367b) (368) (372) (373) (374) (375) (376)
CO2 associated with heat source 2[(307b)+(31)Electrical energy for heat distribution[(3Total CO2 associated with community systems(36)CO2 associated with space heating (secondary)(36)CO2 associated with water from immersion heater or instantaneou(37)Total CO2 associated with space and water heating(37)CO2 associated with space cooling(31)	(10b)] x 100 ÷ (367b) x 0.22 (13) x 0.52 (33) (366) + (368)(372) (29) x 0 (29) x 0 (312) x 0.22 (73) + (374) + (375) = (15) x 0.52	 479.95 27.68 757.2 0 0 757.2 133.08 	(367b) (368) (372) (373) (374) (375) (376) (377)
CO2 associated with heat source 2[(307b)+(31)Electrical energy for heat distribution[(3Total CO2 associated with community systems(36)CO2 associated with space heating (secondary)(36)CO2 associated with water from immersion heater or instantaneou(37)Total CO2 associated with space and water heating(37)CO2 associated with space cooling(31)CO2 associated with electricity for pumps and fans within dwelling	(10b)] x 100 ÷ (367b) x 0.22 (13) x 0.52 (33) (366) + (368)(372) (29) x 0 (29) x 0 (312) x 0.22 (73) + (374) + (375) = (15) x 0.52 (331)) x 0.52	 479.95 27.68 757.2 0 0 757.2 133.08 138.61 	(367b) (368) (372) (373) (374) (375) (376) (377) (378)

sum of (376)...(382) =

(383) ÷ (4) =

Energy saving/generation technologies (333) to (334) as applicable Item 1

Total CO2, kg/year Dwelling CO2 Emission Rate El rating (section 14)

0.52 x 0.01 =	-91.66	(380)	
	1154.5	(383)	
	10.88	(384)	
	89.76	(385)	



Appendix E - Renewable Technologies; Description, Benefits and Limitations

Domestic Solar Hot Water Heating



Solar thermal or solar hot water (SHW) systems use a collector which is generally mounted on the roof, and typically contains a water glycol mixture which is heated by the sun. The heated liquid is then passed through a coil in a hot water storage cylinder. The water in the cylinder is then further heated (if required) by a boiler or electric immersion heater. The free energy obtained from the sun can be used to offset

the amount of energy required for providing domestic hot water, and will reduce both running costs (due to the fuel being displaced electricity, natural gas, Liquefied Petroleum Gas (LPG) or oil) and the associated CO₂ emissions.

These systems are not good enough to provide space heating in the UK due to the climate but are among the most cost-effective renewable energy systems that can be installed to assist with domestic hot water demand.

Solar water heating could be installed by utilising either evacuated tube type panels or flat plate collectors mounted on the roof of the building.

Reasons for Excluding this Technology for this Site

SHW only contributes to the water heating demand of the property and has reduced effectiveness during the winter months. Consequently they do not supply sufficient carbon reduction. This technology is not considered suitable for this project and is not investigated further.

The technology cannot produce a material contribution to the energy needs of a commercial development such as this, as the demand for hot water is for occasional hand washing which represents a very small proportion of the total demand. It is quite possible that the energy consumed by the solar circuit pump would be greater than the energy used by instantaneous water heaters to provide the same amount of hot water. For these reasons solar thermal panels are only suitable for specific commercial applications which have a quantifiable demand for hot water that can be matched to the output characteristic of a solar thermal system.

Biomass Boilers



Biomass heating is the combustion of a biomass fuel such as wood in a boiler to supply space heating and hot water. Biomass fuel is biological in origin and, when from sustainable sources, is regarded as renewable.

The most common fuel is wood, supplied in three forms; logs, chips and compressed wood pellets.

Any biomass heating system requires the following main components:

- Fuel storage;
- One or more boilers;
- One or more heat accumulators;
- A chimney stack or flue;
- A heat meter.

Sufficient fuel must be stored on-site to maintain operations in between deliveries. The amount will depend on circumstances, but is typically not less than a week of operation at full load.

The store must keep the fuel dry. Wet fuel will cause the boiler to malfunction. The design of the store will depend on the fuel selected; logs can be kept in a simple shed, chips in a storage bay and pellets in an enclosed hopper. Typical solutions are silos similar to animal feed storage or partitioned sections in an enclosed barn, outhouse or commodity store.

Access is needed for deliveries and some is needed to convey the fuel to the boiler on demand.

There are two main types of boiler – continuously fuelled and batch fuelled. Continuously fuelled boilers use wood chip or pellet fuels and can be made fully automatic.

The space requirement for biomass plant, equipment and associated fuel storage is significant and given the footprint of the building and its central London location the site has limited off-street loading and delivery areas. Biomass requires frequent and regular deliveries of fuel which would impact on local transportation due to site servicing constraints and would therefore not be suitable for this redevelopment.

Reasons for Excluding this Technology for this Site

There are many discussions at this time with regards to the suitability of biomass within the GLA region due to the Clean Air Act Requirements and the viability of clean biomass systems has not yet been proven.

Therefore the inclusion of biomass has not been deemed appropriate and is not considered further.

Storage limitations dictate whether it is physically feasible to include within the development's renewable energy strategy; a large dry space for storing the fuel would be required to hold several months' worth of fuel. In addition, a fuel supplier would need to be within reasonable vicinity; otherwise the emissions associated with delivery will significantly reduce the on-site carbon savings.

Biomass boilers do not operate in the same way as gas and oil boilers. They have a more limited operating range and cannot respond as rapidly to changes in demand. Short operating cycles are not recommended. The use of a hot water tank or accumulator in the system to balance the output of the boiler and the demand of the heating system is highly recommended. The necessary volume depends on the type of boiler and the character of the heating system. Pellet boilers have a good operating range and a relatively small tank would be used. Log boilers have little range and a large tank that can absorb the energy contained within one or more charges of wood is necessary.

Biomass boilers are combustion appliances and are subject to regulation on placing height and the quantity of pollutant emissions. This should be discussed with the Environmental Health Officer of the Local Authority.



Ground Source Heat Pumps

Ground source heat pumps can be used to provide heating and or cooling to the building. Whilst ground source does rely on fossil fuels (indirectly) to provide the energy source, they are considered renewable given their high coefficient of performance and hence reduced fossil fuel reliance.

This can be one of four methods:

1 Closed horizontal loops, generally comprising a number of flow and return horizontal coiled loops sometimes called 'slinkies'.

2 Closed vertical loops, generally comprising a number of flow and return vertical loops to approximately 100m.

3 Open loop, generally comprising of an abstraction and rejection well.

4 Abstraction only open loop, comprising of an abstraction well with water rejected to either the local sewer systems or river/water course.

Reasons for Excluding this Technology for this Site

In order to provide the anticipated heating and cooling bore holes would be required with sufficient distance needed between them. With the site having limited external areas, ground source heat pumps are deemed not suitable for this project and have not been considered further.

Existing services within the ground would prohibit the installation of a borehole type heat pump, please refer to the utilities report. Space limitations prohibit the installation of a 'slinky' type heat pump.

Wind Turbines

This section covers both large scale and micro wind solutions.

Large scale wind generation systems have capacities over 100kW and are usually used to power larger developments such as, larger scale housing, industrial estates and hotels with many rooms. These systems cannot be roof mounted due to their size and weight.

Reasons for Excluding this Technology for this Site

Due to the large capital cost and surroundings, large scale wind turbine systems are not considered viable at this project.

It is difficult to obtain predictable or large amounts of wind energy in city centre locations, as they require non-turbulent, horizontal air streams to be most effective. Surrounding buildings, trees, etc can cause significant issues with regards to micro and large scale installations unless the rotors are positioned at a considerable height. Micro wind turbine technology has been found to be extremely difficult to achieve a contribution economically. A significant number of units would be required to provide any reasonable energy savings which would have serious visual impact implications.

Tall buildings give their own specific problems in that the building act as a spoiler, pushing wind upwards and over the turbine, reducing effectiveness considerably.

Additional considerations with large and micro wind solutions are the potential issues from stroboscopic light, topple distance, noise, impact on wildlife and structural enhancements which all raise major concerns given the building central London location.

Given the building location in central London and its close proximity to nearby buildings, achieving an acceptable solution that will provide sufficient renewable contribution as well as overcome the installation impacts is unlikely and therefore has not been considered for this project.