MLM

Energy Statement

for

317 Finchely Road London

produced for

317 Finchley Road Limited





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 and Air Source Heat Pumps 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 32.37% improvement in CO₂ emissions over Building Regulations 2013 minimum requirements.

The carbon emissions baseline for the scheme has been identified at 55,486kg 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 19,420 kg CO_2/yr .

The following strategy has been implemented site wide:

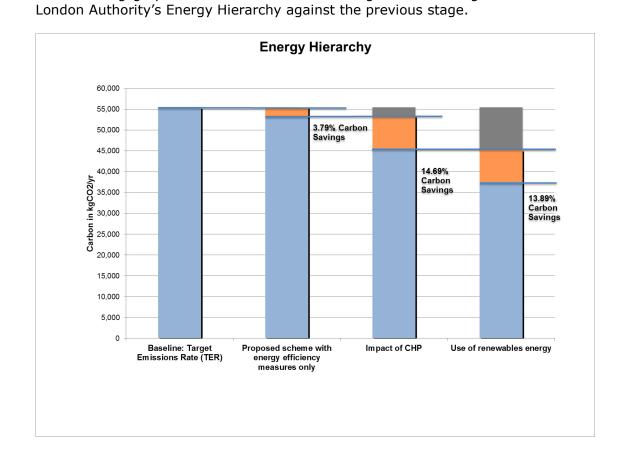
- 'Be Lean': Energy efficiency measures to improve the building fabric and services includes: High performance U-Values (0.13 for external walls, 0.12 for roof, 0.12 for the ground floor, 0.00 for partition walls and 0.8 for windows (Triple glazed) in W/m²K, good air tightness (maximum of 3m³/m²/hr at 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 system has 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.

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

	Carbon Dioxide Emissions (Tonnes/ Annum)	Incremental CO2 Emissions Reduction (%)	Cumulative CO ₂ Emissions Reduction (%)
Step 1 – Baseline	55.486	-	-
Step 2 - 'Be Lean'	53.38	3.79	
Step 3 – 'Be Clean'	45.22	14.69	-
Step 4 – 'Be Green'	37.52	13.89	32.37

The following graph illustrates the carbon savings for each stage of the Greater



3 Planning Requirement

This energy Assessment 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.

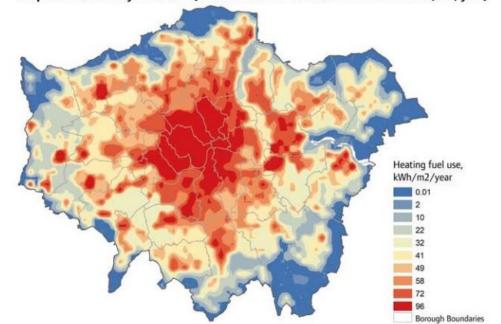
3.2 'Be Lean'

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.

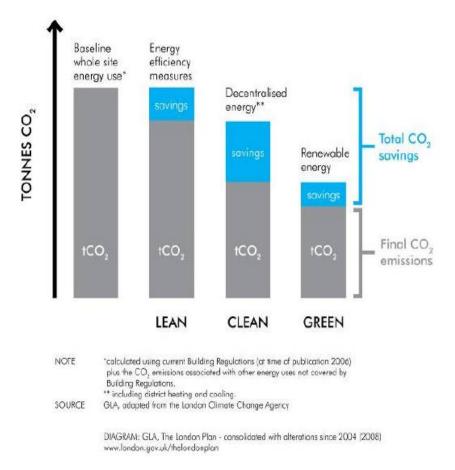


Figure 2 - Energy Hierarchy Diagram, London Plan

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 3.28% which equate to 2,104kg 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/m²K)	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.

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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^\prime (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 only be provided to the two penthouse apartments.

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/m²K)	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.

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.

Other renewable technology options were investigated and discounted.

These alternative technologies included:

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

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

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.

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 CO₂ 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 CO ₂ Emissions Reduction (%)
Step 1 – Baseline	55.486	-	-
Step 2 – 'Be Lean'	53.38	3.79	
Step 3 - `Be Clean'	45.22	14.69	-
Step 4 – 'Be Green'	37.52	13.89	32.37

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 14.69% carbon reduction against the 'Be Lean' stage. The incorporation of the air source heat pumps and systems will allow the development to achieve an overall carbon savings of 33.37% against Building Regulations Part L 2013. This will not 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 Details: **Assessor Name:** Stroma Number: Stroma FSAP 2012 **Software Version: Software Name:** Version: 1.0.1.24 Property Address: flat 1 Address: 1. Overall dwelling dimensions Av. Height(m) Area(m²) Volume(m³) Ground floor 57.7 (1a) x 2.5 (2a) =144.25 (3a) First floor (2b) (1b) x (3b) 45.67 2.5 114.17 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)103.37 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =(5) 258.42 2. Ventilation rate: main secondary other total m³ per hour heating heating Number of chimneys x 40 =(6a) 0 0 0 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)40 4 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =(7c)0 0 Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = 0.15 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =(10)0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 $0.25 - [0.2 \times (14) \div 100] =$ Window infiltration 0 (15)(8) + (10) + (11) + (12) + (13) + (15) =Infiltration rate 0 (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.4 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.78 (20)Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ (21)0.31 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

4

4.3

4.5

4.7

4.9

4.4

4.3

3.8

3.8

3.7

5

5.1

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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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(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	1	(25
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Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall	e 1 e 2 e 3 e 4 54.0 48.7 elements	06 74 ., m²	8.52 8.02	gs 2	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6	x1.	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18	2K = 0.04] = - 0.04] = - 0.04] = - 0.04] = = = = =	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33	(K)	kJ/m²-	K [kJ/K (26 (27 (27 (27 (27 (28 (29) (29)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall * for windows and	e 1 e 2 e 3 e 4 54.0 48.7 elements	06 74 ows, use e	8.52 8.02	gs 2 2 2 2 3 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05	x1.	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18	2K = 0.04] = - 0.04] = - 0.04] = - 0.04] = = = = =	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33	(K)	kJ/m²-	K [kJ/K (26 (27 (27 (27 (27 (28 (29) (29) (31
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall * for windows and *** include the area	e 1 e 2 e 3 e 4 54.0 48.7 elements	06 74 ows, use e	8.52 8.02 effective winternal wall	gs 2 2 2 2 3 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05	x1.	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18	2 K	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33	(K)	kJ/m²-	h 3.2	kJ/K (26 (27 (27 (27 (27 (28 (29 (31 (32
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall * for windows and	e 1 e 2 e 3 e 4 54.0 48.7 elements d roof winddas on both	06 74 ows, use e sides of in = S (A x	8.52 8.02 effective winternal wall	gs 2 2 2 2 3 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05	x1.	W/m ² 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18	2 K	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33	as given ir	kJ/m²-	h 3.2	kJ/K (26 (27 (27 (27 (27 (28 (29 (31 (32 .06 (33
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall * for windows and ** include the area Fabric heat los	e 1 e 2 e 3 e 4 54.0 48.7 elements d roof winder as on both ss, W/K = Cm = S(06 74 00ws, use e sides of in = S (A x (A x k)	8.52 8.02 8.ffective waternal wall	gs 2 2 3 3 4 5 6 7 7 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculatitions	x x1 x1 x1 x1 x x1 x x x x x x x x x x	W/m ² 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18	2 K	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33	as given ir	kJ/m²-	h 3.2	kJ/K (26 (27 (27 (27 (27 (28 (29 (31 (32
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall * for windows and ** include the are Fabric heat los Heat capacity	e 1 e 2 e 3 e 4 54.0 48.7 elements d roof winders on both ss, W/K = Cm = S(es parame	ows, use e sides of in Ster (TMF)	8.52 8.02 effective we naternal wall	gs 2 Indow U-va Is and part	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.08 alue calculatitions	x1.	W/m ² 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18 0 formula 1 (26)(30	2K = -0.04] = -0.04]	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33 0 ue)+0.04] at tive Value	as given ir	kJ/m²-	h 3.2	kJ/K (26 (27 (27 (27 (28 (29 (29 (31 (32 .06 (33 0 (34
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity Thermal mass	e 1 e 2 e 3 e 4 54.0 48.7 elements d roof winders on both ss, W/K: Cm = S(s parame essments whe ead of a dece	ows, use e sides of in ES (A x k) eter (TMF)	8.52 8.02 effective winternal wall U) $P = Cm - tails of the ulation.$	gs indow U-vals and part TFA) ir	A ,r 2.1 3.69 4.83 3.01 5.01 57.7 45.54 40.72 162.6 44.05 alue calculations	x x1. x1. x1. x1. x1. x1. x1. x1. x1. x1	W/m ² 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.18 0 formula 1 (26)(30	2K = 0.04] = -0.04]	(W/ 2.1 4.89 6.4 3.99 6.64 7.501 8.2 7.33 0 ue)+0.04] at tive Value	as given ir	kJ/m²-	h 3.2	kJ/K (26 (27 (27 (27 (28 (29 (29 (31 (32 .06 (33 0 (34

if details of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total fabric he	at loss							. ,	(36) =			50.56	(37)
Ventilation hea	at loss ca	alculated	l monthly	/					$= 0.33 \times ($	(25)m x (5)) 	l	
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 transfer o	coefficier	nt, W/K						(39)m	= (37) + (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 loss para	motor (L	אי ישור אי	/m2l/						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		
0.01	0.07	0.00	0.00	0.00	0.01	0.01	0.01			Sum(40) ₁	<u> </u>	0.95	(40)
Number of day	s in mor	nth (Tab	le 1a)					•	wordgo –	Cam(10)	12712—	0.00	(- /
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
												'	
4. Water heat	ing ener	rgy requi	rement:								kWh/ye	ear:	
Λ		\ I										ı	
Assumed occu if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)1 + 0.0	0013 x (ΓFA -13.		.77		(42)
if TFA £ 13.9			i ovb	(0.0000	/ 10 X (11	71 10.0	/_/]) N 0 10 N (,			
Ann <mark>ual averag</mark>											9.95		(43)
Redu <mark>ce the</mark> annua not m <mark>ore tha</mark> t 125	_		_		_	-	to achieve	a water us	se target o	t			
	Feb	Mar				Jul	Aug	Con	Oct	Nov	Dec		
Jan Hot water usage ii			Apr ach month	May $Vd, m = fa$	Jun			Sep	Oct	INOV	Dec		
(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		
(1.1)	100.00	101100	01.00	33.33	00.00	00.00	00.00			m(44) ₁₁₂ :		1199.45	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600			` ′			
(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)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)				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)
Water storage Storage volum		includin	a any c	olar or M	WHDS	etoraga	within co	me vec	col		450		(47)
If community h	` ,					_		aille ves	9 <u>C</u> I		150		(47)
Otherwise if no	•			•			` '	ers) ente	er 'O' in <i>(</i>	47)			
Water storage		not wate	, (u.i.o ii	.0.000	- rotal ital	10000		0.0, 0	».	, • • •			
a) If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):				1	.39		(48)
Temperature fa	actor fro	m Table	2b							0	.54		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		0	.75		(50)
b) If manufact			-									· 	
Hot water stora	•			e 2 (KW	n/litre/da	ay)					0		(51)
If community h Volume factor	_		JII 4.3								0		(52)
Temperature fa			2b							—	0		(52)
Energy lost fro				ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (_	, , ,				, , (= ·)	. , (,	-	.75		(55)
` , ,		•										l	. ,

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 22.58 23.33 (56)										
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H										
(57)m= 23.33 21.07 23.33 22.58 23.33 22.58 23.33 22.58 23.33 (57)										
Primary circuit loss (annual) from Table 3										
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m										
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)										
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (59)										
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m										
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (61)										
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$										
(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 DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)										
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)										
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (63										
Output from water heater										
(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										
Output from water heater (annual) ₁₁₂ 2121.29 (64										
Heat gains from water heating, kWh/month 0.25 [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]										
(65)m= 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										
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating										
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (see Table 5 and 5a):										
5. Internal gains (see Table 5 and 5a):										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 (66)										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also 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										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also 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 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 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 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 36.84 3										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also 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 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 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 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see 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 36.84 36.84 36.84 36.84 (69) Pumps and fans gains (Table 5a)										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 [66] Lighting gains (calculated in Appendix L, equation L9 or L9a), also 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 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 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 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 36.84 3										
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.4										

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

Orienta	tion:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c	Gains (W)		
North	0.9x	0.77	X	3.69	x	10.63	x	0.63	x	0.7	=	11.99	(74)
North	0.9x	0.77	X	4.83	x	10.63	х	0.63	x	0.7	=	15.7	(74)
North	0.9x	0.77	X	3.01	х	10.63	х	0.63	x	0.7	=	9.78	(74)
North	0.9x	0.77	×	5.01	x	10.63	x	0.63	x	0.7] =	16.28	(74)
North	0.9x	0.77	X	3.69	x	20.32	х	0.63	x	0.7	=	22.92	(74)
North	0.9x	0.77	X	4.83	x	20.32	х	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	x	34.53	x	0.63	x	0.7	=	31.76	(74)
North	0.9x	0.77	x	5.01	x	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	x	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	X	55.46	X	0.63	X	0.7] =	84.92	(74)
North	0.9x	0.77	×	3.69	x	74.72	х	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	0.77	×	3.01	x	74.72	x	0.63	x	0.7	=	68.73	(74)
North	0.9x	0.77	×	5.01	x	74.72	х	0.63	x	0.7	=	114.4	(74)
North	0.9x	0.77	x	3.69	x	79.99	X	0.63	x	0.7	=	90.2	(74)
North	0.9x	0.77	×	4.83	х	79.99	x	0.63	x	0.7	=	118.07	(74)
North	0.9x	0.77	X	3.01	x	79.99	x	0.63	x	0.7	=	73.58	(74)
North	0.9x	0.77	X	5.01	x	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	x	74.68	X	0.63	x	0.7	=	110.23	(74)
North	0.9x	0.77	X	3.01	x	74.68	X	0.63	X	0.7	=	68.69	(74)
North	0.9x	0.77	X	5.01	x	74.68	x	0.63	X	0.7	=	114.34	(74)
North	0.9x	0.77	X	3.69	x	59.25	x	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	x	59.25	x	0.63	X	0.7	=	90.71	(74)
North	0.9x	0.77	X	3.69	x	41.52	X	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	×	5.01	x	41.52	x	0.63	x	0.7	=	63.57	(74)
North	0.9x	0.77	×	3.69	x	24.19	x	0.63	x	0.7	=	27.28	(74)
North	0.9x	0.77	×	4.83	x	24.19	x	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	5.0)1	X	2	4.19	X		0.63	x	0.7	=	37.04	(74)
North	0.9x	0.77	х	3.6	69	x	1	3.12	X		0.63	x	0.7	=	14.79	(74)
North	0.9x	0.77	X	4.8	33	x	1	3.12	X		0.63	x	0.7	=	19.36	(74)
North	0.9x	0.77	X	3.0)1	x	1	3.12	x		0.63	x	0.7	=	12.07	(74)
North	0.9x	0.77	X	5.0)1	x	1	3.12	X		0.63	x [0.7	=	20.08	(74)
North	0.9x	0.77	X	3.6	69	x	8	3.86	x		0.63	x	0.7	=	10	(74)
North	0.9x	0.77	X	4.8	33	x	8	8.86	x		0.63	x	0.7	=	13.09	(74)
North	0.9x	0.77	X	3.0)1	x	8	8.86	x		0.63	x	0.7	=	8.15	(74)
North	0.9x	0.77	X	5.0)1	x	8	3.86	x		0.63	_ x [0.7	_ =	13.57	(74)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m																
(83)m=	53.75 10	2.72	174.54	280.36	377.68	4	04.31	377.48	299	.48	209.86	122.27	66.31	44.81]	(83)
Total g	ains – inter	rnal a	nd sola	r (84)m =	= (73)m	+ (8	83)m	, watts					!		4	
(84)m=	530.25 57	6.91	633.06	713.52	784.85	7	86.7	743.93	672	.43	595.99	533.99	507.39	508.14		(84)
7. Me	an internal	temp	erature	(heating	season)									•	
				,		<i></i>	area f	from Tab	ole 9	Th1	1 (°C)				21	(85)
Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)																
		Feb	Mar	Apr	May	È	Jun	Jul		ug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	0.98	0.91	-	0.74	0.56	0.6		0.9	0.99	1	1		(86)
		$\overline{}$				_						0.00				
	internal te	-										00.54	1 00 10	40.04	1	(07)
(87)m=	19.93 20	0.03	20.24	20.54	20.81	2	20.96	20.99	20.	99	20.87	20.54	20.19	19.91		(87)
Temp	erature dui	ring h	eating p	_	rest of	dw	elling	from Ta	able 9	9, Th	12 (°C)				,	
(88)m=	2 <mark>0.11 20</mark>	0.11	20.11	20.12	20.13	2	0.14	20.14	20.	14	20.13	20.13	20.12	20.12		(88)
Util <mark>isa</mark>	ntion factor	for ga	ains for	rest of d	welling,	h2,	m (se	e Table	9a)							
(89)m=	1	1	0.99	0.97	0.88	1	0.66	0.46	0.5	53	0.85	0.98	1	1		(89)
Mean	internal ter	mpera	ature in	the rest	of dwell	ina	T2 (fe	ollow ste	ns 3	to 7	' in Tahl	e 9c)	•		•	
(90)m=		8.82	19.11	19.56	19.93	Ť	20.11	20.13	20.	$\overline{}$	20.02	19.56	19.05	18.65]	(90)
` ′	l l				<u> </u>	<u> </u>		<u> </u>	<u> </u>		f	LA = Livir	ng area ÷ (4	4) =	0.29	(91)
							` .		,,		۸\					`
ı	internal te	-		1		т —	<u> </u>	1					T		1	(00)
(92)m=		9.17	19.44	19.84	20.19		0.36	20.38	20.		20.27	19.85	19.38	19.02		(92)
	adjustmen			î .		_		1		_		•	10.00	40.00	1	(02)
(93)m=		9.17	19.44	19.84	20.19	2	0.36	20.38	20.	38	20.27	19.85	19.38	19.02		(93)
•	ace heating						-1-1	44 . (T - 1. 1	. 0			(70)	1	. 1. (.	
	to the mea			•		nea	at ste	ер 11 от	rabi	ie 9b	, so tha	t 11,m=((76)m an	a re-cai	culate	
		Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec	1	
Utilisa	tion factor			<u> </u>	Iviay		oan	<u> </u>	<u></u>	<u> </u>	ООР		1101	1 200	J	
(94)m=	1	1	0.99	0.97	0.88		0.68	0.49	0.5	56	0.86	0.98	1	1]	(94)
	l gains, hm	nGm .	W = (9	<u> </u>	L 4)m	_			<u> </u>					l	J	
(95)m=		5.08	627.82	690.56	689.61	5	35.1	364.19	379	9.2	511.82	523.97	505.57	507.46]	(95)
	lly average	exte	rnal ten	nperature	from T	abl	e 8	I	<u> </u>	1			1	I	J	
(96)m=		4.9	6.5	8.9	11.7	_	14.6	16.6	16	.4	14.1	10.6	7.1	4.2]	(96)
	oss rate fo	r mea	ın interr	nal temp	erature.	Lm	, W =	=[(39)m :	x [(9:	 3)m-	- (96)m]	1	I	1	
(97)m=	1473.56 142			- ·		_	58.48	367.02	385	- -	600.8	906.62	1209.96	1466.66]	(97)
ı	<u> </u>					_		!					-			

Space heating	g requir	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m= 702.5	570.2	490.97	277.22	106.37	0	0	0	0	284.69	507.16	713.65		_
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	3652.77	(98)
Space heating	g requir	ement in	kWh/m²	/year								35.34	(99)
9a. Energy req		nts – Ind	ividual h	eating sy	ystems i	ncluding	g micro-C	CHP)					
Space heating Fraction of sp	_	at from s	econdar	v/supple	mentary	, system					Г	0	(201)
Fraction of sp					oa. y	oyoto	(202) = 1	- (201) =			L	1	(202)
Fraction of tot			•	` ,			(204) = (2	02) × [1 –	(203)] =		L T	1	(204)
	Efficiency of main space heating system 1												
Efficiency of s	seconda	ıry/suppl	ementar	y heating	g systen	า, %					Ī	0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	⊒ ar
Space heating	g requir	ement (c	alculate	d above))							·	
702.5	570.2	490.97	277.22	106.37	0	0	0	0	284.69	507.16	713.65		
$(211)m = \{[(98)]$		T				ı	<u> </u>	1	1	I			(211)
751.34	609.84	525.1	296.49	113.77	0	0	O Tota	0	304.48 ar) =Sum(2	542.42	763.26	2002 7	(211)
Space heating	a fuel (e	ocondar	v) k\//b/	month			1018	ii (KVVII/yea	ai) =3uiii(2	2 1) _{15,1012}		3906.7	(211)
$= \{[(98)m \times (20)]\}$			- /	monu									
(215)m = 0	0	0	0	0	0	0	0	0	0	0	0		
							Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water heating													
Output from wa		ter (calc 193.75	ulated al	169.7	151.32	145.03	159.55	159.4	179.81	190.5	204.5		
Efficiency of wa		ater										79.8	(216)
(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)
Fuel for water	•					•	•	•	•				
(219)m = (64)m = (219)m = (238.79)m = (2	m x 100 210.78	$0 \div (217)$ 222.21	201.47	202.97	189.62	181.74	199.94	199.75	208.99	218.21	232.72		
()		<u> </u>	<u> </u>			<u> </u>		I = Sum(2				2507.2	(219)
Annual totals									k'	Wh/year	. <u> </u>	kWh/year	
Space heating	fuel use	ed, main	system	1								3906.7	
Water heating	fuel use	ed										2507.2	
Electricity for p	umps, f	ans and	electric	keep-ho	t								
central heatin	g pump	:									30		(2300
boiler with a fan-assisted flue													(230
Total electricity	otal electricity for the above, kWh/year sum of (230a)(230g) =												(231)
Electricity for li			-									429.8	(232)
		– Individ									L		

Energy

kWh/year

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

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 o	f (265)(271) =		1647.39	(272)

TER = 15.94 (273)

				User D	etails:						
Assessor Name: Software Name:	Stroma	a FSAP 201	2			a Num are Vei			Versio	on: 1.0.1.24	
			Р	roperty.	Address	: Flat 2					
Address :											
1. Overall dwelling dime	ensions:			Δ	- (2\		Av. Ha	: a.b.4/\		Values a/m²	21
Ground floor					a(m²) 50.32	(1a) x		ight(m) 2.5	(2a) =	Volume(m ²	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e	e)+(1r	า) 5	0.32	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d	d)+(3e)+	.(3n) =	125.8	(5)
2. Ventilation rate:											
Number of chimneys	mai heat		econdar leating	ry □ + □	other 0	7 = [total 0	x 4	40 =	m³ per hou	ir (6a)
Number of open flues		0 + [0	┧╻┝	0	」	0	x	20 =	0	(6b)
Number of intermittent fa			U	_	<u> </u>	┙┝			10 =		╡` ′
						Ļ	2		10 =	20	(7a)
Number of passive vents						Ĺ	0			0	(7b)
Number of flueless gas f	ires					L	0	X 4	40 =	0	(7c)
									Air ch	nanges per he	our
Infiltration due to chimne	ve flues a	and fans - (6	a)+(6b)+(7	7a)+(7h)+(7c) =	Г					
If a pressurisation test has l						continue fr	20 rom (9) to (÷ (5) =	0.16	(8)
Number of storeys in t								ĺ		0	(9)
Additional infiltration								[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0						•	uction			0	(11)
if both types of wall are p deducting areas of openi			ponding to	the great	er wall are	a (after					
If suspended wooden			ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er	iter 0.05, e	else enter 0								0	(13)
Percentage of window	s and doo	rs draught st	ripped							0	(14)
Window infiltration					•	2 x (14) ÷ 1	•			0	(15)
Infiltration rate					. , , ,	. , ,	12) + (13) -			0	(16)
Air permeability value,				•	•	•	etre of e	envelope	area	5	(17)
If based on air permeabi Air permeability value applie	•						is heina u	sad		0.41	(18)
Number of sides sheltere		msauon test nas	s been doi	ie or a det	gree an pe	тпеаышу	is being us	seu		3	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	19)] =			0.78	(20)
Infiltration rate incorpora	ting shelte	r factor			(21) = (18) x (20) =				0.32	(21)
Infiltration rate modified	for monthly	y wind speed	1								-
Jan Feb	Mar A	pr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from	Table 7								_	
(22)m= 5.1 5	4.9 4	.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Easter (22a) (2	2)m · 4										
Wind Factor $(22a)m = (22a)m = 1.27$.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
(22a)m= 1.27 1.25	ا ا تعاد	. 1 1.00	I 0.50	I U.SO	J 0.52	I '	I 1.00	1.14	1.10	I	

djusted infiltra 0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37	1	
Calculate effec	-						0.29	0.52	0.54	0.30	0.37	J	
If mechanica	l ventila	ition:										0	(2
If exhaust air he	at pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	wise (23b)) = (23a)			0	(2
If balanced with	heat reco	overy: effic	eiency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				0	(2
a) If balance	d mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	MV) (24b)m = (22	2b)m + (2	23b)		_	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole he if (22b)m				•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(2
d) If natural v				•	•				0.5]	•	•	•	
4d)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		(2
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				•	
5)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		(2
B. Heat losses	and he	at lose i	narai <mark>me</mark> ti	or:									
LEMENT	Gros area	ss	Openin	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value		A X k kJ/K
oors					2.1	x	1	= [2.1				(2
indows Type	1				3.33	x1,	/[1/(1.4)+	0.04] =	4.41	Ħ			(2
indows Type					5.01		/[1/(1.4)+	<u> </u>	6.64	Ħ			(2
alls	59.4	19	10.4	4	49.05		0.18] = [8.83	5 7		¬ ⊢	(2
otal area of e			10.1	<u>·</u>	59.49	=	0.10		0.00				(;
arty wall		,				<u></u>				— г			(:
or windows and	roof wind	ows use e	effective wi	ndow I I-v	17.5 alue calcul	^ ated using	formula 1	= [/[(1/L]-valu	0 e)+0 041 a	L as aiven in	naragrani		(
include the area						atou uomg	, romaia r	I(17 G Valu	0) 10.0 1] 0	io givoii iii	paragrapi	7 0.2	
abric heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				21.99	9 (
eat capacity (Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(:
nermal mass	parame	ter (TMF	= Cm +	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(;
r design assess				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
n be used instea				.a.:.a. A.	ا بنام مصما	,							
nermal bridge	•	,			•	`						4.7	(;
details of therma Intal fabric hea		are not kr	iowii (30) =	= U. 13 X (3) 1)			(33) +	(36) =			26.69) (:
entilation hea		alculated	d monthly	/						25)m x (5))	20.00	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
3)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		(;
eat transfer c		<u> </u>				l			= (37) + (37)	<u> </u>	ļ	ı	
		1L, VV/[X						(33)111	- (01) + (00)111			
9)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	

leat lo	ss para	meter (F	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		
Numbe	er of day	s in mor	nth (Tabl	le 1a)					1	Average =	Sum(40) ₁ .	12 /12=	0.99	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ing ener	gy requi	rement:								kWh/yea	r:	
if TF				[1 - exp	(-0.0003	49 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		.7		(42)
Reduce	the annua	al average		usage by	5% if the d	welling is	designed t	(25 x N) to achieve		se target o		.56		(43
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
lot wate		n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
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	004.70	— (44
nergy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		894.76	(44
45)m=	121.63	106.38	109.78	95.71	91.83	79.24	73.43	84.26	85.27	99.37	108.47	117.8		
inotoni	lanaaua u	vator booti	as at paint	of use (no	, bot water	atorogo)	antar O in	boxes (46)		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
· ·	storage		10.47	14.50	13.77	11.09	71.01	12.04	12.79	14.91	10.27	17.07		(10
Storag	e volum	e (litres)	includin	ig any so	olar or W	WHRS	storage	within sa	ame ves	sel		150		(47
	-	_	nd no ta		_			(47) mbi boil	ora) anta	or (O' in (47)			
	storage		not wate	i (uno n	iciuues ii	iistaiitai	ieous co	יווטט וטווויו	ers) erite	51 0 111 (47)			
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):				1.	39		(48
empe	rature fa	actor fro	m Table	2b							0.	54		(49
			storage	-		:		(48) x (49)) =		0.	75		(50
,			eclared of factor fr	•								0		(51
	-	_	ee sectio	on 4.3	,		• /							
		from Tal		OI-							-	0		(52
			m Table					(47) (54)	(50) (50)		0		(53
٠.		m water [54) in (5	storage	, KVVN/ye	ear			(47) x (51)) X (52) X (53) =		75		(54 (55
	. ,	. , .	culated f	or each	month			((56)m = (55) × (41)ı	m	0.	75		(00
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
-												m Appendix	Н	(
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	y circuit	loss (an	nual) fro	m Table	 e 3		•	•				0		(58
Primar	y circuit	loss cal	culated f	for each	month (•	. ,	65 × (41)						
(mod	dified by	factor fi	om Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
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	ralculated	for each	month (′61)m =	(60) ÷	365 v (41	۱m							
(61)m= 0	0	0	0	0	0	0))	0	0	0	0]	(61)
	auired for	water h	eating ca	alculated	l for ea	ch month	(62)	 m =	0.85 × ((45)m +	(46)m +	(57)m +	ים - (59)m + (61)m	
(62)m= 168.2	-i	156.37	140.8	138.43	124.3		130		130.36	145.97	153.57	164.39]	(62)
Solar DHW inp	ut calculated	using App	endix G o	· Appendix	H (neg	ative quantity	y) (ent	ter '0'	' if no sola	r contribu	tion to wate	er heating))	
(add addition	nal lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	dix C	G)					
(63)m= 0	0	0	0	0	0	0	0)	0	0	0	0]	(63)
Output from	water hea	ter											_	
(64)m= 168.2	3 148.47	156.37	140.8	138.43	124.3	120.03	130	.86	130.36	145.97	153.57	164.39		_
								Outp	out from wa	ater heate	er (annual)	l12	1721.8	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	31)m	1] + 0.8 >	k [(46)m	+ (57)m	+ (59)m	<u> </u>	
(65)m= 77.72	2 69.04	73.78	67.9	67.81	62.42	61.69	65.	29	64.43	70.32	72.14	76.44]	(65)
include (5	7)m in cald	culation	of (65)m	only if c	ylinde	is in the	dwell	ling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a):										
Metabolic ga	ains (Table	5), Wat	ts	-		_			-			,	-	
Jar	n Feb	Mar	Apr	May	Jun	Jul	А	ug	Sep	Oct	Nov	Dec	_	
(66)m= 84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.	98	84.98	84.98	84.98	84.98		(66)
Ligh <mark>ting g</mark> air	_	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee	Table 5					
(67)m= 13.68	3 12.15	9.88	7.48	5.59	4.72	5.1	6.6	63	8.9	11.3	13.19	14.06		(67)
App <mark>liance</mark> s (gains (ca <mark>lc</mark>	ulated ir	Append	dix L, eq	uation	L13 or L1	3 a),	also	see Ta	ble 5			_	
(68)m= 148.0	7 149.6	145.73	137.49	127.08	117.3	110.77	109	.23	113.11	121.35	131.75	141.53		(68)
Coo <mark>king gai</mark>	ns (calcula	ited in A	ppendix	L, equat	ion L1	5 or L15a), als	o se	e Table	5			_	
(69)m= 31.5	31.5	31.5	31.5	31.5	31.5	31.5	31	.5	31.5	31.5	31.5	31.5		(69)
Pumps and	fans gains	(Table 5	5a)								_		_	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	_					_		-	
(71)m= -67.9	8 -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	ng gains (T	able 5)											-	
(72)m= 104.4	6 102.74	99.16	94.3	91.14	86.7	82.92	87.	76	89.48	94.51	100.2	102.75		(72)
Total intern	al gains =	:			(6	66)m + (67)n	n + (68	3)m +	+ (69)m + ((70)m + (71)m + (72))m	-	
(73)m= 317.7	7 315.98	306.26	290.76	275.31	260.2	250.28	255	.12	262.98	278.65	296.63	309.83		(73)
6. Solar ga														
Solar gains ar		•					ations	to co		ie applica		tion.	0.1	
Orientation:	Access F Table 6d		Area m²			lux able 6a		т	g_ able 6b	7	FF able 6c		Gains (W)	
North o o				_			1					_	. ,	7,-,,
North 0.9		X	3.3		x	10.63	X]		0.63	×	0.7	_ =	10.82	[(74)
North 0.9		X	5.0		x	10.63] X]		0.63		0.7	=	16.28](74)
North 0.9		X	3.3		x	20.32] X]		0.63	X	0.7	=	20.68](74)
		X	5.0		X	20.32] X	_	0.63	X	0.7	=	31.11](74)
North 0.9	× 0.77	X	3.3	33	Х	34.53	X		0.63	X	0.7	=	35.14	(74)

			-		-		٦ .						_
North	0.9x	0.77	X	5.01	X	34.53	X	0.63	X	0.7	=	52.87	(74)
North	0.9x	0.77	X	3.33	X	55.46	×	0.63	X	0.7	=	56.45	(74)
North	0.9x	0.77	X	5.01	X	55.46	X	0.63	X	0.7	=	84.92	(74)
North	0.9x	0.77	X	3.33	X	74.72	X	0.63	X	0.7	=	76.04	(74)
North	0.9x	0.77	X	5.01	X	74.72	X	0.63	X	0.7		114.4	(74)
North	0.9x	0.77	X	3.33	X	79.99	X	0.63	X	0.7	=	81.4	(74)
North	0.9x	0.77	X	5.01	X	79.99	X	0.63	X	0.7	=	122.47	(74)
North	0.9x	0.77	X	3.33	X	74.68	X	0.63	X	0.7	=	76	(74)
North	0.9x	0.77	X	5.01	X	74.68	X	0.63	X	0.7	=	114.34	(74)
North	0.9x	0.77	X	3.33	X	59.25	X	0.63	x	0.7	= [60.29	(74)
North	0.9x	0.77	X	5.01	X	59.25	X	0.63	X	0.7	=	90.71	(74)
North	0.9x	0.77	x	3.33	X	41.52	x	0.63	X	0.7	=	42.25	(74)
North	0.9x	0.77	X	5.01	X	41.52	X	0.63	x	0.7	<u> </u>	63.57	(74)
North	0.9x	0.77	×	3.33	X	24.19	X	0.63	x	0.7	<u> </u>	24.62	(74)
North	0.9x	0.77	x	5.01	X	24.19	X	0.63	x	0.7	=	37.04	(74)
North	0.9x	0.77	X	3.33	X	13.12	X	0.63	x	0.7	=	13.35	(74)
North	0.9x	0.77	X	5.01	X	13.12	X	0.63	x	0.7	=	20.08	(74)
North	0.9x	0.77	X	3.33	X	8.86	Х	0.63	Х	0.7	=	9.02	(74)
North	0.9x	0.77	j×	5.01	i x	8.86	x	0.63	x	0.7	=	13.57	(74)
	_												
Solar g	ains in	watts, calcu	lated	for each mor	nth		(83)m	n = Sum(74)m.	(82)m				
(83)m=	27.1	51.79 88	01	141.37 190.	14 2	03.87 190.34	151	04 405 00	04.05	00.10	00.50		(83)
` ' L		01.73	1.01	141.57	-	03.07	151	.01 105.82	61.65	33.43	22.59		(03)
L				(84)m = (73)			131	.01 105.82	61.65	33.43	22.59		(00)
L		nternal and			m + (406		340.3		332.42		(84)
Total ga	ains — ii 344.8	nternal and 367.78 394	solar 4.28	(84)m = (73)	m + (83)m , watts							
Total ga (84)m= [7. Mea	ains — ii 344.8 an inter	nternal and 367.78 394	solar 4.28 ture ((84)m = (73) 432.13 465. (heating seas	m + (75 4	83)m , watts	406	.12 368.79				21	
Total ga (84)m= [7. Mea Tempe	344.8 an intererature	nternal and s 367.78 39 nal tempera during heati	solar 4.28 ture ((84)m = (73) 432.13 465. (heating seaseriods in the	m + (75 4 on) living	83)m , watts 64.08 440.62	406	.12 368.79				21	(84)
Total ga (84)m= [7. Mea Tempe	344.8 an intererature	nternal and s 367.78 39 nal tempera during heati	solar 4.28 ture ((84)m = (73) 432.13 465. (heating seaseriods in the	m + (75 4 on) living ,m (s	83)m , watts 64.08	406 ble 9	.12 368.79		330.06		21	(84)
Total ga (84)m= [7. Mea Tempe	344.8 an intererature	nternal and s 367.78 394 nal tempera during heati etor for gains Feb N	solar 4.28 ture (ing po	(84)m = (73) 432.13 465. (heating seaseriods in the eving area, h1	m + (75 4 son) living ,m (s	83)m , watts 64.08 440.62 area from Ta ee Table 9a)	406 ble 9	.12 368.79 , Th1 (°C)	340.3	330.06	332.42	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m=	344.8 an intererature tion facure	nternal and some start and some star	ture (ing po	(84)m = (73) 432.13	m + (75 4 on) living ,m (s	83)m , watts 64.08	406 ble 9,	.12 368.79 , Th1 (°C) ug Sep .55 0.82	340.3 ⁴	330.06 Nov	332.42 Dec	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m=	344.8 an intererature tion facure	nternal and some stor for gains Feb N 0.99 0. I temperatur	ture (ing po	(84)m = (73) 432.13	m + (75 4 50n) living ,m (s	83)m , watts 64.08	406 ble 9,	.12 368.79 .Th1 (°C) ug Sep .55 0.82 .Table 9c)	340.3 ⁴	Nov 0.99	332.42 Dec	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m=	ains – in 344.8 an interestion factor of the second of t	nternal and some stor for gains Feb No.99 0.1 temperatur 20.14 20	ture (ing positions for line) for line	(84)m = (73) 432.13	m + (75 4 5 4 7 2 7 2	83)m , watts 64.08	406 ble 9 A 0.5 7 in T 20.	368.79 Th1 (°C) Ug Sep 55 0.82 Table 9c) 99 20.92	340.3' Oct 0.97	Nov 0.99	332.42 Dec 1	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= Tempe	ains – in 344.8 an interestion factor of the second of t	nternal and some start and some star	ture (ing positions of the formal state) for a for limited from the formal state (ing positions of the formal state) for a for a formal state (ing positions of the formal state) for a formal state (ing positions of the formal state	(84)m = (73) 432.13	m + (75 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9 A 0.5 7 in T 20.	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C)	Oct 0.97	Nov 0.99	332.42 Dec 1	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= Tempe (88)m=	ains – in 344.8 an interestion factor Jan 1 interna 20.03 erature 20.07	nternal and some story for gains Feb No.99 0. I temperature 20.14 20 during heating h	ture (ing positions of the following positions) to the following positions of the following positions	(84)m = (73) 432.13	m + (75 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9, 0.5 7 in T 20. able 9	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C)	340.3' Oct 0.97	Nov 0.99	Dec 1 20.01	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= Tempe (88)m= Utilisa	ains – in 344.8 an interestion factor of the second of th	nternal and some stor for gains feb	ture (ing period of the second of the secon	(84)m = (73) 432.13	m + (75 4 4 50n) fiving ,m (say 5 7 2 2 of dw 9 9 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9 1 9	83)m , watts 64.08	406 ble 9 0.5 7 in T 20. able 9 20 9 9a)	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C) 1 20.1	Oct 0.97 20.64	Nov 0.99 20.29 20.09	Dec 1 20.01 20.08	21	(84) (85) (86) (87) (88)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= Tempe (88)m= Utilisa (89)m=	ains – in 344.8 an interestion factor of the second of th	nternal and some stor for gains feb	ture (ing period of the state	(84)m = (73) 432.13	m + (75 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9 0.5 7 in T 20. able 9 20 20 0.4	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 0, Th2 (°C) 1 20.1	Oct 0.97 20.64 20.09	Nov 0.99	Dec 1 20.01	21	(84)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= [Tempe (88)m= Utilisa (89)m= Mean	ains – in 344.8 an interestion factor Jan 1 interna 20.03 erature 20.07 tion factor 0.99 interna	nternal and some stor for gains Feb No.99 0. I temperature 20.14 20 during heating hea	ture (ing per form in ing per form in ing per form ing p	(84)m = (73) 432.13 465. (heating seaseriods in the eving area, h1) Apr Marcon Marco	m + (75 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9, 0.5 7 in T 20. able 9 0.4 eps 3	368.79 Th1 (°C) Ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C) 1 20.1 15 0.75 to 7 in Table	Oct 0.97 20.64 20.09 0.95 e 9c)	Nov 0.99 20.29 20.09	Dec 1 20.01 20.08	21	(84) (85) (86) (87) (88)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= Tempe (88)m= Utilisa (89)m=	ains – in 344.8 an interestion factor of the second of th	nternal and some stor for gains Feb No.99 0. I temperature 20.14 20 during heating hea	ture (ing period of the state	(84)m = (73) 432.13	m + (75 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9 0.5 7 in T 20. able 9 20 20 0.4	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C) .1 20.1 to 7 in Table .1 20.03	Oct 0.97 20.64 20.09 0.95 e 9c) 19.67	Nov 0.99 20.29 20.09 19.18	332.42 Dec 1 20.01 20.08		(84) (85) (86) (87) (88) (89)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= [Tempe (88)m= Utilisa (89)m= Mean	ains – in 344.8 an interestion factor Jan 1 interna 20.03 erature 20.07 tion factor 0.99 interna	nternal and some stor for gains Feb No.99 0. I temperature 20.14 20 during heating hea	ture (ing per form in ing per form in ing per form ing p	(84)m = (73) 432.13 465. (heating seaseriods in the eving area, h1) Apr Marcon Marco	m + (75 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9, 0.5 7 in T 20. able 9 0.4 eps 3	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C) .1 20.1 to 7 in Table .1 20.03	Oct 0.97 20.64 20.09 0.95 e 9c) 19.67	Nov 0.99 20.29 20.09	332.42 Dec 1 20.01 20.08	0.48	(84) (85) (86) (87) (88)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= [Utilisa (89)m= Mean (90)m= Mean	ains – in 344.8 an interestion factor Jan 1 interna 20.03 erature 20.07 tion factor 0.99 interna 18.79	nternal and some stor for gains Feb No.99 0. I temperature 20.14 20 during heating to for gains on the stor for gains of the stor fo	ture (ing positions) for right (ing position	(84)m = (73) 432.13 465. (heating seaseriods in the eving area, h1) Apr Ma 0.95 0.88 iving area T1 20.63 20.63 20.8 eriods in rest 20.09 20.09 20.0 est of dwelling 0.8 he rest of dw 19.65 19.9 19.9 r the whole d 19.9	m + (75 4 75 4 75 4 75 4 75 4 76 7 77 2 77 2 77 2 77 2 77 2 77 2 77 2	83)m , watts 64.08	406 ble 9 0.5 7 in T 20. able 9 0.4 eps 3 20 + (1	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C) 1 20.1 15 0.75 to 7 in Table 1 20.03	Oct 0.97 20.64 20.09 0.95 e 9c) 19.67 iLA = Liv	Nov 0.99 20.29 20.09 0.99	332.42 Dec 1 20.01 20.08 1 18.77 4) =		(84) (85) (86) (87) (88) (89) (90)
Total ga (84)m= 7. Mea Tempe Utilisa (86)m= Mean (87)m= [Tempe (88)m= Utilisa (89)m= Mean (90)m= Mean (90)m=	ains – in 344.8 an interestion factor of the series of th	nternal and some stor for gains feb	ture (ing period of the second of the secon	(84)m = (73) 432.13	m + (75 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	83)m , watts 64.08	406 ble 9 0.5 7 in T 20. able 9 20 eps 3 20 + (1 20.	368.79 Th1 (°C) ug Sep 55 0.82 Table 9c) 99 20.92 9, Th2 (°C) 1 20.1 to 7 in Table 1 20.03 f fLA) × T2 53 20.46	340.3' Oct 0.97 20.64 20.09 0.95 e 9c) 19.67 LA = Liv	330.06 Nov 0.99 20.29 20.09 19.18 ring area ÷ (4)	332.42 Dec 1 20.01 20.08		(84) (85) (86) (87) (88) (89)

(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. Spac	e heatir	ng requ	iirement											
						ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
		T	r gains			l	11	Δ	0	0-4	Navi	Dan		
<u> </u>	Jan	Feb	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	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)
` ' _			W = (94			0.01	J	0.0	0.70	0.00	0.00	0.00		(- /
		364.06	385.77	404.61	381.06	283.73	192.85	201.29	286.38	324.03	325.99	330.67		(95)
` '		ıe 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 los	ss rate f	or mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]			l	
(97)m= 7	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 h	heating	require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m= 3	315.64	253.31	212.14	112.41	39.12	0	0	0	0	112.55	220.08	321.8		
								Tota	l per year	(kWh/yeaı) = Sum(9	8) _{15,912} =	1587.04	(98)
Space h	heating	require	ement in	kWh/m²	/year								31.54	(99)
9a. Ener	av reau	iremen	ts – Indi	vidual h	eating sy	vstems i	ncluding	ı micro-C	:HP)					
Space I			ito irrai	viadai ii		y otorno r	rioraarrig		,					
-	_		t from se	econdar	//supple	mentary	system						0	(201)
Fraction	of spa	ce hea	t from m	ain syst	em(s)			(202) = 1 -	(201) =				1	(202)
			ng from i					(204) = (2	02) × [1 –	(203)] =			1	(204)
			ice heati										93.5	(206)
	-		ry/supple			cycton	0/						0	(208)
		- 1												┙`
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
	Ť	253.31	212.14		39.12	0	0	0	0	112.55	220.08	321.8		
<u> </u>						0		0	0	112.00	220.00	321.0		(5.4.4)
(211)m =		1 X (20- 270.92	4)] } X 1 226.89	00 ÷ (20 120.23	41.84	0	0	0	0	120.37	235.38	344.17		(211)
Ľ	007.00	270.92	220.09	120.23	41.04	0	0		l (kWh/yea				4007.07	(211)
0		f l . /		.\ .\\\/ -/				rota	ii (KVVIII) yoo	ar) =0am(2	- ' '/15,1012		1697.37	(211)
Space r = {[(98)m	•	,	econdary	, , .	montn									
(215)m=	0	0	00 - (20	0	0	0	0	0	0	0	0	0		
(= 10)									l (kWh/yea	_			0	(215)
Water he	eating								,	,	7 10, 10 12			`` ′
Output fr	_	er heat	ter (calc	ulated al	oove)									
-		148.47	156.37	140.8	138.43	124.34	120.03	130.86	130.36	145.97	153.57	164.39		
Efficienc	y of wat	er hea	ter					•				•	79.8	(216)
(217)m= 8	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 for \	water he	eating,	kWh/mc	onth				•				•	•	
(219)m =	= (64)m	x 100	÷ (217)	m				1					1	
(219)m= 1	194.55	172.18	182.62	167.18	168.95	155.81	150.41	163.98	163.36	173.5	179.04	189.88		_
								Tota	I = Sum(2				2061.46	(219)
Annual t		دما برمد	d mair	ovete~	1					k'	Wh/year	•	kWh/yea	<u>'</u>
Space he	eaung fl	iei use	u, main	system	ı								1697.37	

Water heating fuel used			2061.46
Electricity for pumps, fans and electric keep-hot			
central heating pump:			30 (2300
boiler with a fan-assisted flue			45 (230e
Total electricity for the above, kWh/year	sum of (2	230a)(230g) =	75 (231)
Electricity for lighting			241.56 (232)
12a. CO2 emissions – Individual heating systems	including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	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	5	sum of (265)(271) =	976.2 (272)
TER =			19.4 (273)

			User E	Details:						
Assessor Name: Software Name:	Stroma FSAP 2	012		Strom Softwa				Versio	on: 1.0.1.24	
		Р	roperty	Address	: Flat 3					
Address :										
1. Overall dwelling dimer	nsions:		•	<i>(</i> 0)					M 1	٥١
Ground floor				a(m²) 66.88	(1a) x		2.5	(2a) =	Volume(m)	(3a
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+((1e)+(1r	1) (66.88	(4)					
Dwelling volume					(3a)+(3b	o)+(3c)+(3c	d)+(3e)+	.(3n) =	167.2	(5)
2. Ventilation rate:								'		
Number of chimneys	main heating	secondar heating	у П + Г	other 0	7 = F	total 0	x	40 =	m³ per hou	ır (6a
•			」]			20 =		╡`
Number of open flues	U	0]	0	」	0			0	(6b
Number of intermittent fan	1S				Ĺ	2		10 =	20	(7a
Number of passive vents					L	0	X	10 =	0	(7b
Number of flueless gas fire	es					0	X	40 =	0	(70
								Δir ch	nanges per h	our
Infiltration due to chimney	o fluor and fans –	(63)±(6b)±(7	(a)+(7b)+((70) -			_			
If a pressurisation test has be					continue f	20 rom (9) to		÷ (5) =	0.12	(8)
Number of storeys in the							-/		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10
Structural infiltration: 0.2					•	ruction			0	(11
if both types of wall are pre deducting areas of opening		responding to	the grea	ter wall are	a (after					
If suspended wooden flo		ealed) or 0.	.1 (seale	ed), else	enter 0				0	(1:
If no draught lobby, ente	er 0.05, else enter	0							0	(13
Percentage of windows	and doors draught	stripped							0	(14
Window infiltration				0.25 - [0.2	` '	-	(4-)		0	(15
Infiltration rate	50 1:					12) + (13)			0	(16
Air permeability value, out of the Air permeability value, or air permeability	•		•	•	•	netre of e	envelope	area	5	(17
Air permeability value applies						r is being u	sed		0.37	(18
Number of sides sheltered					·	ŭ			3	(19
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.78	(20
Infiltration rate incorporation	ng shelter factor			(21) = (18) x (20) =				0.29	(21
Infiltration rate modified fo	r monthly wind spe	ed		_			_		1	
Jan Feb I	Mar Apr Ma	ıy Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe						,		,	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
<u> </u>	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
				1	L		1	L	J	

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.26	0.29	0.31	0.32	0.34		
alculate effec		•	rate for t	he appli	cable ca	se	l					ı 	
If mechanica				(22		(1	.=	. (22)) (22.)			0	(2
If exhaust air he		0		, ,	,	. ,	,, .	,) = (23a)			0	(2
If balanced with		-	-	_								0	(2
a) If balance		ı —	.			- ` ` 	- ` ` - 	ŕ	<u> </u>		` ` ´	÷ 100]	,
1a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
b) If balance		i	i		1		ЛV) (24b	i `	2b)m + (2	23b)		1	
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole he if (22b)m				•	-				5 × (23b)			
lc)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
d) If natural if (22b)m				•	•				0.5]		-		
d)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		(:
Effective air	change	rate - er	nter (24a	or (24k	o) or (24	c) or (24	d) in box	x (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		(
. Heat losses	and he	at loss i	naramet	or.							_	_	-
EMENT	Gros area	SS	Openin	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	<)	k-value		A X k kJ/K
ors					2.1	x	1	= [2.1				(:
ndows Type	1				5.7	x1,	/[1/(1.4)+	0.04] =	7.56	Ħ			
ndows Type	2				2.81	x1,	/[1/(1.4)+	0.04] =	3.73	Ħ			
ndows Type					6.11		/[1/(1.4)+	L	8.1	片			(
alls	95.5		16.7	<u>, </u>	78.78	=	0.18		14.18	=			(
tal area of e			10.7			<u>`</u>	0.10	[14.10				
or windows and			effective wi	ndow H-va	95.5	ated using	ı formula 1	/[(1/Ll-valu	ne)±0 041 a	ns aiven in	naragrant	132	(:
nclude the area						atou uomg	normala 1	/[(0)10.01] 0	io givoii iii	paragrapi	7 0.2	
bric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				35.66	6 (
at capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	
ermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(
r design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
n be used instea				.a.a. A.a	ا بناممم	,							
ermal bridge	,	,			•	`						2.25	(
etails of therma tal fabric hea		are not ki	OWII (30) =	- U. 13 X (3	1)			(33) +	(36) =			37.9	1 (
ntilation hea		alculated	l monthly	/					= 0.33 × (25)m x (5))	07.0	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
)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		(
at transfer o		<u> </u>			I	<u> </u>	I	<u> </u>	= (37) + (37)	<u> </u>	!	ı	
at transier C			1				1				l	1	
)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		

Heat loss para	ımeter (l	HLP), W	/m²K					(40)m	= (39)m ÷	- (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		
	ļ	!	<u> </u>	<u> </u>	<u>I</u>	!	<u> </u>	!	Average =	Sum(40) ₁	12 /12=	1.02	(40)
Number of day	/s in mo	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. Water heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		17		(42)
Annual averag Reduce the annua not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed i			se target o		5.69		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	•	•	•	•		
(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		
		,		41		_	T (000)			ım(44) ₁₁₂ =		1028.3	(44)
Energy content of													
(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		(,r_)
If inst <mark>antane</mark> ous w	vater heati	ing at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	ım(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)
Water storage		10.02	10.0	10.00	10.00		11.00		17.10	10.7	20.01		(- /
Storage volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	eating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot water	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage a) If manufact		oclared I	occ foct	or ic kno	wo (k\\/l	a/dayı):					00		(40)
ŕ				JI 15 KI10	wii (Kvvi	i/uay).					39		(48)
Temperature for Energy lost from				oor			(48) x (49)	\ _			54		(49)
b) If manufact		•	•		or is not		(40) X (49)	, –		0.	75		(50)
Hot water stor			-								0		(51)
If community h	•		on 4.3										
Volume factor			Oh.								0		(52)
Temperature f							(47) (54)) (50) ((FO)		0		(53)
Energy lost fro Enter (50) or (_	, KVVh/ye	ear			(47) X (51)) x (52) x (53) =		0 75		(54) (55)
Water storage	. , .	,	for each	month			((56)m = ((55) × (41)	m	0.	75		(55)
		1			20.50			·		1 00 50	22.22		(56)
(56)m= 23.33 If cylinder contains	21.07 s dedicate	23.33	22.58	m = (56)m	22.58 x [(50) = (23.33 H11)1 ÷ (5	23.33 0) else (5	22.58 7)m = (56)	23.33 m where (22.58 (H11) is fro	23.33 m Append	ix H	(30)
				· · ·						· ·			(EZ)
(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 circuit	•	•			>	(=o) =	,				0		(58)
Primary circuit				,	•	• •	, ,		r thorma	setat)			
(modified by (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)
(38)111= 23.20	21.01	23.20	22.01	23.20	22.01	23.20	23.20	22.01	23.20	22.01	23.20		(00)

Combi logo os	laulata d	for oach	month ((C1)m	(CO) + 2(GE (41	١,,,,						
Combi loss ca	liculated 0	or each	0	0	(60) ÷ 30	05 × (41)	0	T 0	0	0	0	1	(61)
			<u> </u>				<u> </u>		<u> </u>	<u> </u>	<u> </u>	(F0)m + (61)m	(01)
(62)m= 186.38	164.34	172.75	155.08	152.13	136.16	130.98	143.43		160.8	169.75	181.97	- (59)m + (61)m]	(62)
Solar DHW input	1			L								,	(02)
(add additiona									r continua	ion to wate	or ricating)	1	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from w	/ater hea	ter		l			ļ.	Į.	<u>I</u>			1	
(64)m= 186.38		172.75	155.08	152.13	136.16	130.98	143.43	143.09	160.8	169.75	181.97	1	
	1	ļ	ļ.	Į	<u> </u>	<u>!</u>	Ou	tput from w	ı ater heate	r (annual)₁	l12	1896.88	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	 1]	_
(65)m= 83.75	74.32	79.22	72.64	72.37	66.35	65.34	69.47	68.66	75.25	77.52	82.29	1	(65)
include (57)	m in calc	culation of	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	om com	munity h	neating	
5. Internal g					•						•		
Metabolic gair	,			,									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m= 108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equati	ion L9 o	r L9a), <mark>a</mark>	lso see	Table 5					
(67)m= 17.35	15.41	12.53	9.49	7.09	5.99	6.47	8.41	11.29	14.33	16.73	17.83]	(67)
App <mark>liance</mark> s ga	ins (ca <mark>lc</mark>	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble <mark>5</mark>			-	
(68)m= 189.91	191.88	186.91	176.34	163	150.45	142.07	140.1	145.07	155.64	168.99	181.53]	(68)
Cooking gains	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also s	see Table	5			-	
(69)m= 33.84	33.84	33.84	33.84	33.84	33.84	33.84	33.84	33.84	33.84	33.84	33.84		(69)
Pumps and fa	ns gains	(Table 5	5a)									-	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m= -86.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72	-86.72]	(71)
Water heating	gains (T	able 5)										_	
(72)m= 112.57	110.59	106.48	100.9	97.27	92.16	87.82	93.38	95.36	101.14	107.67	110.6]	(72)
Total interna	gains =				(66))m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	(1)m + (72))m	_	
(73)m= 378.35	376.4	364.45	345.24	325.88	307.12	294.88	300.41	310.23	329.63	351.91	368.48]	(73)
6. Solar gain													
Solar gains are		ŭ					itions to d		e applicat		tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	ıx ble 6a		g_ Table 6b	т	FF able 6c		Gains (W)	
							. –						1
East 0.9x	1	X	5.			19.64	X _	0.63	╣ ^ϫ ╞	0.7	=	23.99	(76)
East 0.9x	1	X	5.			38.42	X	0.63	×	0.7	=	46.94	(76)
East 0.9x	1	X	5.			63.27	X	0.63		0.7	=	77.3	(76)
East 0.9x	1	X	5.	==	-	92.28	X	0.63	_ ×	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	۰ ۵۰ Γ			.,		-		45.77	1 1	0.00	–		_	444.40	(76)
East	0.9x	1		X	5.7	X		15.77] X]	0.63	x	0.7	_ =	141.43	$= \frac{(76)}{(76)}$
East	0.9x	1		X	5.7	X		10.22] X	0.63	×	0.7	╡ -	134.65	(76)
	0.9x	1		X	5.7	→ ×		94.68] X]	0.63	×	0.7	_ =	115.66	(76)
East	0.9x	1		X	5.7	→ ×		73.59] X]	0.63	×	0.7	=	89.9	(76)
East	0.9x	1		X	5.7	×		5.59	X	0.63	X	0.7	_ =	55.69	(76)
East	0.9x	1		X	5.7	×	2	24.49	X	0.63	X	0.7	=	29.92	(76)
East	0.9x	1		X	5.7	X		6.15	X	0.63	X	0.7	=	19.73	(76)
South	0.9x	0.54		X	2.81	X		6.75	X	0.63	X	0.7	=	28.16	(78)
South	0.9x	0.54		X	2.81	X	7	76.57	X	0.63	X	0.7	=	46.11	(78)
South	0.9x	0.54		X	2.81	X	9	7.53	X	0.63	X	0.7	=	58.74	(78)
South	0.9x	0.54		X	2.81	X	1	10.23	X	0.63	X	0.7	=	66.39	(78)
South	0.9x	0.54		X	2.81	X	1	14.87	X	0.63	X	0.7	=	69.18	(78)
South	0.9x	0.54		X	2.81	X	1	10.55	X	0.63	X	0.7	=	66.58	(78)
South	0.9x	0.54		x	2.81	x	1	08.01	x	0.63	X	0.7	=	65.05	(78)
South	0.9x	0.54		x	2.81	x	1	04.89	X	0.63	X	0.7	=	63.17	(78)
South	0.9x	0.54		x	2.81	X	1	01.89	x	0.63	X	0.7	=	61.36	(78)
South	0.9x	0.54		x	2.81	x	8	32.59	x	0.63	X	0.7	=	49.74	(78)
South	0.9x	0.54		X	2.81	X	5	55.42	Х	0.63	X	0.7	=	33.38	(78)
Sout <mark>h</mark>	0.9x	0.54		x	2.81	×		40.4	x	0.63	x	0.7	_	24.33	(78)
West	0.9x	0.54		x	6.11	x	1	9.64	x	0.63	х	0.7	_ =	25.72	(80)
West	0.9x	0.54		x	6.11	= x	3	88.42	x	0.63	х	0.7	=	50.31	(80)
West	0.9x	0.54		x	6.11	x	-	3.27	Х	0.63	х	0.7		82.86	(80)
West	0.9x	0.54		x	6.11	= ×	9	2.28	Х	0.63	Х	0.7	=	120.84	(80)
West	0.9x	0.54		x	6.11	х	1	13.09	х	0.63	Х	0.7	=	148.1	(80)
West	0.9x	0.54		x	6.11	x	1	15.77	x	0.63	x	0.7	=	151.61	(80)
West	0.9x	0.54		x	6.11	x	1	10.22	x	0.63	x	0.7	=	144.33	(80)
West	0.9x	0.54		x	6.11	×		94.68	x	0.63	x	0.7		123.98	(80)
West	0.9x	0.54		x	6.11	×	7	' 3.59	x	0.63	x	0.7	_ =	96.37	(80)
West	0.9x	0.54		X	6.11	×		15.59	х	0.63	x	0.7	╡ -	59.7	(80)
West	0.9x	0.54		X	6.11	×		24.49	x	0.63	x	0.7	= =	32.07	(80)
West	0.9x	0.54		x	6.11	= x		6.15	X	0.63	x	0.7	= =	21.15	(80)
	L														
Solar ga	ains in	watts, ca	alcula	ited	for each mo	nth			(83)m	n = Sum(74)m	(82)m				
(83)m=	77.87	143.36	218.	.9	299.97 355	.44 3	359.62	344.03	302	.82 247.63	165.1	3 95.36	65.21		(83)
Total ga	ains – i	nternal a	ınd so	olar	(84)m = (73)m +	(83)m	, watts						_	
(84)m=	456.22	519.77	583.	35	645.21 681	.32 (666.74	638.91	603	.23 557.86	494.7	7 447.27	433.69		(84)
7. Mea	an inter	nal temp	eratu	ıre (heating sea	son)									
Tempe	erature	during h	eatin	g pe	eriods in the	living	area	from Tal	ole 9,	Th1 (°C)				21	(85)
Utilisat	tion fac	tor for g	ains f	or li	ving area, h	1,m (s	see Ta	ıble 9a)							
	Jan	Feb	Ма	ar	Apr M	lay	Jun	Jul	A	ug Sep	Oct	Nov	Dec]	
(86)m=	1	0.99	0.98	8	0.93 0.8	31	0.63	0.46	0.5	0.76	0.95	0.99	1]	(86)
Mean	interna	l temper	ature	in li	ving area T	1 (follo	ow ste	ps 3 to 7	7 in T	able 9c)					
(87)m=	19.99	20.14	20.3		20.68 20.		20.98	21	20.		20.66	20.27	19.96]	(87)
L					1			!				-	!	1	

_							_							
				1	1	dwelling			· ` ´					(00)
(88)m=	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)
	ation fac		i	i		h2,m (se		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	internal	temper	ature in	the rest	of dwelli	ing T2 (f	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	internal	temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × 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	interna	l temper	ature fro	m Table	4e, whe	ere appro	priate				
(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. Sp	ace hea	ting requ	uirement											
			ternal tei or gains	•		ned at ste	ep 11 of	Table 9l	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
uie ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		Iviay	Juli	Jui	Aug	Зер	Oct	INOV	Dec		
(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)
	LI ıl gains,	hmGm	, W = (9	4)m x (8	4)m				l					
(95)m=	453.48	513.25	565.19	588.93	536.28	393.62	268.32	280.4	406.15	464.56	441.59	431.68		(95)
Montl	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	for me	an interr	al temp	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(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	e heating	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4 ⁻	1)m			
(98)m=	441.56	337.74	266.44	133.38	46	0	0	0	0	142.46	305.7	454.93		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2128.22	(98)
Space	e heating	g require	ement in	kWh/m	²/year								31.82	(99)
9a. En	ergy req	uiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatin	_										•		_
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	tem(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sy	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	econda	ry/suppl	ementar	y heatin	g systen	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	- ear
Space	e heating	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	06)									(211)
	472.26	361.22	284.96	142.66	49.2	0	0	0	0	152.37	326.95	486.56		
			•		•	•		Tota	I (kWh/yea	ar) =Sum(2	211),15,1012	F	2276.18	(211)
Space	e heating	g fuel (s	econdar	y), kWh/	month									
		1)] } x 1	00 ÷ (20	8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
a	-0 A D 00 A	0) (\ http://w	_							Dogo	

186.38 164.34 172.75 155.08 152.13 13	36.16 130.98	143.43	143.09	160.8	169.75	181.97		
fficiency of water heater							79.8	(2
117)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		(2
uel for water heating, kWh/month	•	•						
(219) m = (64) m x $100 \div (217)$ m (219) m = $(214.14 \mid 189.56 \mid 200.96 \mid 183.71 \mid 185.41 \mid 130$	70.63 164.14	179.74	179.31	190.31	196.55	208.77		
214.14 100.00 200.00 100.71 100.41 1	104.14		I = Sum(2		100.00	200.77	2263.24	\(2
nnual totals					Wh/year	•	kWh/yea	
pace heating fuel used, main system 1					,		2276.18	
ater heating fuel used							2263.24	Ī
lectricity for pumps, fans and electric keep-hot						'		
central heating pump:						30		(2
poiler with a fan-assisted flue						45		(2
otal electricity for the above, kWh/year		sum	of (230a).	(230g) =			75	(2
ectricity for lighting							306.38	<u> </u>
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP						
	Грогом			i	on fac	4	Emissions	
	Energy kWh/year			kg CO		tor	kg CO2/ye	
pace heating (main system 1)	(211) x			0.2		=	491.65	(2
pace heating (secondary)	(215) x			0.5		=	0	` (2
3 (***)	(219) x			0.2		=	488.86	` (2
/ater heating				0.2	0			\`- (2
		+ (263) + (264) =				980.51	11/2
pace and water heating	(261) + (262)	+ (263) + (264) =			_		=
pace and water heating lectricity for pumps, fans and electric keep-hot	(261) + (262) · (231) x	+ (263) + (264) =	0.5	19	=	38.93	(2
Vater heating pace and water heating lectricity for pumps, fans and electric keep-hot lectricity for lighting otal CO2, kg/year	(261) + (262)	+ (263) + (0.5°	19	=		(2 (2

TER =

(273)

17.62

			User D	Details:						
Assessor Name: Software Name:	Stroma FSAP 20	12		Strom Softwa				Versio	on: 1.0.1.24	
		Р	roperty	Address	: Flat 4					
Address :										
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 71.18	(1a) x		2.5	(2a) =	Volume(m)	3) (3a
Total floor area TFA = (1a	u)+(1b)+(1c)+(1d)+(1	e)+(1n	ı) 7	71.18	(4)					
Dwelling volume					(3a)+(3b	o)+(3c)+(3c	d)+(3e)+	(3n) =	177.95	(5)
2. Ventilation rate:										
Number of chimneys		secondar heating	у П + Г	other 0	7 = F	total 0	x	40 =	m³ per hou	ır (6a
Number of open flues			」]			20 =		╡`
·		0] ' L	0] ⁻	0			0	(6b
Number of intermittent far	1S				Ĺ	3		10 =	30	(7a
Number of passive vents					L	0	X	10 =	0	(7b
Number of flueless gas fir	es					0	X	40 =	0	(70
								Air ch	nanges per h	our
Infiltration due to chimney	e flues and fans – (6a)+(6b)+(7	(a)+(7h)+((7c) =	Г			÷ (5) =		(8)
If a pressurisation test has be					continue f	30 rom (9) to		÷ (5) =	0.17	(0)
Number of storeys in th									0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10
Structural infiltration: 0.2					•	ruction			0	(11
if both types of wall are pre deducting areas of opening		sponding to	the great	ter wall are	a (after					
If suspended wooden fl		aled) or 0.	1 (seale	ed), else	enter 0				0	(12
If no draught lobby, ente	er 0.05, else enter 0								0	(13
Percentage of windows	and doors draught s	stripped							0	(14
Window infiltration				0.25 - [0.2	. ,	-			0	(15
Infiltration rate				(8) + (10)					0	(16
Air permeability value, o	•		•	•	•	netre of e	envelope	area	5	(17
If based on air permeability Air permeability value applies						ris heina u	ısed		0.42	(18
Number of sides sheltered		.0 20011 4011	0 01 4 40	groo an po	modelinty	io boilig a			3	(19
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.78	(20
Infiltration rate incorporati	ng shelter factor			(21) = (18) x (20) =				0.32	(21
Infiltration rate modified fo	or monthly wind spee	d								
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7	_	_		_	_				
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a) (22)m : 4									
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25 1	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
(224)111 1.21 1.20	.20 1.1 1.00	0.33	0.90	1 0.32	<u> </u>	1.00	1.12	1.10	J	

0.41	0.41	e (allowi _{0.4}	0.36	0.35	0.31	0.31	0.3	0.32	0.25	0.26	0.20	1	
alculate effec	_	l '				l	0.3	0.32	0.35	0.36	0.38]	
If mechanica	al ventila	ition:										0	(2
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(2
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h) =				0	(2
a) If balance	d mech	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b	m = (22)	2b)m + (23b)	1	1	
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h				•	•				- (00)				
if (22b)n		<u> </u>	<u> </u>	<u> </u>	ŕ –	· ` `	ŕ		· ` `	ŕ	Ι ο	1	
lc)m= 0	0	0	0	0	0	0	0	0	0	0	0		(:
d) If natural if (22b)n				•	•				0.5]				
d)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]	(
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)	•	•	•	•	
i)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		(.
. Heat losse	c and he	at loce i	o aramote	or.									
LEMENT	Gros		Openin		Net Ar	ea	U-val	IIE	AXU		k-value	2	ΑΧk
	area		m		A ,r		W/m2		(W/	K)	kJ/m².		kJ/K
oors					2.1	Х	1	= [2.1				(
in <mark>dows</mark> Type	1				5.4	x1,	/[1/(1.4)+	0.04] =	7.16				(:
indows Type	2				10.29	x1,	/[1/(1.4)+	0.04] =	13.64	П			(:
alls	91.8	В	17.79	9	74.01	X	0.18	=	13.32	<u> </u>		\neg	(
oof	71.1	8	0		71.18	3 x	0.13	<u> </u>	9.25			= =	
tal area of e	lements	, m²			162.9	8							(
or windows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragrapl	1 3.2	
nclude the area				ls and par	titions		(0.0)	(00)					
bric heat los		•	U)				(26)(30)					45.48	=
eat capacity	^	,						., ,	. , ,	2) + (32a).	(32e) =	0	(
ermal mass	•	`		,					tive Value			250	(:
r design assess n be used inste				construct	ion are noi	r known pr	ecisely the	e indicative	values of	IMPIN T	adie 1†		
ermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix l	<						19.05	5 (
etails of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
tal fabric he	at loss							(33) +	(36) =			64.53	3 (
ntilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ļ	
)m= 34.38	34.19	34	33.1	32.93	32.15	32.15	32.01	32.45	32.93	33.27	33.63		(
eat transfer o	coefficier	nt, W/K						(39)m	= (37) + (38)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		
,													

leat loss	paramete	er (F	HLP), W	m²K					(40)m	= (39)m ÷	- (4)		i	
l0)m= 1.	39 1.3	9	1.38	1.37	1.37	1.36	1.36	1.36	1.36	1.37	1.37	1.38		
			-41- / T -1-	la 4a\						Average =	: Sum(40) ₁	12 /12=	1.37	(40
lumber of	- i-		<u> </u>		N/	1	11	Δ	0	0-4	Nan	D.,		
		eb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(4
1)m= 3	31 2	3	31	30	31	30	31	31	30	31	30	31		(4
4. Water	heating 6	enei	gy requi	rement:								kWh/ye	ear:	
	13.9, N	= 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		27		(4:
	13.9, N							(O= 11)					İ	
nnual ave										se target d		3.22		(4
ot more tha		-				-	-							
J	an F	eb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot water us	age in litre	per	day for ea		•	ctor from	Table 1c x		!	!	!	ļ.		
4)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		
											ım(44) ₁₁₂ =		1058.61	(4
nergy conte	ent of hot w	ater	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
5)m= 143	3.91 125	86	129.88	113.23	108.65	93.75	86.88	99.69	100.88	117.57	128.34	139.37		
:		4:		-f (n-	batwata	()	- u t - u O i u	h (40		Total = Su	m(45) ₁₁₂ =		1388.01	(4
	ous water f													
6)m=	.59 18.		19.48	16.98	16.3	14.06	13.03	14.95	15.13	17.64	19.25	20.9		(4
torage vo			includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(4
commun	`									00.	<u> </u>	130		(-
	if no sto	-			_				ers) ente	er '0' in ((47)			
	age loss			•					,	·	,			
) If manu	ufacturer'	s de	eclared l	oss facto	or is kno	wn (kWł	n/day):				1.	39		(4
emperatu	ure facto	fro	m Table	2b							0.	54		(4
nergy los	st from w	ater	storage	, kWh/ye	ear			(48) x (49)) =		0.	75		(5
) If manu				-									İ	
ot water commun	•				e 2 (kW	h/litre/da	ıy)					0		(5
	ctor from	_		JII 4.3								0		(5
emperati				2b								0		(5
nergy los					ear			(47) x (51)) x (52) x (53) =		0		(5
0,	or (54) i		•	, 100011/90	Jui			(11)11(01)	, x (0 =) x (<i>-</i>		.75		(5
` '	age loss	•	•	or each	month			((56)m = (55) × (41)	m				•
	3.33 21.		23.33	22.58	23.33	22.58	23.33			23.33	22.58	23.33		(5
*	ntains dedi							23.33 0), else (5	22.58 7)m = (56)				l ix H	(0
_							· · · · ·	· · · · ·			· ·		 	/5
7)m= 23	21.	J/	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(5
rimary ci		•	•									0		(5
-	rcuit loss				,		. ,	, ,						
	d by fact						i			i —	1		l	
9)m= 23	3.26 21.)1	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(

Combi loss c	alculated	for each	month (′61)m =	(60) ± 3	365 v (41)m							
(61)m= 0	0	0	0	0	00) - 0	0 700) 0		0	0	T 0	0	1	(61)
` '		water he	eating ca	l	l for ear	ch month	<u> </u>				(46)m +		」 · (59)m + (61)m	, ,
(62)m= 190.5	`	176.47	158.32	155.24	138.85		146	_	145.98	164.17	173.43	185.96]	(62)
Solar DHW inpu					<u> </u>		<u> </u>					er heating)]	` /
(add addition														
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(63)
Output from v	water hea	ter											1	
(64)m= 190.5	_	176.47	158.32	155.24	138.85	133.47	146	.29	145.98	164.17	173.43	185.96]	
						-!		Outp	out from wa	ater heate	er (annual)	12	1936.62	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	1)m	n] + 0.8 x	((46)m	ı + (57)m	+ (59)m	n]	
(65)m= 85.12	75.52	80.46	73.72	73.4	67.25	66.16	70.4	42	69.62	76.37	78.75	83.62]	(65)
include (57)m in calc	culation of	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a):										
Metabolic ga														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aı	ug	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)
Lighting gain	s (calculat	ted in Ap	pendix	L, equ <mark>at</mark>	ion L9	or L9a), a	ılso s	ee	Table 5					
(67)m= 18.25	16.21	13.18	9.98	7.46	6.3	6.8	8.8	35	11.87	15.07	17.59	18.76		(67)
Appliances g	ains (ca <mark>lc</mark>	ulated in	Append	dix L, eq	uation I	_13 or L1	3a), a	also	see Tal	ble 5			1	
(68)m= 200.04	202.11	196.88	185.74	171.69	158.48	149.65	147.	.57	152.81	163.94	178	191.21]	(68)
Cooking gain	s (calcula	ted in A	opendix	L, equat	tion L15	or L15a), als	o se	e Table	5		•	•	
(69)m= 34.37	34.37	34.37	34.37	34.37	34.37	34.37	34.3	37	34.37	34.37	34.37	34.37		(69)
Pumps and fa	ans gains	(Table 5	āa)										•	
(70)m= 3	3	3	3	3	3	3	3	1	3	3	3	3]	(70)
Losses e.g. e	vaporatio	n (negat	ive valu	es) (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 heatin	g gains (T	able 5)		-	-	-					-	-	-	
(72)m= 114.42	2 112.38	108.15	102.39	98.66	93.4	88.93	94.0	66	96.69	102.65	109.37	112.39]	(72)
Total interna	al gains =				(60	6)m + (67)m	n + (68	3)m +	+ (69)m + ((70)m + (71)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. Solar gair	ns:													
Solar gains are		Ü				•	ations 1	to co	nvert to th	e applica		tion.		
Orientation:	Access F Table 6d	actor	Area m²			ux able 6a		т	g_ able 6b	-	FF able 6c		Gains (W)	
NI - mil-							1 1							٦
North 0.9x		X	10.		X	10.63	X		0.63		0.7	=	23.45	(74)
North 0.9x		X	10.		X	20.32	X		0.63	x	0.7	=	44.82	[(74)
North 0.9x		×	10.		X _	34.53	X		0.63		0.7	_ =	76.15	[(74)
North 0.9x		X	10.		X _	55.46	X		0.63		0.7	=	122.32	[(74)
North 0.9x	0.54	X	10.	29	X	74.72	X		0.63	X	0.7	=	164.78	(74)

	_		_												_
North	0.9x	0.54	×	10.2	29	X	79.99	9	X	0.63	X	0.7	=	176.4	(74)
North	0.9x	0.54	X	10.2	29	X	74.68	8	X	0.63	X	0.7	= [164.69	(74)
North	0.9x	0.54	X	10.2	29	X	59.2	5	X	0.63	X	0.7	= [130.66	(74)
North	0.9x	0.54	X	10.2	29	X	41.52	2	X	0.63	X	0.7	= [91.56	(74)
North	0.9x	0.54	X	10.2	29	X	24.19	9	x	0.63	X	0.7	=	53.35	(74)
North	0.9x	0.54	X	10.2	29	X	13.12	2	x	0.63	X	0.7	= [28.93	(74)
North	0.9x	0.54	x	10.2	29	X	8.86	5	x	0.63	X	0.7	= [19.55	(74)
West	0.9x	0.54	x	5.4	1	X	19.64	4	x	0.63	x	0.7	= [22.73	(80)
West	0.9x	0.54	x	5.4	1	X	38.42	2	x	0.63	x	0.7	= [44.47	(80)
West	0.9x	0.54	x	5.4	1	X	63.27	7	x	0.63	x	0.7	= [73.23	(80)
West	0.9x	0.54	x	5.4	1	X	92.28	8	x	0.63	х	0.7	=	106.8	(80)
West	0.9x	0.54	x	5.4	1	X	113.0	9	x	0.63	x	0.7		130.89	(80)
West	0.9x	0.54	×	5.4	1	X	115.7	77	х	0.63	x	0.7	<u> </u>	133.99	(80)
West	0.9x	0.54	×	5.4	1	X	110.2	22	х	0.63	x	0.7	<u> </u>	127.56	(80)
West	0.9x	0.54	×	5.4	1	X	94.68	8	х	0.63	x	0.7	<u> </u>	109.57	(80)
West	0.9x	0.54	×	5.4	1	X	73.59	9	х	0.63	x	0.7	<u> </u>	85.17	(80)
West	0.9x	0.54	×	5.4	1	X	45.59	9	х	0.63	x	0.7	<u> </u>	52.76	(80)
West	0.9x	0.54	×	5.4	1	X	24.49	9	Х	0.63	Х	0.7		28.34	(80)
West	0.9x	0.54	= x	5.4		х	16.15	5	х	0.63	х	0.7	=	18.69	(80)
	_		<u> </u>												_
Solar ç	gains in	watts, <mark>calc</mark> ı	ulated	for each	n month	1		(83)m	= Sum(74)m .	(82)m				
(83)m=	<mark>4</mark> 6.18	89.28 14	49.38	229.12	295.67	3.	10.39 29	2.25	240.	24 176.73	106.11	57.27	38.24		(83)
Total g	<mark>jain</mark> s – ii	nternal and	solar	(84)m =	(73)m	+ (8	33)m , w	atts							
(84)m=	439	480.1 52	27.71	587.36	633.59	62	28.68 59	97.75	551.	43 498.21	447.89	422.35	420.71		(84)
7. Me	an inter	nal tempera	ature	(heating	seasor	า)									
Temp	erature	during hea	ting p	eriods in	the liv	ing	area fror	n Tab	le 9,	Th1 (°C)				21	(85)
Utilisa	ation fac	tor for gain	s for I	iving are	a, h1,n	n (s	ee Table	9a)							
	Jan	Feb	Mar	Apr	May		Jun ,	Jul	Αι	ug Sep	Oct	Nov	Dec		
(86)m=	1	1 (0.99	0.98	0.93	(D.81 C	0.66	0.7	2 0.91	0.98	1	1		(86)
Mean	interna	l temperatu	ıre in I	iving are	ea T1 (f	ollo	w steps	3 to 7	in T	able 9c)					
(87)m=	19.47		9.85	20.23	20.59	_	i_	0.96	20.9		20.27	19.81	19.44		(87)
												_!			
Temn	erature	during hea	tina n	eriods in	rest of	f dw	elling fro	m Tal	hle C	Th2 (°C)					
-		during hea				1		- 1			19.79	19.78	19.78		(88)
(88)m=	19.77	19.77 1	9.78	19.79	19.79		19.8 1	19.8	19.		19.79	19.78	19.78		(88)
(88)m=	19.77	19.77 1	9.78 s for r	19.79 est of dv	19.79 velling,	h2,	19.8 1 m (see 7	19.8 Гable :	19. 9a)	8 19.79					` '
(88)m= Utilisa (89)m=	19.77 ation fac	19.77 1 tor for gain	9.78 s for r	19.79 rest of dv 0.97	19.79 welling, 0.89	h2,	19.8 1 m (see 7	19.8 Table 9	19. 9a) 0.5	7 0.85	0.98	19.78	19.78		(88)
(88)m= Utilisa (89)m= Mean	19.77 ation fac	19.77 1 tor for gain 0.99 (9.78 s for r 0.99	19.79 rest of dv 0.97 the rest of	19.79 welling, 0.89 of dwel	h2,	19.8 1 m (see 7 0.71 0	Table 90.5	19. 9a) 0.5 ps 3	8 19.79 7 0.85 to 7 in Tabl	0.98 e 9c)	0.99	1		(89)
(88)m= Utilisa (89)m=	19.77 ation fac	19.77 1 tor for gain 0.99 (9.78 s for r	19.79 rest of dv 0.97	19.79 welling, 0.89	h2,	19.8 1 m (see 7 0.71 0	19.8 Table 9	19. 9a) 0.5	7 0.85 to 7 in Tabl	0.98 e 9c)	0.99	1 17.72		(89)
(88)m= Utilisa (89)m= Mean	19.77 ation fac	19.77 1 tor for gain 0.99 (9.78 s for r 0.99	19.79 rest of dv 0.97 the rest of	19.79 welling, 0.89 of dwel	h2,	19.8 1 m (see 7 0.71 0	Table 90.5	19. 9a) 0.5 ps 3	7 0.85 to 7 in Tabl	0.98 e 9c)	0.99	1 17.72	0.33	(89)
(88)m= Utilisa (89)m= Mean (90)m=	19.77 ation fac 1 interna 17.75	19.77 1 tor for gain 0.99 (I temperatu 17.94 1	9.78 s for r 0.99 tre in t	19.79 rest of dv 0.97 the rest of 18.86	19.79 welling, 0.89 of dwel 19.37	h2,	19.8 1 m (see 7 0.71 0 T2 (follo	19.8 Table 9.75 Table 9.78 19. 9a) 0.5 ps 3	7 0.85 to 7 in Tabl	0.98 e 9c)	0.99	1 17.72	0.33	(89)	
(88)m= Utilisa (89)m= Mean (90)m= Mean (92)m=	19.77 ation fac 1 interna 17.75 interna 18.32	19.77 1 tor for gain 0.99 0 I temperatu 17.94 1 I temperatu 18.49 1	9.78 s for r 0.99 rre in t 8.32 rre (fo 8.83	19.79 rest of dv 0.97 the rest of 18.86 r the who	19.79 welling, 0.89 of dwel 19.37 ole dwe	h2,	19.8 1 m (see] 0.71 (follo 19.7 1: g) = fLA 0.08 2	9.8 Fable 9 0.5 w step 9.78 x T1 - 0.17	19. 9a) 0.5 0.5 19.7 + (1 - 20.4	7 0.85 to 7 in Tabl 7 19.56 f - fLA) × T2	0.98 e 9c) 18.94 LA = Liv	0.99 18.26 ing area ÷ (-	1 17.72	0.33	(89)

(93)m= 18.32	10.40	10.00	10.22	10.70	20.00	20.47	20.46	10.05	10.20	10.77	10.20	1	(93)
9 Space by		18.83	19.32	19.78	20.08	20.17	20.16	19.95	19.38	18.77	18.29		(93)
8. Space he Set Ti to the			mporatui	o obtain	and at et	on 11 of	Table 0	n so tha	t Ti m-/	76)m an	d ro-calc	culato	
the utilisation					icu ai sii	5 p 11 01	Table 3	J, 50 IIIa	t 11,111—(i Ojili ali	u ie-caic	Julate	
Jar	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation f	actor for g	ains, hm	:										
(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)
Useful gain	s, hmGm	, W = (94	1)m x (84	4)m								•	
(95)m= 436.9	3 476.51	519.64	563.65	564.28	465.01	331.58	340.98	430.07	434.97	418.88	419.07		(95)
Monthly av	erage exte	1	perature		able 8		,	,				Ī	
(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 ra						-``	- ` 	<u> </u>				1	(0-)
(97)m= 1386.			1017	787.23	530.02	345.26	362.8	566.88	855.62	1141.74	1383.27		(97)
Space heat	Ť	1 1				ī		<u>`</u>	<u> </u>		747.00	1	
(98)m= 706.5	2 581.18	517.07	326.41	165.88	0	0	0	0	312.96	520.46	717.36		7(00)
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	3847.83	(98)
Space heat	ing requir	ement in	kWh/m²	/year								54.06	(99)
9a. Energy r	equiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space hea	ting:												_
Fraction of	space hea	it from se	econdar	y/supple	mentary	system						0	(201)
Fraction of	space hea	at from m	ain syst	em(s)			(202) = 1 -	(201) =				1	(202)
Fraction of	total hea <mark>ti</mark>	ng from r	main sys	stem 1			(204) = (204)	02) × [1 –	(203)] =			1	(204)
Efficiency o	of main s <mark>pa</mark>	ace heati	ing syste	em 1								93.5	(206)
Efficiency o	of seconda	ry/supple	ementar	y heating	system	າ, %						0	(208)
Jar	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	⊒ ar
Space heat						Jui	Aug	ОСР	Oct	1404	DCC	KVVIII y	ai
· -	2 581.18				0	0	0	0	312.96	520.46	717.36		
(211)m = {[(9	98)m x (20)4)1	 00 ÷ (20	L 16)		ļ		ļ		<u> </u>			(211)
755.6	 	553.01	349.1	177.41	0	0	0	0	334.72	556.64	767.23		(=)
		<u> </u>					Tota	l (kWh/yea	ar) =Sum(2	L 211) _{15.1012}	<u> </u> =	4115.33	(211)
Space heat	ina fuel (s	econdar	v) kWh/	month									
$= \{[(98) \text{m x } ($	•	-	• • •	111011111									
<u> </u>		`				I	1			ı	_		
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		
(215)m= 0	0	0	0	0	0	0		0 I (kWh/yea	_			0	(215)
` /	Į ·	0	0	0	0	0			_			0	(215)
(215)m= 0 Water heati Output from	ng				0	0			_			0	(215)
Water heati	ng water hea				138.85	133.47			_			0	(215)
Water heati	ng water hea	ter (calcu	ulated al	oove)			Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	79.8	(215)
Water heati Output from	ng water hea 167.95 water hea	ter (calcu	ulated al	oove)			Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=		_
Water heati Output from 190.9 Efficiency of (217)m= 87.99 Fuel for water	water hea 167.95 water hea 87.86 er heating,	ter (calculater (c	ulated al 158.32 86.7 onth	oove) 155.24	138.85	133.47	Tota	I (kWh/yea	164.17	215) _{15,1012}	185.96		(216)
Water heati Output from 190.9 Efficiency of (217)m= 87.99 Fuel for wate (219)m = (6	water hea 167.95 water hea 9 87.86 er heating, 4)m x 100	ater (calculater (calculater (calculater 87.51 kWh/mcd) ÷ (217)	ulated al 158.32 86.7 onth m	00Ve) 155.24 84.99	138.85 79.8	133.47 79.8	Tota 146.29 79.8	145.98 79.8	164.17 86.51	215) _{15,1012} 173.43 87.57	185.96		(216)
Water heati Output from 190.9 Efficiency of (217)m= 87.99 Fuel for water	water hea 167.95 water hea 9 87.86 er heating, 4)m x 100	ter (calculater (c	ulated al 158.32 86.7 onth	oove) 155.24	138.85	133.47	Tota 146.29 79.8	145.98 79.8	164.17 86.51	215) _{15,1012}	185.96	79.8	(216) (217)
Water heati Output from 190.9 Efficiency of (217)m= 87.99 Fuel for wate (219)m = (6) (219)m= 216.4	water hea 167.95 water hea 87.86 er heating, 4)m x 100 9 191.16	ater (calculater (calculater (calculater 87.51 kWh/mcd) ÷ (217)	ulated al 158.32 86.7 onth m	00Ve) 155.24 84.99	138.85 79.8	133.47 79.8	Tota 146.29 79.8	145.98 79.8	164.17 86.51 189.77	215) _{15,1012} 173.43 87.57	185.96 88.07 211.15	79.8 2281.04	(216) (217)
Water heati Output from 190.9 Efficiency of (217)m= 87.99 Fuel for wate (219)m = (6	water hea 167.95 water hea 87.86 er heating, 4)m x 100 9 191.16	ater (calculater (calculater (calculater 87.51 kWh/mc (217)) 201.65	ulated al 158.32 86.7 onth m 182.6	00ve) 155.24 84.99	138.85 79.8	133.47 79.8	Tota 146.29 79.8	145.98 79.8	164.17 86.51 189.77	215) _{15,1012} 173.43 87.57	185.96 88.07 211.15	79.8	(216) (217)

					_
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	sum of	(230a)(230g) =		75	(231)
Electricity for lighting				322.27	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	ır
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	4) =		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) =		1587.8 22.31	(272)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201	2		Strom Softwa				Versio	on: 1.0.1.24	
			Р	roperty .	Address	: Flat 5					
Address :											
1. Overall dwelling dimen	sions:			Δ	- (··· 2)		A 11-	! a.l. (/.a.)		V a la con a (con 2)	
Ground floor					2.57	(1a) x		ight(m) 2.5	(2a) =	Volume(m³)) (3a)
First floor				3	2.51	(1b) x	2	2.5	(2b) =	81.27	(3b)
Second floor				3	1.06	(1c) x	2	2.5	(2c) =	77.65	(3c)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1e)+(1r	1) 10	06.14	(4)			_		
Dwelling volume						(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	265.35	(5)
2. Ventilation rate:											
	main heating		econdar eating	у	other		total			m³ per hou	r
Number of chimneys	0	┐ + [¨	0] + [0] = [0	X	40 =	0	(6a)
Number of open flues	0	+ [0] + [0] = [0	x	20 =	0	(6b)
Number of intermittent fans	3						4	Х	10 =	40	(7a)
Number of passive vents							0	x	10 =	0	(7b)
Number of flueless gas fire	s						0	X	40 =	0	(7c)
Infiltration due to chimneys	s, flues and fa	ans = (6	a)+(6b)+(7	(a)+(7b)+(7c) =		40	H	Air ch ÷ (5) =	o.15	our (8)
If a pressurisation test has been			ed, procee	d to (17), o	otherwise (continue fi	rom (9) to	(16)			_
Number of storeys in the Additional infiltration	awelling (ns	5)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2	5 for steel or	timber	frame or	0.35 for	r masoni	v consti	ruction	[(0)	.,	0	(11)
if both types of wall are pre- deducting areas of opening	sent, use the va	lue corres				•					 ` ′
If suspended wooden flo			ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	r 0.05, else e	enter 0								0	(13)
Percentage of windows	and doors dr	aught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	! x (14) ÷ 1	100] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (12) + (13) -	+ (15) =		0	(16)
Air permeability value, q	50, expresse	d in cub	ic metre	s per ho	our per s	quare m	etre of e	envelope	area	5	(17)
If based on air permeability										0.4	(18)
Air permeability value applies	if a pressurisatio	on test has	s been dor	ne or a deg	gree air pe	rmeability	is being u	sed			7
Number of sides sheltered Shelter factor					(20) = 1 -	[0.075 x (⁻	19)] =			2	(19)
Infiltration rate incorporating	a shelter fac	tor			(21) = (18		/-			0.85	(20)
Infiltration rate modified for	•		l			, (-)				0.34	(~1)
	1ar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind spe	ed 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										
	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18			
	ļ.	<u> </u>		!	!					
Adjusted infiltration rate (allowing for shelt		<u> </u>	<u> </u>							
0.43 0.43 0.42 0.37 Calculate effective air change rate for the	0.32 on one of the call of the	1 1	0.32 0.	.34	0.37	0.38	0.4			
If mechanical ventilation:	арричало ча								0	(23a)
If exhaust air heat pump using Appendix N, (23b)	= (23a) × Fmv (6	equation (N5))) , otherwise	e (23b) =	= (23a)		İ		0	(23b)
If balanced with heat recovery: efficiency in % allo	owing for in-use fa	actor (from Ta	able 4h) =				İ		0	(23c)
a) If balanced mechanical ventilation wi	th heat recove	ery (MVHR	R) (24a)m	= (22b	o)m + (2	23b) × [1	– (23c)	÷ 100]		
(24a)m= 0 0 0 0	0 0	0	0	0	0	0	0			(24a)
b) If balanced mechanical ventilation wi	thout heat red	covery (MV	/) (24b)m :	= (22b)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 p	•									
if (22b)m < 0.5 × (23b), then (24c) =	`		`		<u> </u>					
(24c)m= 0 0 0 0	0 0	0		0	0	0	0			(24c)
d) If natural ventilation or whole house p if (22b)m = 1, then (24d)m = (22b)m				m2 v ∩	51					
).57 0.55			.56	0.57	0.57	0.58			(24d)
Effective air change rate - enter (24a) o					0.07	0.07	0.00			(= : -)
	0.57 0.55	<u> </u>	_	.56	0.57	0.57	0.58			(25)
0.11(1										
3. Heat losses and heat loss parameter:	Not Ar	00	Ll volue		A V I I		k volus		A V	le.
3. Heat losses and heat loss parameter: ELEMENT Gross Openings area (m²) m²	Net Ar A ,r		U-value W/m2K		A X U (W/k	()	k-value kJ/m²-ł		A X kJ/k	
ELEMENT Gross Openings				=		()				
ELEMENT Gross Openings area (m²)	A ,r	m² ×	W/m2K	= _	(W/k	() 				(
ELEMENT Gross Openings area (m²) Doors	A ,r	x1/[1/	W/m2K	= [(W/k	() 				(26)
ELEMENT Gross area (m²) Doors Windows Type 1	A ,r 2.1 2.23	x1/[1/	W/m2K 1 /(1.4)+ 0.04	= [4] = [4] = [2.1 2.96	(s)				(26) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2	A ,r 2.1 2.23 3.44	x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04	= [1] = [1] = [1] = [2.1 2.96 4.56	() 				(26) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3	A ,r 2.1 2.23 3.44 3.53	x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04	= [1] = [1] = [1] = [1] = [2.1 2.96 4.56 4.68	() 				(26) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	A ,r 2.1 2.23 3.44 3.53 2.08	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76	(s)				(26) (27) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	A ,r 2.1 2.23 3.44 3.53 2.08	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56					(26) (27) (27) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1					(26) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8	A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65					(26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9	A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65					(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10	A ,r 2.1 2.23 3.44 3.53 2.08 3.44 2.34 1.89 2 1.46 2.02	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68	S)				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 40.22 Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Vindows Type 3 Windows Type 4 Windows Type 5 Windows Type 7 Windows Type 9 Windows Type 10 Walls Type 1 Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Vindows Type 3 Windows Type 4 Windows Type 5 Windows Type 7 Windows Type 9 Windows Type 10	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	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68					(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 2 Walls Type 2 Walls Type 2 Walls Type 2 Walls Type 3 Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Valuation Openings m² Openings m² Openings m² Openings m² Valuation Openings m² Valuation Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Valuation Openings m² Openings	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	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58					(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 2 Walls Type 3 39.17 Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Valla Type 3 Windows Type 9 Vindows Type 9 Vindows Type 9 Vindows Type 10 Valls Type 1 Valla Type 3	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	x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/ x1/[1/	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.8)+ 0.08 0.18 0.18		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58 5.64					(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 40.22 9.2 Walls Type 2 39.17 7.86 Walls Type 3 39.17 7.37 Roof 31.06 0	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	x1/[1/ x1/[1/[1/ x1/[1/[1/ x1/[1/[1/ x1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58					(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 2 Walls Type 3 39.17 Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Openings m² Valla Type 3 Windows Type 9 Vindows Type 9 Vindows Type 9 Vindows Type 10 Valls Type 1 Valla Type 3	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	x1/[1/ x1/[1/[1/ x1/[1/[1/ x1/[1/[1/ x1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1	W/m2K 1 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.4)+ 0.04 /(1.8)+ 0.08 0.18 0.18		2.1 2.96 4.56 4.68 2.76 4.56 3.1 2.51 2.65 1.94 2.68 5.58 5.64					(26) (27) (27) (27) (27) (27) (27) (27) (27

* for windows an						ated using	formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragrapi	h 3.2	
Fabric heat lo	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				55.47	(33)
Heat capacity	/ Cm = S	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mas	s parame	ter (TMF	c = Cm ÷	: TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assec				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal brido	ges : S (L	x Y) cal	culated (using Ap	pendix l	<						19.05	(36)
if details of thern		are not kn	own (36) =	= 0.15 x (3	1)								_
Total fabric h									(36) =			74.52	(37)
Ventilation he	1	I	monthly	Ī						(25)m x (5)	1	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(00)
(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 transfer	-	nt, W/K						(39)m	= (37) + (38)m		7	
(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		— ,
Heat loss par	ameter (I	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) _{1.} - (4)	12 /12=	124.45	(39)
(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]	
					•	•			Average =	Sum(40) ₁ .	12 /12=	1.17	(40)
Number of da	_	·	le 1a)									1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ating ene	rgy requ	irement:								kWh/y	ear:	
Assumed occi	cupancy, .9, N = 1	N		(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (TFA -13		kWh/y	ear:	(42)
Assumed occ if TFA > 13 if TFA £ 13	cupancy, .9, N = 1 .9, N = 1	N + 1.76 x	[1 - exp	`	,		, , -	,	TFA -13.	.9)	79	ear:	, ,
Assumed occi	cupancy, 2.9, N = 1 2.9, N = 1 ge hot way	N + 1.76 x ater usag hot water	[1 - exp ge in litre usage by	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		.9)		ear:	(42) (43)
Assumed occ if TFA > 13 if TFA £ 13 Annual avera Reduce the annual	cupancy, 2.9, N = 1 2.9, N = 1 ge hot way	N + 1.76 x ater usag hot water	[1 - exp ge in litre usage by	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		.9)	79	ear:	, ,
Assumed occ if TFA > 13 if TFA £ 13 Annual avera Reduce the annu not more that 12	supancy, .9, N = 1 .9, N = 1 ge hot wa ual average 5 litres per	N + 1.76 x ater usag hot water person per	ge in litre usage by a r day (all w	es per da 5% if the d vater use, I	ay Vd,av dwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	100	79	ear:	, ,
Assumed occ if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12	supancy, .9, N = 1 .9, N = 1 ge hot wa ual average 5 litres per	N + 1.76 x ater usag hot water person per	ge in litre usage by a r day (all w	es per da 5% if the d vater use, I	ay Vd,av dwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	100	79	ear:	, ,
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annu not more that 12 Jan Hot water usage (44)m= 110.5	supancy, .9, N = 1 .9, N = 1 ge hot wa ual average 5 litres per in litres per 106.48	N + 1.76 x ater usag hot water person per Mar r day for ea	ge in litre usage by a r day (all w Apr ach month	es per da 5% if the d vater use, I May Vd,m = fa 94.42	ay Vd,av fwelling is that and co Jun ctor from 1	erage = designed and designed a	(25 x N) to achieve Aug (43) 94.42	+ 36 a water us Sep 98.44	Oct 102.46 Total = Su	Nov 106.48 m(44) ₁₁₂ =	79 0.45 Dec	ear:	, ,
Assumed occ if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage	supancy, .9, N = 1 .9, N = 1 ge hot way all average 5 litres per l	N + 1.76 x ater usag hot water person per Mar r day for ea	ge in litre usage by a r day (all w Apr ach month	es per da 5% if the d vater use, I May Vd,m = fa 94.42	ay Vd,av fwelling is that and co Jun ctor from 1	erage = designed and designed a	(25 x N) to achieve Aug (43) 94.42	+ 36 a water us Sep 98.44	Oct 102.46 Total = Su	Nov 106.48 m(44) ₁₁₂ =	79 0.45 Dec		(43)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annu not more that 12 Jan Hot water usage (44)m= 110.5	supancy, .9, N = 1 .9, N = 1 ge hot way all average 5 litres per l	+ 1.76 x ater usag hot water person per Mar r day for ea 102.46 used - cal	ge in litre usage by s r day (all w Apr ach month 98.44	es per da 5% if the 6 vater use, 1 May 100 1	ay Vd,av fwelling is that and co Jun ctor from 7 90.41	erage = designed and ld) Jul Table 1c x 90.41	(25 x N) to achieve Aug (43) 94.42	+ 36 a water us Sep 98.44 0 kWh/mor 114.87	Oct 102.46 Total = Sunth (see Tailland)	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1	79 0.45 Dec 110.5 c, 1d) 158.69		(43)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86	supancy, .9, N = 1 .9, N = 1 ge hot wa ual average 5 litres per litres per 106.48 of hot water 143.32 water heati	+ 1.76 x ater usage hot water person per Mar r day for ear 102.46 used - cal 147.89	ge in litre usage by a day (all w Apr ach month 98.44 culated mo 128.93	es per da 5% if the deserving May Vd,m = fa 94.42 onthly = 4.	ay Vd,av Iwelling is that and co Jun ctor from 7 90.41 190 x Vd,r 106.76	erage = designed in did) Jul Table 1c x 90.41 m x nm x E 98.93 enter 0 in	(25 x N) to achieve Aug (43) 94.42 DTm / 3600 113.52 boxes (46)	+ 36 a water us Sep 98.44 0 kWh/mor 114.87	Oct 102.46 Total = Sunth (see Tailland)	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14 m(45) ₁₁₂ =	79 0.45 Dec 110.5 c, 1d) 158.69	1205.42	(43)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86	supancy, .9, N = 1 .9, N = 1 ge hot wa ual average 5 litres per in litres per 106.48 of hot water 143.32 water heati 21.5	+ 1.76 x ater usage hot water person per Mar day for each 102.46 used - cal	ge in litre usage by a r day (all w Apr ach month 98.44 culated mo	es per da 5% if the da 5% if th	ay Vd,av Iwelling is that and co Jun ctor from 7 90.41 190 x Vd,r	erage = designed and designed a	(25 x N) to achieve Aug (43) 94.42 97m / 3600 113.52	+ 36 a water us Sep 98.44 0 kWh/mor	Oct 102.46 Total = Sunth (see Tailland)	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14	79 0.45 Dec 110.5 c, 1d) 158.69	1205.42	(43)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86 If instantaneous (46)m= 24.58	Supancy, .9, N = 1 .9, N = 1 ge hot way all average 5 litres per 106.48 106.48 143.32 water heatiful 21.5 e loss:	N + 1.76 x ater usag hot water person per Mar r day for ea 102.46 used - cal 147.89 ng at point 22.18	ge in litre usage by a r day (all w Apr ach month 98.44 culated mo 128.93	es per da 5% if the covater use, I May Vd,m = fa 94.42	ay Vd,av Iwelling is hot and co Jun ctor from 1 90.41 190 x Vd,r 106.76	erage = designed id) Jul Table 1c x 90.41 m x nm x E 98.93 enter 0 in 14.84	(25 x N) to achieve Aug (43) 94.42 07m / 3600 113.52 boxes (46) 17.03	+ 36 a water us Sep 98.44 0 kWh/mor 114.87) to (61) 17.23	Oct 102.46 Total = Su 133.88 Total = Su 20.08	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14 m(45) ₁₁₂ = 21.92	79 0.45 Dec 110.5 c, 1d) 158.69	1205.42	(43)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annu not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86 If instantaneous (46)m= 24.58 Water storage	supancy, .9, N = 1 .9, N = 1 ge hot wa yel average 5 litres per in litres per 106.48 of hot water 143.32 water heati 21.5 e loss: me (litres)	N + 1.76 x ater usage hot water person per Mar 102.46 used - cal 147.89 ng at point 22.18 includir	ge in litre usage by a r day (all w Apr ach month 98.44 128.93 r of use (not) 19.34	es per da 5% if the content use, I May Vd,m = fa 94.42 onthly = 4. 123.72 o hot water 18.56 olar or W	ay Vd,av Iwelling is hot and co Jun ctor from 7 90.41 190 x Vd,r 106.76 r storage),	erage = designed and designed a	(25 x N) to achieve Aug (43) 94.42 07m / 3600 113.52 boxes (46) 17.03 within sa	+ 36 a water us Sep 98.44 0 kWh/mor 114.87) to (61) 17.23	Oct 102.46 Total = Su 133.88 Total = Su 20.08	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14 m(45) ₁₁₂ = 21.92	79 0.45 Dec 110.5 c, 1d) 158.69 23.8	1205.42	(43) (44) (45) (46)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86 If instantaneous (46)m= 24.58 Water storage Storage volum If community Otherwise if response if the storage in the storage	Supancy, .9, N = 1 .9, N = 1 ge hot water sper litres per es per litres lit	+ 1.76 x ater usage hot water person per Mar r day for ear 102.46 147.89 ng at point 22.18 includir and no tar	ge in litre usage by a r day (all w Apr ach month 98.44 128.93 r of use (not 19.34 and any so	es per da 5% if the d rater use, I May Vd,m = fa 94.42 onthly = 4. 123.72 o hot water 18.56 colar or W relling, e	ay Vd,av Iwelling is that and co Jun ctor from 7 90.41 190 x Vd,r 106.76 r storage), 16.01	erage = designed in designed i	(25 x N) to achieve Aug (43) 94.42 DTm / 3600 113.52 boxes (46) 17.03 within sa (47)	+ 36 a water us Sep 98.44 0 kWh/mor 114.87 1 to (61) 17.23 ame ves	Oct 102.46 Total = Su 133.88 Total = Su 20.08	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14 m(45) ₁₁₂ = 21.92	79 0.45 Dec 110.5 c, 1d) 158.69 23.8	1205.42	(43) (44) (45) (46)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86 If instantaneous (46)m= 24.58 Water storage Storage volum If community	supancy, .9, N = 1 .9, N = 1 ge hot wa yal average 5 litres per 106.48 of hot water 143.32 water heati 21.5 e loss: me (litres) heating a no stored e loss:	H + 1.76 x ater usage hot water person per Mar r day for ear 102.46 used - cal 147.89 and at point 22.18 including and no tal hot water water usage results and no tal and	ge in litre usage by ser day (all we have ach month) 98.44 128.93 For use (not) 19.34 and any so ank in dwer (this in	es per da 5% if the d rater use, I May Vd,m = fa 94.42 onthly = 4. 123.72 o hot water 18.56 olar or W yelling, e	ay Vd,av Iwelling is hot and co Jun ctor from 7 90.41 190 x Vd,r 106.76 r storage), 16.01 /WHRS nter 110	erage = designed in designed i	(25 x N) to achieve Aug (43) 94.42 DTm / 3600 113.52 boxes (46) 17.03 within sa (47)	+ 36 a water us Sep 98.44 0 kWh/mor 114.87 1 to (61) 17.23 ame ves	Oct 102.46 Total = Su 133.88 Total = Su 20.08	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14 m(45) ₁₁₂ = 21.92	79 0.45 Dec 110.5 c, 1d) 158.69 23.8	1205.42	(43) (44) (45) (46)
Assumed occi if TFA > 13 if TFA £ 13 Annual avera Reduce the annual not more that 12 Jan Hot water usage (44)m= 110.5 Energy content of (45)m= 163.86 If instantaneous (46)m= 24.58 Water storage Storage volum If community Otherwise if materials	supancy, .9, N = 1 .9, N = 1 ge hot water sper litres per es per litres lit	N + 1.76 x ater usage hot water person per Mar r day for ear 102.46 used - cal 147.89 and at point 22.18 including and no tal hot water eclared I	ge in litre usage by a r day (all w Apr ach month 98.44 128.93 r of use (not) 19.34 and any so ank in dw er (this in	es per da 5% if the d rater use, I May Vd,m = fa 94.42 onthly = 4. 123.72 o hot water 18.56 olar or W yelling, e	ay Vd,av Iwelling is hot and co Jun ctor from 7 90.41 190 x Vd,r 106.76 r storage), 16.01 /WHRS nter 110	erage = designed in designed i	(25 x N) to achieve Aug (43) 94.42 DTm / 3600 113.52 boxes (46) 17.03 within sa (47)	+ 36 a water us Sep 98.44 0 kWh/mor 114.87 1 to (61) 17.23 ame ves	Oct 102.46 Total = Su 133.88 Total = Su 20.08	Nov 106.48 m(44) ₁₁₂ = ables 1b, 1 146.14 m(45) ₁₁₂ = 21.92	79 0.45 Dec 110.5 c, 1d) 158.69 23.8	1205.42	(43) (44) (45) (46) (47)

Energy lost from water storage, kWh/year	$(48) \times (49) =$).75		(50)
 b) If manufacturer's declared cylinder loss factor is not know Hot water storage loss factor from Table 2 (kWh/litre/day) 	า:			1	(54)
If community heating see section 4.3			0		(51)
Volume factor from Table 2a			0		(52)
Temperature factor from Table 2b			0		(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53)	3) =	0		(54)
Enter (50) or (54) in (55)).75		(55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$	1			
(56)m= 23.33 21.07 23.33 22.58 23.33 22.58 23.33	3 23.33 22.58	23.33 22.58	23.33		(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷	(50), else (57) m = (56) m	n where (H11) is f	om Append	lix H	
(57)m= 23.33 21.07 23.33 22.58 23.33 22.58 23.33	3 23.33 22.58	23.33 22.58	23.33		(57)
Primary circuit loss (annual) from Table 3			0		(58)
Primary circuit loss calculated for each month (59)m = (58) ÷	365 × (41)m			•	
(modified by factor from Table H5 if there is solar water hea	ating and a cylinder	thermostat)		_	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26	3 23.26 22.51	23.26 22.51	23.26		(59)
Combi loss calculated for each month (61)m = (60) \div 365 × (4	11)m				
(61)m= 0 0 0 0 0 0 0	0 0	0 0	0		(61)
Total heat required for water heating calculated for each mon	th (62) m = 0.85 × (4	45)m + (46)m -	+ (57)m +	(59)m + (61)m	
(62)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5	i	180.47 191.23	1		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quar	tity) (enter '0' if no solar	contribution to wa	ter heating)		
(add additional lines if FGHRS and/or WWHRS applies, see					
(63)m= 0 0 0 0 0 0	0 0	0 0	0		(63)
			1 0		(63)
Output from water heater		0 0	1 0		(63)
		180.47 191.23	1		(63)
Output from water heater	2 160.11 159.97		205.29	2129.12	(63)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5	2 160.11 159.97 Output from wat	180.47 191.23 ter heater (annual	205.29		, ,
Output from water heater	2 160.11 159.97 Output from wat om + (61)m] + 0.8 x	180.47 191.23 ter heater (annual	205.29		, ,
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45)]	2 160.11 159.97 Output from wat om + (61)m] + 0.8 x 7 75.02 74.27	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66	205.29 112 n + (59)m 90.04]	(64)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m= 91.76 81.32 86.45 78.94 78.41 71.57 70.11	2 160.11 159.97 Output from wat om + (61)m] + 0.8 x 7 75.02 74.27	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66	205.29 112 n + (59)m 90.04]	(64)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m= 91.76 81.32 86.45 78.94 78.41 71.57 70.15 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):	2 160.11 159.97 Output from wat om + (61)m] + 0.8 x 7 75.02 74.27	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66	205.29 112 n + (59)m 90.04]	(64)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m= 91.76 81.32 86.45 78.94 78.41 71.57 70.15 include (57)m in calculation of (65)m only if cylinder is in the	2 160.11 159.97 Output from wat om + (61)m] + 0.8 x 7 75.02 74.27	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66	205.29 n + (59)m 90.04 nmunity h]	(64)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m= 91.76 81.32 86.45 78.94 78.41 71.57 70.11 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor	205.29 n + (59)m 90.04 nmunity h]	(64)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m= 91.76 81.32 86.45 78.94 78.41 71.57 70.17 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep 8 139.48 139.48	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor	205.29 n + (59)m 90.04 nmunity h]	(64) (65)
Output from water heater (64)m = 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m = 91.76 81.32 86.45 78.94 78.41 71.57 70.17 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul (66)m = 139.48 139.48 139.48 139.48 139.48 139.48 139.48 139.48 139.48 139.48 139.48 139.48 139.48	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep 8 139.48 139.48 also see Table 5	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor	205.29 n + (59)m 90.04 nmunity h]	(64) (65)
Output from water heater (64)m= 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45 (65)m= 91.76 81.32 86.45 78.94 78.41 71.57 70.11 include (57)m in calculation of (65)m only if cylinder is in the standard form of the	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wa Aug Sep 8 139.48 139.48 also see Table 5 11.68 15.67	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23	205.29 n + (59)m 90.04 nmunity h]	(65) (66)
Output from water heater (64)m= 210.46	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep 8 139.48 139.48 also see Table 5 11.68 15.67 13a), also see Tab	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23	205.29 n + (59)m 90.04 nmunity h]	(65) (66)
Output from water heater (64)m= 210.46	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep 8 139.48 139.48 also see Table 5 11.68 15.67 13a), also see Tab 2 196.16 203.11	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23 ale 5 217.91 236.6	205.29 112 n + (59)m 90.04 nmunity h Dec 139.48]	(65) (66) (67)
Output from water heater (64)m = 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ′ [0.85 x (45 (65)m = 91.76 81.32 86.45 78.94 78.41 71.57 70.11 include (57)m in calculation of (65)m only if cylinder is in the standard form of the standard form	2 160.11 159.97 Output from wat 1m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot was 139.48 also see Table 5 11.68 15.67 13a), also see Table 5 2 196.16 203.11 5a), also see Table 6	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23 ale 5 217.91 236.6	205.29 112 n + (59)m 90.04 nmunity h Dec 139.48]	(65) (66) (67)
Output from water heater (64)m = 210.46 185.4 194.48 174.03 170.31 151.85 145.5 Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45.65)m = 91.76 81.32 86.45 78.94 78.41 71.57 70.17 include (57)m in calculation of (65)m only if cylinder is in the standard form of the standard form	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep 8 139.48 139.48 also see Table 5 11.68 15.67 13a), also see Table 5 2 196.16 203.11 5a), also see Table 5	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23 ale 5 217.91 236.6	205.29 112 n + (59)m 90.04 nmunity h Dec 139.48 24.76]	(65) (66) (67) (68)
Output from water heater (64)m= 210.46	2 160.11 159.97 Output from wat m + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot wat Aug Sep 8 139.48 139.48 also see Table 5 11.68 15.67 13a), also see Table 5 2 196.16 203.11 5a), also see Table 5	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23 ale 5 217.91 236.6	205.29 112 n + (59)m 90.04 nmunity h Dec 139.48 24.76]	(65) (66) (67) (68)
Output from water heater (64)m = 210.46	2 160.11 159.97 Output from wat tim + (61)m] + 0.8 x 7 75.02 74.27 e dwelling or hot was also see Table 5 11.68 15.67 13a), also see Table 5 2 196.16 203.11 5a), also see Table 5 36.95 36.95	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23 ale 5 217.91 236.6 5 36.95 36.95	205.29 112 n + (59)m 90.04 nmunity h Dec 139.48 24.76 254.16]	(66) (67) (68) (69)
Output from water heater (64)m = 210.46	2 160.11 159.97 Output from wat the second of the second	180.47 191.23 ter heater (annual [(46)m + (57)r 81.79 84.66 ater is from cor Oct Nov 139.48 139.48 19.9 23.23 ale 5 217.91 236.6 5 36.95 36.95	205.29 112 n + (59)m 90.04 nmunity h Dec 139.48 24.76 254.16 36.95]	(66) (67) (68) (69)

Water	heatin	g gains (T	able 5)												
(72)m=	123.33	, , , , , , , , , , , , , , , , , , , 	116.2	109.	64 105.	39	99.4	94.31	100	.83 103.15	109.9	3 117.59	121.02		(72)
		ıl gains =		1)m + (67)m		3)m + (69)m + (<u> </u>		
(73)m=	481.16	-	463.14	437.	56 411.	29	386.21	370.06	376		415.5	1	467.79		(73)
. ,	lar gair	ns:													
			using sol	ar flux f	om Table	6a a	nd assoc	iated equa	tions	to convert to th	e applic	able orientat	ion.		
Orienta	ation:	Access F	actor	Α	ea		Flu	IX		g_		FF		Gains	
		Table 6d		ı	ገ ²		Ta	ble 6a		Table 6b		Table 6c		(W)	
East	0.9x	1)		2.23] ,	(19.64	x	0.63	x	0.7	=	9.39	(76)
East	0.9x	1)		3.53	,	,	19.64	x	0.63	X	0.7	=	14.86	(76)
East	0.9x	1)		2.34	,	,	19.64	x	0.63	X	0.7	=	9.85	(76)
East	0.9x	1)		2.02	,	,	19.64	x	0.63	x	0.7	=	8.5	(76)
East	0.9x	1)		2.23)	((38.42	x	0.63	X	0.7	=	18.36	(76)
East	0.9x	1)		3.53	,	((38.42	x	0.63	X	0.7	=	29.07	(76)
East	0.9x	1)		2.34	,	((38.42	x	0.63	x	0.7	=	19.27	(76)
East	0.9x	1)		2.02)	((38.42	x	0.63	X	0.7	=	16.63	(76)
East	0.9x	1)		2.23	},		63.27	Х	0.63	Х	0.7	=	30.24	(76)
East	0.9x	1	,		3.53	,		63.27	х	0.63	x	0.7		47.87	(76)
East	0.9x	1	,		2.34	,		63.27] x	0.63	x	0.7	=	31.73	(76)
East	0.9x	1	,		2.02)		63.27] x	0.63	x	0.7	=	27.39	(76)
East	0.9x	1	,		2.23	3,	((92.28	x	0.63	x	0.7	=	44.1	(76)
East	0.9x	1	,		3.53		9	92.28	х	0.63	x	0.7	=	69.82	(76)
East	0.9x	1	,		2.34] ,		2.28	x	0.63	x	0.7	=	46.28	(76)
East	0.9x	1)		2.02] ,		92.28	x	0.63	x	0.7	=	39.95	(76)
East	0.9x	1)		2.23	,	1	13.09	X	0.63	X	0.7	=	54.05	(76)
East	0.9x	1)		3.53		1	13.09	x	0.63	x	0.7	=	85.56	(76)
East	0.9x	1)		2.34] ,	1	13.09	X	0.63	×	0.7	=	56.72	(76)
East	0.9x	1	>		2.02	,	1	13.09	X	0.63	X	0.7	=	48.96	(76)
East	0.9x	1)		2.23] ,	1	15.77	x	0.63	×	0.7	=	55.33	(76)
East	0.9x	1)		3.53)	1	15.77	X	0.63	X	0.7	=	87.59	(76)
East	0.9x	1)		2.34] ,	1	15.77	x	0.63	x	0.7	=	58.06	(76)
East	0.9x	1)		2.02	,	1	15.77	X	0.63	X	0.7	=	50.12	(76)
East	0.9x	1)		2.23] ,	1	10.22	X	0.63	X	0.7	=	52.68	(76)
East	0.9x	1	>		3.53	,	1	10.22	X	0.63	X	0.7	=	83.39	(76)
East	0.9x	1)		2.34] ,	1	10.22	x	0.63	×	0.7	=	55.28	(76)
East	0.9x	1)		2.02)	1	10.22	x	0.63	X	0.7	=	47.72	(76)
East	0.9x	1)		2.23] ,	((94.68	x	0.63	x	0.7	=	45.25	(76)
East	0.9x	1)		3.53] ,	((94.68	x	0.63	x	0.7	=	71.63	(76)
East	0.9x	1)		2.34] ,	((94.68	x	0.63	x	0.7	=	47.48	(76)
East	0.9x	1)		2.02] ,	((94.68	x	0.63	X	0.7	=	40.99	(76)

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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	x	3.53	x	24.49	x	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	х	3.53	x	16.15	x	0.63	X	0.7	=	12.22	(76)
East	0.9x	1	х	2.34	х	16.15	x	0.63	X	0.7	=	8.1	(76)
East	0.9x	1	х	2.02	x	16.15	x	0.63	x	0.7	=	6.99	(76)
South	0.9x	0.54	х	3.44	х	46.75	x	0.63	x	0.7	=	34.47	(78)
South	0.9x	0.54	х	3.44	X	46.75	Х	0.63	X	0.7	=	34.47	(78)
South	0.9x	0.54	х	2	х	46.75	x	0.63	x	0.7	=	20.04	(78)
South	0.9x	0.54	x	1.46	х	46.75	x	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	x	76.57	X	0.63	x	0.7	=	56.45	(78)
South	0.9x	0.54	x	2	x	76.57	X	0.63	x	0.7	=	32.82	(78)
South	0.9x	0.54	х	1.46	х	76.57	x	0.63	x	0.7	=	23.96	(78)
South	0.9x	0.54	х	3.44	x	97.53	x	0.63	X	0.7	=	71.91	(78)
South	0.9x	0.54	х	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	х	3.44	х	110.23	x	0.63	x	0.7	=	81.27	(78)
South	0.9x	0.54	х	3.44	х	110.23	x	0.63	X	0.7	=	81.27	(78)
South	0.9x	0.54	х	2	x	110.23	x	0.63	x	0.7	=	47.25	(78)
South	0.9x	0.54	х	1.46	x	110.23	x	0.63	x	0.7	=	34.49	(78)
South	0.9x	0.54	х	3.44	x	114.87	x	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	j =	35.95	(78)
South	0.9x	0.54	x	3.44	x	110.55	x	0.63	x	0.7	=	81.5	(78)
South	0.9x	0.54	x	3.44	x	110.55	x	0.63	x	0.7	=	81.5	(78)
South	0.9x	0.54	x	2	x	110.55	x	0.63	x	0.7	j =	47.39	(78)
South	0.9x	0.54	x	1.46	x	110.55	x	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)
	_		•		•		1				•		-

South 0.8	South	ا میر	0.54	1	0.44	1	400.04	1 .	0.00	۱	0.7	1 _	70.04	7(70)
South 0.8x		0.9x	0.54] X	3.44	X 1	108.01] X]	0.63	X	0.7] = 1	79.64	(78)
South 0.8		늗] 1]])]]]		╡
South		<u> </u>]]]]]]				! 		╡
South 0.3x 0.54 x 2 x 104.89 x 0.63 x 0.7 = 44.96 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 75.12 (78) South 0.3x 0.54 x 3.44 x 101.89 x 0.63 x 0.7 = 75.12 (78) South 0.3x 0.54 x 3.44 x 101.89 x 0.63 x 0.7 = 75.12 (78) South 0.3x 0.54 x 2 x 101.89 x 0.63 x 0.7 = 43.67 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 43.67 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 43.67 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 43.67 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 43.67 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 60.89 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 60.89 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 60.89 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 60.89 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 60.89 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 60.89 (78) South 0.3x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 25.84 (78) South 0.3x 0.54 x 1.46 x 105.42 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 105.42 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 105.42 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 105.42 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 104.4 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 104.4 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 104.4 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 104.4 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 1.46 x 104.4 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.84 x 0.63 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.85 x 0.83 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.85 x 0.83 x 0.7 = 440.86 (78) South 0.3x 0.54 x 10.89 x 10.85 x 0.63 x 0.7 = 440.86 (78) South 0.		늗] 1]]]]]]		╡
South 0,9x 0,54 x 1.46 x 104.89 x 0,63 x 0,7 = 32.82 (78) South 0,9x 0,54 x 3.44 x 101.89 x 0,63 x 0,7 = 75.12 (78) South 0,9x 0,54 x 3.44 x 101.89 x 0,63 x 0,7 = 75.12 (78) South 0,9x 0,54 x 1.46 x 101.89 x 0,63 x 0,7 = 75.12 (78) South 0,9x 0,54 x 1.46 x 101.89 x 0,63 x 0,7 = 43.67 (78) South 0,9x 0,54 x 1.46 x 101.89 x 0,63 x 0,7 = 43.67 (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 3.44 x 82.59 x 0,63 x 0,7 = 60.89 (78) South 0,9x 0,54 x 1.46 x 82.59 x 0,63 x 0,7 = 60.89 (78) South 0,9x 0,54 x 1.46 x 82.59 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 1.46 x 82.59 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 1.46 x 82.59 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 = 40.86 (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 = 40.86 (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 40.4 x 55.42 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 55.42 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 55.42 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 55.42 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 55.42 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 65.54 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 65.54 x 0,63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 60.63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 60.63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 60.63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 40.4 x 60.63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 3.44 x 60.63 x 0,7 = 40.86 (78) South 0,9x 0,54 x 1.88 x 1.88 x 1.88 x 0.63 x 0,7 = 40.86 (80) West 0,9x 0,54 x 1.88 x 1.88 x 1.88 x 1.88 x 0.63 x 0,7 = 40.86 (80) West 0,9x 0,54 x 1.88 x 1.88 x 113.09 x 0.63 x 0,7 = 40.41 (80) West 0,9x 0,54 x 1.88 x 113.09 x 0.63 x 0.7 = 40.41 (80) West 0,9x 0,54 x 1.88 x 113.09 x 0.63 x 0.7 = 40.41 (80) West 0,9x 0,54 x 1.88 x 113.09 x 0.63 x 0.7 = 40.41 (80) West 0,9x 0,54 x 1.88 x 113.09 x 0.		늗		J 1)]]]				!]		╡
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South 0.9x 0.54 x 3.44 x 101.89 x 0.63 x 0.7 = 75.12 (78) South 0.9x 0.54 x 1.46 x 101.89 x 0.63 x 0.7 = 43.67 (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 3.44 x 82.59 x 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 3.44 x 82.59 x 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 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x 3.44 x 55.42 x 0.63 x 0.7 = 440.86 (78) South 0.9x 0.54 x 3.44 x		늗] 1]]]]				! 1		╡
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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 3.44 x 82.59 x 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 3.44 x 82.59 x 0.63 x 0.7 = 60.89 (78) South 0.9x 0.54 x 3.44 x 32.59 x 0.63 x 0.7 = 35.4 (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 = 40.86 (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 = 40.86 (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 = 40.86 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 40.86 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 40.86 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 40.86 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 (78) South 0.9x 0.54 x 3.44 x 3.44 x 40.4 x 0.63 x 0.7 = 17.34 (78) South 0.9x 0.54 x 3.44 x 3.44 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 3.44 x 3.44 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 3.44 x 3.44 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 3.44 x 3.44 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 3.44 x 3.44 x 3.45 x 3.		<u> </u>]]]]]]				! 1		╡
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South 0.9x 0.54		<u> </u>	0.54	X	2	X	82.59	X	0.63	X	0.7	=	35.4	╡゛゛
South 0.9x 0.54		늗	0.54	X	1.46	X	82.59	X	0.63	X	0.7	=	25.84	╡
South 0.9x 0.54 x 2 x 55.42 x 0.63 x 0.7 = 17.34 778 South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 78 South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 78 South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 78 South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 78 South 0.9x 0.54 x 2.08 x 19.64 x 0.63 x 0.7 = 17.32 78 South 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 12.64 78 West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 17.13 80 West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 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 1.89 x 38.42 x 0.63 x 0.7 = 15.56 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 1.89 x 38.42 x 0.63 x 0.7 = 28.21 80 West 0.9x 0.54 x 1.89 x 63.27 x 0.63 x 0.7 = 25.63 80 West 0.9x 0.54 x 1.89 x 92.28 x 0.63 x 0.7 = 41.14 80 West 0.9x 0.54 x 1.89 x 92.28 x 0.63 x 0.7 = 41.14 80 West 0.9x 0.54 x 1.89 x 92.28 x 0.63 x 0.7 = 41.14 80 West 0.9x 0.54 x 1.89 x 92.28 x 0.63 x 0.7 = 44.14 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.69 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80 West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 80		0.9x	0.54	X	3.44	X	55.42	X	0.63	X	0.7	=	40.86	╡゛゛
South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 17.34 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 (78) South 0.9x 0.54 x 3.44 x 40.4 x 0.63 x 0.7 = 29.78 (78) South 0.9x 0.54 x 2.0x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 1.46 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 1.46 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 17.32 (78) West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 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 1.89 x 38.42 x 0.63 x 0.7 = 15.56 (80) West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 28.21 (80) West 0.9x 0.54 x 1.89 x 63.27 x 0.63 x 0.7 = 25.63 (80) West 0.9x 0.54 x 1.89 x 63.27 x 0.63 x 0.7 = 25.63 (80) West 0.9x 0.54 x 1.89 x 92.28 x 0.63 x 0.7 = 37.38 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 41.14 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 50.42 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.81 (80) West 0.9x 0.54 x 1.89 x 113.09 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 110.22 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 110.22 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 110.22 x 0.63 x 0.7 = 44.85 (80) West 0.9x 0.54 x 1.89 x 110.22 x 0.63 x 0.7 = 44.85 (80)			0.54	X	3.44	X	55.42	X	0.63	X	0.7	=	40.86	=
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South 0.9x 0.54		0.9x	0.54	X	1.46	Х	55.42	X	0.63	X	0.7	 	17.34	(78)
South 0.9x 0.54 x 2 x 40.4 x 0.63 x 0.7 = 17.32 (78) South 0.9x 0.54 x 1.46 x 40.4 x 0.63 x 0.7 = 17.32 (78) West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 8.76 (80) West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 7.96 (80) West 0.9x 0.54 x 2.08 x 38.42 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 1.89 x 63.27 x		<u> </u>	0.54	X	3.44	X	40.4	×	0.63	X	0.7	=	29.78	╡゛゛
South 0.9x 0.54 x 1.46 x 40.4 x 0.63 x 0.7 = 12.64 (78) West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 8.76 (80) West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 7.96 (80) West 0.9x 0.54 x 1.89 x 38.42 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 1.89 x 63.27 x 0.63 x 0.7 = 28.21 (80) West 0.9x 0.54 x 1.89 x 63.27 x 0.63 x 0.7 = 28.21 (80) West 0.9x 0.54 x 2.08 x 92.28 <t< td=""><td></td><td><u> </u></td><td>0.54</td><td>X</td><td>3.44</td><td>X</td><td>40.4</td><td>X</td><td>0.63</td><td>X</td><td>0.7</td><td> =</td><td>29.78</td><td>╡</td></t<>		<u> </u>	0.54	X	3.44	X	40.4	X	0.63	X	0.7	=	29.78	╡
West 0.9x 0.54 x 2.08 x 18.64 x 0.63 x 0.7 = 8.76 (80) West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 7.96 (80) West 0.9x 0.54 x 2.08 x 38.42 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 2.08 x 63.27 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 = 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 x 2.08 x 113.09 <	_	0.9x	0.54	X	2	X	40.4	Х	0.63	X	0.7	=	17.32	╡
West 0.9x 0.54 x 1.89 x 19.64 x 0.63 x 0.7 = 7.96 (80) West 0.9x 0.54 x 2.08 x 38.42 x 0.63 x 0.7 = 17.13 (80) West 0.9x 0.54 x 1.89 x 63.27 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 x 1.89 x 63.27 x 0.63 x 0.7 = 28.21 (80) West 0.9x 0.54 x 1.89 x 92.28 x 0.63 x 0.7 = 37.38 (80) West 0.9x 0.54 x 1.89 x 113.09		0.9x	0.54	X	1.46	X	40.4	X	0.63	X	0.7	=	12.64	╡
West 0.9x 0.54 x 2.08 x 38.42 x 0.63 x 0.7 = 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 x 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 x 2.08 x 113.09 x 0.63 x 0.7 = 50.42 (80) West 0.9x 0.54 x 2.08 x 113.09		0.9x	0.54	X	2.08	Х	19.64	X	0.63	X	0.7	=	8.76	(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 x 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 = 25.63 (80) West 0.9x 0.54 x 2.08 x 113.09 x 0.63 x 0.7 = 41.14 (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 x 2.08 x 115.77		0.9x	0.54	X	1.89	X	19.64	X	0.63	X	0.7	=	7.96	(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 x 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 x 1.89 x 92.28 x 0.63 x 0.7 = 41.14 (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 x 2.08 x 115.77 x 0.63 x 0.7 = 51.61 (80) West 0.9x 0.54 x 2.08 x 115.77		0.9x	0.54	X	2.08	X	38.42	X	0.63	X	0.7	=	17.13	╡
West 0.9x 0.54 x 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 x 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 x 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 = 46.9 (80) West 0.9x 0.54 x 1.89 x 110.22		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 92.28 x 0.63 x 0.7 = 41.14 (80) West 0.9x 0.54 x 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 x 1.89 x 115.77 x 0.63 x 0.7 = 51.61 (80) West 0.9x 0.54 x 1.89 x 115.77 x 0.63 x 0.7 = 51.61 (80) West 0.9x 0.54 x 2.08 x 110.22 x 0.63 x 0.7 = 46.9 (80) West 0.9x 0.54 x 1.89 x 110.22		0.9x	0.54	X	2.08	X	63.27	X	0.63	X	0.7	=	28.21	(80)
West 0.9x 0.54 x 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 x 1.89 x 115.77 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 = 46.9 (80) West 0.9x 0.54 x 2.08 x 110.22 x 0.63 x 0.7 = 46.9 (80) West 0.9x 0.54 x 1.89 x 110.22 x 0.63 x 0.7 = 44.65 (80) West 0.9x 0.54 x 1.89 x 94.68		0.9x	0.54	X	1.89	X	63.27	X	0.63	X	0.7	=	25.63	(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 x 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 = 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 x 1.89 x 110.22 x 0.63 x 0.7 = 44.65 (80) West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (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 x 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 x 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 = 44.65 (80) West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68		0.9x	0.54	X	1.89	x	92.28	x	0.63	X	0.7	=	37.38	(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 x 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 x 1.89 x 110.22 x 0.63 x 0.7 = 44.65 (80) West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (80) West 0.9x 0.54 x 2.08 x 73.59	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 x 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 x 1.89 x 110.22 x 0.63 x 0.7 = 44.65 (80) West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (80) West 0.9x 0.54 x 2.08 x 73.59 x 0.63 x 0.7 = 32.81 (80)		0.9x	0.54	X	1.89	X	113.09	x	0.63	X	0.7	=	45.81	(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 x 1.89 x 110.22 x 0.63 x 0.7 = 44.65 (80) West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (80) West 0.9x 0.54 x 2.08 x 73.59 x 0.63 x 0.7 = 32.81 (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 x 1.89 x 110.22 x 0.63 x 0.7 = 44.65 (80) West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (80) West 0.9x 0.54 x 2.08 x 73.59 x 0.63 x 0.7 = 32.81 (80)	West	0.9x	0.54	X	1.89	X	115.77	X	0.63	X	0.7	=	46.9	(80)
West 0.9x 0.54 x 2.08 x 94.68 x 0.63 x 0.7 = 42.21 (80) West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (80) West 0.9x 0.54 x 2.08 x 73.59 x 0.63 x 0.7 = 32.81 (80)		0.9x	0.54	x	2.08	x	110.22	x	0.63	x	0.7	=	49.14	(80)
West 0.9x 0.54 x 1.89 x 94.68 x 0.63 x 0.7 = 38.35 (80) West 0.9x 0.54 x 2.08 x 73.59 x 0.63 x 0.7 = 32.81 (80)		0.9x	0.54	x	1.89	×	110.22	x	0.63	x	0.7	=	44.65	(80)
West 0.9x 0.54 x 2.08 x 73.59 x 0.63 x 0.7 = 32.81 (80)	West	0.9x	0.54	X	2.08	×	94.68	x	0.63	x	0.7	=	42.21	(80)
3.00	West	0.9x	0.54	X	1.89	x	94.68	x	0.63	x	0.7	=	38.35	(80)
West 0.9x 0.54 x 1.89 x 73.59 x 0.63 x 0.7 = 29.81 (80)	West	0.9x	0.54	X	2.08	x	73.59	x	0.63	x	0.7	=	32.81	(80)
	West	0.9x	0.54	X	1.89	X	73.59	X	0.63	X	0.7	=	29.81	(80)

West	0.9x	0.54	X	2.0)8	x	4	5.59	x		0.63	x [0.7	=	20.32	(80)
West	0.9x	0.54	х	1.8	39	x	4	5.59	x		0.63	x [0.7	=	18.47	(80)
West	0.9x	0.54	Х	2.0)8	x	2	24.49	x		0.63	x	0.7	=	10.92	(80)
West	0.9x	0.54	Х	1.8	39	x	2	24.49	x		0.63	x [0.7	=	9.92	(80)
West	0.9x	0.54	Х	2.0)8	x	1	6.15	х		0.63	х	0.7	=	7.2	(80)
West	0.9x	0.54	х	1.8	39	x	1	6.15	х		0.63	x	0.7	=	6.54	(80)
					-											
Solar g	ains in	watts, ca	alculated	d for eac	h month				(83)m	n = Si	um(74)m .	(82)m	_		_	
(83)m=	162.92	285.71	407.22	522.97	596.09	5	94.6	572.21	518	.37	448.02	320.69	196.77	138.3		(83)
Total ga	ains – ir	nternal a	ınd sola	r (84)m =	= (73)m	+ (8	83)m	, watts					_		,	
(84)m=	644.08	764.61	870.36	960.52	1007.39	9	80.81	942.27	894	.88	837.8	736.28	642.02	606.09		(84)
7. Mea	an inter	nal temp	erature	(heating	season)										
Tempe	erature	during h	eating p	periods in	n the livi	ng	area 1	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisat	tion fac	tor for g	ains for	living are	ea, h1,m	(s	ee Ta	ble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.96	0.88	(0.73	0.56	0.6	61	0.84	0.97	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollo	w ste	ps 3 to 7	' in T	able	e 9c)				•	
(87)m=	19.71	19.88	20.15	20.48	20.77	_	0.94	20.99			20.87	20.49	20.04	19.68		(87)
Tompo	raturo	during h	ooting r	eriods ir	roct of	du	olling	from To	bla (0 T	2 (°C)					
(88)m=	19.93	19.93	19.93	19.94	19.94	_	9.95	19.95	19.	$\overline{}$	19.95	19.94	19.94	19.94	1	(88)
L						_			-		10.00	10.01	10.01	10.01		()
				rest of d		_	<u> </u>		_	10	0.77	0.00	0.00		1	(90)
(89)m=	1	0.99	0.98	0.94	0.84	,	0.64	0.43	0.4	+0	0.77	0.96	0.99	1		(89)
				the rest	_	ı	·		·	_				i	1	
(90)m=	18.21	18.46	18.85	19. <mark>34</mark>	19.71	1	9.91	19.95	19.	95	19.85	19.36	18.7	18.17		(90)
											İ	LA = Liv	ng area ÷ (4) =	0.19	(91)
Mean_i	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	LA × T1	+ (1	– fL	A) × T2				_	
(92)m=	18.5	18.74	19.1	19.56	19.91	2	0.11	20.15	20.	14	20.04	19.57	18.95	18.46		(92)
Apply	adjustn	nent to t	he mear	n interna		_		m Table	4e,	whe	re appro	priate		•	1	
(93)m=	18.5	18.74	19.1	19.56	19.91	2	0.11	20.15	20.	14	20.04	19.57	18.95	18.46		(93)
		ting requ														
				mperaturusing Ta		ned	at ste	ep 11 of	Tabl	le 9t	o, so tha	t Ti,m=	(76)m an	d re-cald	culate	
	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Λ	ug	Sep	Oct	Nov	Dec	1	
L Utilisat		tor for g		<u> </u>	iviay	_	Juli	Jui		ug	Sep	Oct	1400	l Dec	J	
(94)m=	1	0.99	0.98	0.93	0.84		0.65	0.46	0.	5	0.77	0.95	0.99	1]	(94)
L	gains,	hmGm .	W = (9	4)m x (8	L 4)m	<u> </u>									J	
г	641.31	757	849.05	897.6	843.46	6	40.02	430.89	451	.23	647.44	701.31	636.08	604.13]	(95)
Month	ly avera	age exte	rnal ten	perature	from T	abl	e 8							•	J	
(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 lo	oss rate	e for mea	an interr	nal tempe	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	– (96)m]			•	
(97)m=	1796.54	1746.54	1586.69	1326.04	1020.01	6	76.85	435.91	459	.31	733.06	1114.3	1478.36	1787.16		(97)
Space	heatin	g require	ement fo	r each n	nonth, k	Wh	/mont	th = 0.02	4 x	[(97)	m – (95)m] x (4	11)m	•	,	
(98)m=	859.49	664.97	548.8	308.48	131.35		0	0	C)	0	307.32	606.44	880.17		

Total per year (kWh/year) = $Sum(98)_{15,912}$ =	4307.02	(98)
Space heating requirement in kWh/m²/year	40.58	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	1	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	kWh/ye	ear
Space heating requirement (calculated above) 859.49 664.97 548.8 308.48 131.35 0 0 0 0 307.32 606.44 880.17	ı	
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		(211)
919.24 711.2 586.95 329.92 140.48 0 0 0 328.68 648.6 941.36	ı	(211)
Total (kWh/year) =Sum(211) _{15,1012} =	4606.44	(211)
Space heating fuel (secondary), kWh/month		
$= \{ [(98)m \times (201)] \} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 Total (kWh/year) =Sum(215) _{15,1012} =		7(045)
	0	(215)
Water heating Output from water heater (calculated above)		
210.46 185.4 194.48 174.03 170.31 151.85 145.52 160.11 159.97 180.47 191.23 205.29		
Efficiency of water heater	79.8	(216)
(217)m= 88.17 87.93 87.43 86.33 84.13 79.8 79.8 79.8 79.8 86.22 87.68 88.26		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m		
(219)m= 238.69 210.85 222.44 201.59 202.43 190.29 182.36 200.64 200.46 209.31 218.09 232.59	ı	
Total = Sum(219a) ₁₁₂ =	2509.74	(219)
Annual totals kWh/year	kWh/yea	<u>r</u>
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:	ı	(230c)
boiler with a fan-assisted flue 45	ı	(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 systems including micro-CHP		
Energy Emission factor kWh/year kg CO2/kWh	Emissions	
Space heating (main system 1) $(211) \times 0.216 = $	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 o	of (265)(271) =		1796.85	(272)

TER =

(273)

16.93

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

		Harri Batalla				
		User Details:				
Assessor Name:	0. 5045.0040	Stroma N		., .		
Software Name:	Stroma FSAP 2012	Software '		Versio	n: 1.0.1.24	
A d due e e	P	roperty Address: flat	1			
Address: 1. Overall dwelling dimens	eione:					
1. Overall awelling difficult	310113.	Area(m²)	Av. Height(m	n)	Volume(m³)	
Ground floor		57.7 (1a)		(2a) =	144.25	(3a)
First floor		45.67 (1b)	x 2.5	(2b) =	114.17] (3b)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1e)+(1r	1) 103.37 (4)				_
Dwelling volume		,	+(3b)+(3c)+(3d)+(3e)+	·(3n) =	258.42	(5)
2. Ventilation rate:				L	200.12	
2. Ventilation rate.	main secondar heating heating	y other	total		m³ per hour	
Number of chimneys	heating heating + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fans	S		0	x 10 =	0	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fire	es		0	x 40 =	0	(7c)
				Air ch	anges per hou	ır
Infiltration due to chimneys	s, flues and fans = (6a)+(6b)+(7	7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
	en ca <mark>rried o</mark> ut or is int <mark>ended,</mark> procee	d to (17), otherwise contin	ue from (9) to (16)	r		- -
Number of storeys in the Additional infiltration	e dwelling (ns)			(0) 410 4	0	(9)
	5 for steel or timber frame or	O 35 for masonry co		(9)-1]x0.1 =	0](10)] ₍₄₄₎
	sent, use the value corresponding to			l	0	(11)
If suspended wooden flo	or, enter 0.2 (unsealed) or 0	.1 (sealed), else ente	r 0	[0	(12)
If no draught lobby, ente	r 0.05, else enter 0			Ī	0	(13)
Percentage of windows a	and doors draught stripped				0	(14)
Window infiltration		0.25 - [0.2 x (14	·) ÷ 100] =		0	(15)
Infiltration rate		(8) + (10) + (11)	+ (12) + (13) + (15) =		0	(16)
Air permeability value, q	50, expressed in cubic metre	es per hour per squar	e metre of envelor	oe area	3	(17)
If based on air permeability	/ value, then (18) = [(17) ÷ 20]+(8), otherwise $(18) = (16)$		Ī	0.15	(18)
Air permeability value applies i	if a pressurisation test has been dor	ne or a degree air permeal	oility is being used	_		
Number of sides sheltered		(00) 4 50 075	- (40)]		3	(19)
Shelter factor		(20) = 1 - [0.075]		Į	0.78	(20)
Infiltration rate incorporatin	g shelter factor	$(21) = (18) \times (20)$	0) =		0.12	(21)
Infiltration rate modified for						
Jan Feb M	lar Apr May Jun	Jul Aug S	ep Oct No	v Dec		
Monthly average wind spee	ed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

M* 15 (00) (00)			
Wind Factor $(22a)m = (22)m \div 4$ $(22a)m = 1.27 $	95 0.92 1 1.0	8 1.12 1.18	1
			1
Adjusted infiltration rate (allowing for shelter and wind spee			7
0.15 0.15 0.14 0.13 0.12 0.11 0. Calculate effective air change rate for the applicable case	11 0.11 0.12 0.1	2 0.13 0.14]
If mechanical ventilation:			0.5 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equa	on (N5)), otherwise (23b) = (23	a)	0.5 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor	(from Table 4h) =		77.35 (23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m	+ (23b) × [1 - (23c)) ÷ 100]
` '	22 0.22 0.23 0.2		(24a)
b) If balanced mechanical ventilation without heat recove		`` '	.
	0 0 0	0 0	(24b)
c) If whole house extract ventilation or positive input vent if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise		23h)	
	$\frac{(240) = (220) \text{ iii} + 0.3 \times (0.00)}{0.000}$	0 0	(24c)
d) If natural ventilation or whole house positive input vent			
if $(22b)m = 1$, then $(24d)m = (22b)m$ otherwise $(24d)m$			
(24d)m= 0 0 0 0 0	0 0 0	0 0	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or	(24d) in box (25)		
(25)m =	22 0.22 0.23 0.2	4 0.24 0.25	(25)
3. Heat losses and heat loss parameter:			
ELEMENT Gross Openings Net Area	U-value A >		
ELEMENT Gross Openings Net Area A ,m²	W/m2K (W/K) kJ/m²-	K kJ/K
ELEMENT Gross Openings Met Area A ,m² Doors 2.1	W/m2K (x 2 = 4	W/K) kJ/m².	K kJ/K (26)
ELEMENT Gross Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69	$ \begin{array}{c cccc} W/m2K & (\\ x & 2 & = & 4\\ x1/[1/(0.8) + 0.04] & = & 2. \end{array} $	W/K) kJ/m²- 2 86	K kJ/K (26) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 2 A ,m ² Openings m ² Net Area A ,m ² 2.1 3.69 4.83	$ \begin{array}{c cccc} W/m2K & (\\ x & 2 & = & 4\\ x1/[1/(0.8) + 0.04] & = & 2.\\ x1/[1/(0.8) + 0.04] & = & 3. \end{array} $	W/K) kJ/m ² · 86 74	(26) (27) (27)
ELEMENTGross area (m²)Openings m²Net Area A , m²Doors2.1Windows Type 13.69Windows Type 24.83Windows Type 33.01	W/m2K x	W/K) kJ/m²- 2 86 74	K kJ/K (26) (27) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Vindows Type 4 5.01	W/m2K x	W/K) kJ/m ² - 2 86 74 33 88	K kJ/K (26) (27) (27) (27) (27)
ELEMENTGross area (m²)Openings m²Net Area A , m²Doors2.1Windows Type 13.69Windows Type 24.83Windows Type 33.01Windows Type 45.01Floor57.7		W/K) kJ/m ² - 2 86 74 33 88	K kJ/K (26) (27) (27) (27) (27) (28)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type 1 54.06 8.52 45.54		W/K) kJ/m²- 2 86 74 33 88 501 92	K kJ/K (26) (27) (27) (27) (27) (28) (29)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Root 40.72		W/K) kJ/m ² - 2 86 74 33 88	K kJ/K (26) (27) (27) (27) (27) (28) (29) (29)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Total area of elements, m² 162.61	W/m2K	W/K) kJ/m²- 2	K kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (31)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Total area of elements, m² 162.61 Party wall 44.05		W/K) kJ/m²- 2	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Total area of elements, m² 162.61		W/K) kJ/m²- 2	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)
ELEMENT Gross area (m²) Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 8.52 45.54 Walls Type2 48.74 8.02 40.72 Total area of elements, m² 162.61 Party wall 44.05		W/K) kJ/m²- 2	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)
Party wall Poors Gross area (m²) Doors Q.1 Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Floor Walls Type 1 Total area of elements, m² Party wall * for windows and roof windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitions Net Area A , m² A , m² Party A , m² A , m		W/K) kJ/m²- 2	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32) h 3.2
Party wall FLEMENT Gross area (m²) Doors Quantification of windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitions Party Floor Party wall A, m²		W/K) kJ/m²- 2	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32) h 3.2
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Floor Walls Type 1 Total area of elements, m² Party wall * for windows and roof windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K For design assessments where the details of the construction are not kno		KJ/m²-	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32) h 3.2 (33) (34)
ELEMENTGross area (m²)Openings m²Net Area A ,m²Doors2.1Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 8.52 Walls Type2 48.74 8.02 Total area of elements, m^2 162.61 Party wall 44.05 * for windows and roof windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitionsFabric heat loss, W/K = S (A x U)Heat capacity Cm = S(A x k)Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²K		KJ/m²-	K kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32) h 3.2 (33) (34)

if details of therma	0 0	are not kn	own (36) =	= 0.15 x (3	1)			(22)	(0.0)				-
Total fabric he		م عدار بدا د	الطاعموما					` '	(36) =	(05) (5)		48.94	(37)
Ventilation hea				<u> </u>		Ι	Α.	` '		(25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(38)
(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		(30)
Heat transfer of	coefficier	nt, W/K			·	1		(39)m	= (37) + (38)m	1	i	
(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		_
Heet less nors	motor (l	JI D) \\\	/m2l/						_	Sum(39) ₁	12 /12=	69.44	(39)
Heat loss para (40)m= 0.69	0.69	0.68	0.67	0.67	0.66	0.66	0.66	0.66	= (39)m ÷	0.67	0.68		
(40)m= 0.69	0.69	0.66	0.67	0.67	0.66	0.66	0.66			<u> </u>		0.67	(40)
Number of day	s in moi	nth (Tab	le 1a)					,	average =	Sum(40)₁	12 / 1 Z=	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. Water heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
A		N I										1	(40)
Assumed occu if TFA > 13.9			[1 - exp	(-0 0003	349 x (TF	FA -13 9)2)] + 0 (0013 x (ΓFA -13		.77		(42)
if TFA £ 13.9		11.70 %	ι υπρ	(0.0000	7-5 X (11	70.0	/2/] 1 0.0) X 010 X (1171 10	.5)			
Annual averag											5.22		(43)
Reduce the annua	\					-	to achieve	a water us	se target o	of			
not more that 125		_	uay (all w		lot and co								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage is	n litres per	day for ea	ach month	Va,m = ta	ctor from	l able 1c x	(43)						
(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		_
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		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		
	Į		Į	Į.	Į.			_	Γotal = Su	m(45) ₁₁₂ =	 	1655.45	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)) to (61)					_
(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)
Water storage			-			-		-			-	•	
Storage volum	, ,		•			•		ame ves	sel		0		(47)
If community h	•			•			` '		(01.1	`			
Otherwise if no		hot wate	er (this in	ıcludes ı	nstantar	neous co	mbi boil	ers) ente	er 'O' in ((47)			
Water storage a) If manufact		aclared l	nee farti	nr is kna	wn (k\//h	J/day).					0		(48)
,				JI 13 KI10	WII (ICVVI	i/day).					0		, ,
Temperature f							(40) (40)				0		(49)
Energy lost from b) If manufact		•	-		or is not		(48) x (49)) =		1	10		(50)
Hot water stora			-							0	.02		(51)
If community h	-			,		- /					-	1	(= -/
Volume factor	_									1.	.03		(52)
Temperature 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	55)								1.	.03		(55)
												•	

Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	Н
(57)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (58)m + (48)m + (58)m + (48)m$	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 DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(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	
Output from water heater (annual) ₁₁₂	2306.29 (64)
Heat gains from water heating, kWh/month $0.25^{\circ}[0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$	
(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)
	(00)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community hea	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community hea	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat. 5. Internal gains (see Table 5 and 5a):	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat. 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	ating
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43	ating
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	ating (66)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	ating (66)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat states of the community from the community heat states of the community from the community fr	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat states of the community of the c	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67) (68) (69) (70)

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

North	
North	(74)
North	(74)
North	(74)
North	(74)
North	(74)
North 0.9x 0.77 x 5.01 x 20.32 x 0.4 x 0.7 = 19.75 North 0.9x 0.77 x 3.69 x 34.53 x 0.4 x 0.7 = 24.72 North 0.9x 0.77 x 4.83 x 34.53 x 0.4 x 0.7 = 32.36 North 0.9x 0.77 x 3.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 <tr< td=""><td>(74)</td></tr<>	(74)
North 0.9x 0.77 x 3.69 x 34.53 x 0.4 x 0.7 = 24.72 North 0.9x 0.77 x 4.83 x 34.53 x 0.4 x 0.7 = 32.36 North 0.9x 0.77 x 3.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 33.57 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 51.98 <td>(74)</td>	(74)
North 0.9x 0.77 x 4.83 x 34.53 x 0.4 x 0.7 = 32.36 North 0.9x 0.77 x 3.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 33.57 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 51.98	(74)
North 0.9x 0.77 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 33.57 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
3.40	(74)
	(74)
North 0.9x 0.77 x 5.01 x 55.46 x 0.4 x 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 x 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 x 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 x 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 x 41.52 x 0.4 x 0.7 = 40.36	(74)
North 0.9x 0.77 x 3.69 x 24.19 x 0.4 x 0.7 = 17.32	(74)
North 0.9x 0.77 x 4.83 x 24.19 x 0.4 x 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	X	2	4.19	X		0.4	X	0.7	=	23.52	(74)
North	0.9x	0.77	X	3.6	69	X	1	3.12	X		0.4	x	0.7	=	9.39	(74)
North	0.9x	0.77	X	4.8	33	X	1	3.12	X		0.4	x	0.7	=	12.29	(74)
North	0.9x	0.77	X	3.0)1	x	1	3.12	X		0.4	х	0.7	=	7.66	(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	3.6	69	x	8	3.86	х		0.4	_ x [0.7	_ =	6.35	(74)
North	0.9x	0.77	X	4.8	33	x	8	8.86	х		0.4	x	0.7	_ =	8.31	(74)
North	0.9x	0.77	x	3.0)1	x	8	3.86	x		0.4	_ x [0.7	_ =	5.18	(74)
North	0.9x	0.77	x	5.0)1	x	8	3.86	x		0.4	= x	0.7	_ =	8.62	(74)
	_															
Solar g	ains in	watts, ca	alculated	d for eac	h month				(83)m	n = Su	ım(74)m .	(82)m				
(83)m=	34.13	65.22	110.82	178.01	239.79	_	56.71	239.67	190	.15	133.24	77.63	42.1	28.45		(83)
Total g	ains – i	nternal a	nd sola	r (84)m =	= (73)m	+ (8	33)m	, watts					•			
(84)m=	521.49	550.07	579.63	621	656.48	64	48.25	615.03	572	.42	528.94	499.39	493.72	502.54		(84)
7 Mea	an inter	nal temp	erature	(heating	seasor)							•			
		during h		,		<i>'</i>	area f	from Tah	۵ مار	Th	1 (°C)				21	(85)
		tor for g	•			-			oic o	,	i (O)				21	(00)
Utilisa		Feb	Mar		l .	ΤÌ		Jul			Sep	Oct	Nov	Dec		
(96)	Jan	1	0.99	Apr 0.97	May 0.88	-	Jun 0.66	0.49	0.5	ug	0.83	0.98	1	Dec 1		(86)
(86)m=			0.99	0.97	0.00		J.66	0.49	0.0	04	0.03	0.96				(00)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	in T	able	9c)					
(87)m=	20.34	20.41	20.55	20.77	20.93	2	0.99	21	2	1	20.97	20.77	20.53	20.33		(87)
Temp	erature	during h	eating p	periods in	n rest of	dw	elling	from Ta	ble 9	9, Th	12 (°C)					
(88)m=	20.35	20.35	20.35	20.37	20.37	2	20.38	20.38	20.	38	20.37	20.37	20.36	20.36		(88)
Utilisa	tion fac	tor for g	ains for	rest of d	welling	h2	m (se	e Table	9a)							
(89)m=	1	1	0.99	0.97	0.84	_	0.6	0.42	0.4	17	0.78	0.97	1	1	1	(89)
` ′ L						<u>. </u>	T0 //	" ,				- ·		l	J	
г		l temper		1	1	Ť	·			$\overline{}$			1 40 70	10.44	1	(00)
(90)m=	19.45	19.56	19.77	20.08	20.3	2	20.37	20.38	20.	38	20.35	20.09	19.73	19.44		(90)
											·	LA = LIVI	ng area ÷ (4	+) =	0.29	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	LA × T1	+ (1	– fL	A) × T2		_	-	_	
(92)m=	19.71	19.81	20	20.28	20.49	2	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(92)
Apply	adjustr	nent to th	ne meai	n interna	l temper	atu	re fro	m Table	4e,	whe	re appro	priate			-	
(93)m=	19.71	19.81	20	20.28	20.49	2	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(93)
8. Spa	ace hea	ting requ	ıiremen	t												
						ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=	(76)m an	d re-cal	culate	
the uti		factor fo		T	i -			1					1	ı	1	
[Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
г		tor for g		T .		_									1	(0.1)
(94)m=	1	1	0.99	0.96	0.85	(0.62	0.44	0.4	19	0.79	0.97	1	1		(94)
г		hmGm ,	<u> </u>	, ` `	' 	_		i		-					1	
(95)m=	520.61	548.39	574.84	598.56	558.81	_	01.52	269.11	281	.49	419.27	486.09	491.68	501.9		(95)
г	-	age exte		ri e	ı	_				. 1			1		1	(00)
(96)m=	4.3	4.9	6.5	8.9	11.7		14.6	16.6	16		14.1	10.6	7.1	4.2		(96)
г		for mea											T		1	(07)
(97)m=	1097.49	1058.13	954.76	790.83	608.41	40	05.04	269.31	281	.96	440.43	671.04	897.26	1088.61		(97)

Space heating requirement for each month, kWh/mo	.024 x [(97)m – (95)m] x (41)m	
(98)m= 429.2 342.54 282.66 138.43 36.9 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 scher		
This part is used for space heating, space cooling or Fraction of space heat from secondary/supplementar	• • • • • • • • • • • • • • • • • • • •	(301)
Fraction of space heat from community system 1 – (3	1	(302)
The community scheme may obtain heat from several sources. The includes boilers, heat pumps, geothermal and waste heat from portraction of heat from Community boilers	ns. See Appendix C.	(303a)
Fraction of total space heat from Community boilers		(304a)
Factor for control and charging method (Table 4c(3))		(305)
Distribution loss factor (Table 12c) for community hea	, , ,	(306)
Space heating	kWh/year	,,
Annual space heating requirement	2095.88	
Space heat from Community boilers	(98) x (304a) x (305) x (306) = 2305.47 ((30 7 a)
Efficiency of secondary/supplementary heating syste	from Table 4a or Appendix E) 0 ((308
Space heating requirement from secondary/supplement	ystem (98) x (301) x 100 ÷ (308) = 0 ((309)
Water heating Annual water heating requirement If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) = 2536.91 ((310a)
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 no	0) = (107) ÷ (314) =	(315)
Electricity for pumps and fans within dwelling (Table mechanical ventilation - balanced, extract or positive	om outside 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)
12b. CO2 Emissions – Community heating scheme		
	Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year	
CO2 from other sources of space and water heating Efficiency of heat source 1 (%)		(367a)
CO2 associated with heat source 1	b)+(310b)] x 100 ÷ (367b) x	(367)
Electrical energy for heat distribution	[(313) x	(372)

Total CO2 associated with community s	systems	(363)(366) + (368)(372)		=	1114.67	(373)
CO2 associated with space heating (see	condary)	(309) x	0	=	0	(374)
CO2 associated with water from immers	sion heater or instanta	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and w	ater heating	(373) + (374) + (375) =			1114.67	(376)
CO2 associated with electricity for pump	ps and fans within dwe	elling (331)) x	0.52	=	163.63	(378)
CO2 associated with electricity for lighting	ng	(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 20°	12		Strom				Versio	on: 1.0.1.24	
		Pi	roperty	Address	Flat 2					
Address :										
1. Overall dwelling dimer	nsions:									
Ground floor				ea(m²) 50.32	(1a) x		ight(m) 2.5	(2a) =	Volume(mi	³) (3a
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1d	e)+(1n) [50.32	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	125.8	(5)
2. Ventilation rate:										
Number of chimneys	heating	econdar heating	у 7 + Г	other	7 = 6	total		40 =	m³ per hou	_
•		0	╛╘	0	╛╘	0		20 =	0	(6a
Number of open flues	0 +	0]	0] = [0			0	(6b
Number of intermittent fan	S				L	0	X	10 =	0	(7a
Number of passive vents					L	0	X	10 =	0	(7b
Number of flueless gas fir	es					0	X	40 =	0	(7c
								Air ch	nanges <mark>per</mark> he	our
Infilt <mark>ration</mark> due to chi <mark>mne</mark> y	s, flues and fans = (Sa)+(6b)+(7	a)+(7b)+	(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be	en ca <mark>rried o</mark> ut or is intend	ed, proceed	d to (17),	otherwise of	continue f	rom (9) to	(16)			_
Number of storeys in the	e dw <mark>elling</mark> (ns)								0	(9)
Additional infiltration Structural infiltration: 0.2	OF for otaal or timber	frame ar	0.25 fo				[(9)	-1]x0.1 =	0	(10
if both types of wall are pre					•	ruction			0	(11
deducting areas of opening		-,	g		(
If suspended wooden flo	•	led) or 0.	1 (seal	ed), else	enter 0				0	(12
If no draught lobby, ente									0	(13
Percentage of windows Window infiltration	and doors draught s	tripped		0.25 - [0.2	v (14) ± 1	1001 -			0	(14
Infiltration rate				(8) + (10)	, ,		+ (15) =		0	(15
Air permeability value, of	150 expressed in cul	oic metre	s per h					area	3	(17
If based on air permeabilit			•	•	•				0.15	(18
Air permeability value applies	-					is being u	sed			`
Number of sides sheltered	İ								3	(19
Shelter factor				(20) = 1 -		19)] =			0.78	(20
Infiltration rate incorporation				(21) = (18) x (20) =				0.12	(21
Infiltration rate modified fo		1 1		Т.			1		1	
Jan Feb I	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ed from Table 7						1		•	
Monthly average wind spe	- 1			1						
	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
 	1.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

·	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
0.15 Calculate effec	0.15 Ctive air	0.14 Change	0.13	0.12 he appli	0.11 Cable ca	0.11 Se	0.11	0.12	0.12	0.13	0.14		
If mechanica		-										0.5	(23
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b)) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1	1 – (23c)	÷ 100]	
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		(24
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	MV) (24b	m = (22)	2b)m + (2	23b)	1	1	
(4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n				•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n									0.5]			-	
44d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)					
5)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. Heat losse	s and he	eat loss	paramet	er:							_	_	-
LEMENT	Gros area	SS	Openin	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	<)	k-value		A X k kJ/K
oors					2.1	x	2	= [4.2				(26
/in <mark>dows</mark> Type	1				3.33	x1.	/[1/(0.8)+	0.04] =	2.58	Ħ			(27
indows Type	2				5.01	x1.	/[1/(0.8)+	0.04] =	3.88	Ħ			(27
/alls	59.4	19	10.4	4	49.05	5 X	0.13	=	6.38	5 [$\neg \vdash$	(2
otal area of e	lements	, m²			59.49								(3
arty wall					17.5	x	0		0				(3:
or windows and include the area						ated using	formula 1	/[(1/U-valu	re)+0.04] a	ns given in	paragraph	1 3.2	
abric heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				17.04	(3
eat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(3
nermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(3
or design assess				construct	ion are no	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
n be used inste				ıcina Δr	pendix l	<						6.85	(3
	es : S (L	x Y) cal	culated i	Joning Ap	•								
nermal bridge details of therma	al bridging	,		• .	1)			(2.5)	(2.5)				
nermal bridge details of therma otal fabric he	al bridging at loss	are not kn	own (36) =	= 0.15 x (3	1)			, ,	(36) =	05) (5)		23.89	(3
n be used instead hermal bridged details of thermatotal fabric head entilation head	at loss ca	are not kn	own (36) =	= 0.15 x (3	· -		1 .	(38)m	= 0.33 × (25)m x (5)	·	23.89	(3
nermal bridge details of therma otal fabric hea entilation hea	at loss at loss at loss ca Feb	are not kn	own (36) =	0.15 x (3 / May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (Nov	Dec	23.89	
nermal bridge details of therma otal fabric hea entilation hea Jan 10.85	at loss ca Feb	alculated Mar 10.61	own (36) =	= 0.15 x (3	· -	Jul 9.29	Aug 9.17	(38)m Sep 9.53	= 0.33 × (Oct 9.89	Nov 10.13	·	23.89	
nermal bridge details of therma otal fabric hea entilation hea	at loss ca Feb	alculated Mar 10.61	own (36) =	0.15 x (3 / May	Jun			(38)m Sep 9.53	= 0.33 × (Nov 10.13	Dec	23.89	(3

Heat Id	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		
Numba	r of dov	o in mo	ath /Tab	lo 1o\					1	Average =	Sum(40) ₁ .	12 /12=	0.67	(40)
NUTTIDE	Jan	Feb	nth (Tab Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
,		_			-									, ,
4. Wa	ter heat	ina ener	gy requi	rement:								kWh/yea	ır:	
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		.7		(42)
								(25 x N) to achieve		se target o		.49		(43)
not more	e that 125	litres per p	person per	day (all w	ater use, h	not and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea		Vd,m = fa		1	(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	0.11.00	
Energy (content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		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		
										Γotal = Su	m(45) ₁₁₂ =		1234.92	(45)
							enter 0 in	boxes (46,						
(46)m= Water	19.21 storage	16.8 loss:	17.33	15.11	14.5	12.51	11.59	13.3	13.46	15.69	17.13	18.6		(46)
			includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	nunity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
			hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage		ا امسمام	ft-	ar in Iran	/1.\^/L	· /d o · ·) ·							(40)
,			eclared l		or is kno	wn (Kvvr	n/day):					0		(48)
•			m Table		oor			(49) v (40)	\ _			0		(49)
•			storage eclared o	-		or is not		(48) x (49)) =		1	10		(50)
•			factor fr	-							0.	02		(51)
	•	•	ee section	on 4.3										
		from Tal	ble 2a m Table	2h							—	03		(52)
•								(47) v (E4)	\ v (EQ) v (I	- 2)		.6		(53)
		m water 54) in (5	storage	, KVVII/ye	ear			(47) x (51)) X (52) X (53) =	_	03		(54) (55)
	. , .		culated f	or each	month			((56)m = (55) × (41)ı	m	<u>'</u>	00		(00)
(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)
												m Appendix	Н	(/
(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)
Primar	v circuit	loss (an	ınual) fro	m Table	. 3		<u> </u>					0		(58)
	•	•	•			59)m = ((58) ÷ 36	65 × (41)	m					` '
	•				,		. ,	ng and a		r thermo	stat)			
(11100														

Combi loca	, aalaulata	d for oach	month	(61)m –	(60) · 2(SE v. (41	\m						
Combi loss	1	1 101 each	1 11101111111 1 0	0 1)111 =	00) + 3	05 × (41)	0	0	0	0	0]	(61)
(I							<u> </u>		<u> </u>	<u> </u>	J (59)m + (61)m	(0.7)
(62)m= 183	-i		154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27	(39)111 + (01)111	(62)
Solar DHW in			<u> </u>	<u> </u>		<u> </u>							(-)
(add addition										.o to mate	o:ag/		
(63)m= 0		0	0	0	0	0	0	0	0	0	0		(63)
Output fron	n water he	ater		Į.				·!				ı	
(64)m= 183			154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27		
							Out	put from w	ater heate	r (annual)₁	112	1885.76	(64)
Heat gains	from water	r heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)r	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)
include (57)m in ca	lculation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	om com	munity h	neating	
5. Interna	al gains (se	ee Table 5	5 and 5a):								-	
Metabolic o	gains (Tab	le 5), Wa	tts										
Ja			Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 84.	98 84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98		(66)
Ligh <mark>ting g</mark> a	ins (calcul	ated in A	ppendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(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)
App <mark>liance</mark> s	gains (ca	<mark>culat</mark> ed ir	n Append	dix L, eq	uation L	13 or L1	3a), als	see Ta	ble 5				
(68)m= 148	.07 149.6	145.73	137.49	127.08	117.3	110.77	109.23	113.11	121.35	131.75	141.53		(68)
Cooking ga	ains (calcu	lated in A	ppendix	L, equat	ion L15	or L15a), also s	ee Table	5		-		
(69)m= 31	.5 31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5		(69)
Pumps and	d fans gain	s (Table	5a)									_	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g	. evaporat	ion (nega	tive valu	es) (Tab	le 5)							_	
(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 heat	ting gains	Table 5)										_	
(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 inter	nal gains	=			(66))m + (67)m	n + (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. Solar g													
•	are calculate	•				•	itions to c	onvert to th	ne applicat		tion.		
Orientation	: Access Table 6		Area m²		Flu Tal	ıx ble 6a	_	g_ Fable 6b	т	FF able 6c		Gains (W)	
Namth							, –						1
	.9x 0.7			==		10.63	X	0.4	_ ×	0.7	_ =	6.87	(74)
	.9x 0.7					10.63	X	0.4	_ ×	0.7	_ =	10.34](74)
	.9x 0.7					20.32) ×	0.4	×	0.7	=	13.13](74)
	.9x 0.7				-	20.32	X	0.4	_ ×	0.7	_ =	19.75	(74)
North 0.	.9x 0.7	7 ×	3.3	33	x 3	34.53	X	0.4	X	0.7	=	22.31	(74)

North								-						
NI tl-	0.9x 0.7	7 X	5.0)1	X	34.5	3	X	0.4	X	0.7	=	33.57	(74)
North	0.9x 0.7	7 x	3.3	33	x	55.4	6	x	0.4	X	0.7	=	35.84	(74)
North	0.9x 0.7	7 ×	5.0)1	X	55.4	6	x	0.4	Х	0.7	=	53.92	(74)
North	0.9x 0.7	7 ×	3.3	33	X	74.7	2	x	0.4	x	0.7	=	48.28	(74)
North	0.9x 0.7	7 ×	5.0)1	X	74.7	2	x [0.4	x	0.7	=	72.63	(74)
North	0.9x	7 X	3.3	33	X	79.9	9	x	0.4	х	0.7	=	51.68	(74)
North	0.9x 0.7	7 X	5.0)1	x	79.9	9	x	0.4	х	0.7	=	77.76	(74)
North	0.9x 0.7	7 ×	3.3	33	X	74.6	8	x	0.4	x	0.7	=	48.25	(74)
North	0.9x 0.7	7 ×	5.0)1	X	74.6	8	x	0.4	x	0.7	=	72.6	(74)
North	0.9x 0.7	7 ×	3.3	33	X	59.2	5	x	0.4	x	0.7	=	38.28	(74)
North	0.9x 0.7	7 X	5.0)1	х	59.2	5	x	0.4	x	0.7	=	57.6	(74)
North	0.9x 0.7	7 X	3.3	33	х	41.5	2	x	0.4	x	0.7	=	26.83	(74)
North	0.9x 0.7	7 X	5.0)1	X	41.5	2	x	0.4	x	0.7	-	40.36	(74)
North	0.9x 0.7	7 X	3.3	33	X	24.1	9	x [0.4	×	0.7	= =	15.63	(74)
North	0.9x 0.7	7 X	5.0)1	х	24.1	9	x	0.4	×	0.7	= i	23.52	(74)
North	0.9x 0.7	7 ×	3.3	33	х	13.1	2	x	0.4	T x	0.7	=	8.48	(74)
North	0.9x 0.7	7 ×	5.0)1	X	13.1	2	x	0.4	T x	0.7	<u> </u>	12.75	(74)
North	0.9x 0.7	7 X	3.3	33	X	8.86	5	Х	0.4	Х	0.7		5.73	(74)
North	0.9x 0.7	7 x	5.0)1	Х	8.86	3	×	0.4	x	0.7	= -	8.62	(74)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m														
<u> </u>	17.21 32.89	55.88	89.76	120.91		29.44 12	20.85	95.8	88 67.19	39.15	21.23	14.35		(83)
Total gai	ins – internal	and solar	r (84)m =	= (73)m	+ (8	33)m , w	atts							
(84)m = 3	344.48 358.31	371.33	389.38	404.87	39	98.04 37	79.33	359.	49 338.82	326.78	327.19	333.67		(84)
7. Mear	n internal tem	perature	(heating	seasor	n)									
	rature during		`			area fror	m Table	e 9,	Th1 (°C)				21	(85)
•	on factor for	•			_				` '			ı		
	Jan Feb	Mar	Apr	May	Ť	-	Jul	Αι	ıg Sep	Oct	Nov	Dec		
(86)m=	0.99 0.99	0.97	0.91	0.75	+ ,	\ <u>-</u> -	_		ישיי ויפי					
				0.75	1 '	0.53 (0.38	0.42		0.92	0.98	0.99		(86)
Mean ir	nternal tempe	rature in	living ar	ļ				0.42	2 0.67		0.98	0.99		(86)
	nternal tempe	1		ea T1 (f	ollo	w steps		0.42	2 0.67 able 9c)	0.92	1	0.99		(86)
(87)m=	20.51 20.59	20.72	20.89	ea T1 (f 20.98	ollo	w steps	3 to 7 ii	0.42 in Ta 21	2 0.67 able 9c)		0.98			
(87)m=	20.51 20.59 rature during	20.72 heating p	20.89 periods in	ea T1 (f 20.98	ollo dw	w steps 21 elling fro	3 to 7 ii 21 om Tabl	0.42 in Ta 21 ile 9	2 0.67 able 9c) 20.99 , Th2 (°C)	20.89	20.69	20.5		(87)
(87)m= : : : : : : : : : : : : : : : : : : :	20.51 20.59 rature during 20.35 20.35	20.72 heating p	20.89 periods in 20.36	ea T1 (f 20.98 n rest of 20.37	ollo dw	w steps 21 elling fro 0.38 2	3 to 7 ii 21 om Tabl	0.42 in Ta 21 ile 9 20.3	2 0.67 able 9c) 20.99 , Th2 (°C)	0.92	1			
Temper (88)m= :	20.51 20.59 rature during 20.35 20.35 on factor for	20.72 heating p 20.35 gains for	20.89 periods in 20.36 rest of d	ea T1 (f 20.98 r rest of 20.37 welling,	ollo dw 2 h2,	w steps 21 elling fro 0.38 2 m (see	3 to 7 ii 21 21 20 Table 9	0.42 in Ta 21 ile 9 20.3	2 0.67 able 9c) 20.99 , Th2 (°C)	0.92 20.89 20.37	20.69	20.5		(87)
Temper (88)m=	20.51 20.59 rature during 20.35 20.35	20.72 heating p	20.89 periods in 20.36	ea T1 (f 20.98 n rest of 20.37	ollo dw 2 h2,	w steps 21 elling fro 0.38 2 m (see	3 to 7 ii 21 om Tabl	0.42 in Ta 21 ile 9 20.3	2 0.67 able 9c) 20.99 , Th2 (°C)	20.89	20.69	20.5		(87)
Temper (88)m= 2 Utilisatic (89)m= Mean ir	20.51 20.59 rature during 20.35 20.35 on factor for 0.99 0.98 nternal tempe	20.72 heating p 20.35 gains for 0.96	20.89 periods in 20.36 rest of do 0.89	ea T1 (f 20.98 rest of 20.37 welling, 0.71	dw 2 h2,	w steps 21 elling fro 0.38 2 m (see 7) 0.48 (3 to 7 ii 21 21 20.38 Table 9 0.33	0.42 in Ta 21 ile 9 20.3 (a)	2 0.67 able 9c) 20.99 , Th2 (°C) 88 20.37	0.92 20.89 20.37	20.69	20.5		(87) (88) (89)
Temper (88)m= 2 Utilisatic (89)m= Mean ir	20.51 20.59 rature during 20.35 20.35 on factor for 0.99 0.98	20.72 heating p 20.35 gains for 0.96	20.89 periods in 20.36 rest of do 0.89	ea T1 (f 20.98 rest of 20.37 welling, 0.71	ollo dw 2 h2,	w steps 21 elling fro 0.38 2 m (see 7 0.48 0 T2 (follo	3 to 7 ii 21 com Table 20.38 Table 9 0.33 cow steps	0.42 in Ta 21 ile 9 20.3 (a)	2 0.67 able 9c) 20.99 7, Th2 (°C) 88 20.37 7 0.61 to 7 in Table 88 20.37	0.92 20.89 20.37 0.89 e 9c) 20.25	20.69 20.36 0.98	20.5 20.36 0.99		(87) (88) (89) (90)
Temper (88)m= 2 Utilisatic (89)m= Mean ir	20.51 20.59 rature during 20.35 20.35 on factor for 0.99 0.98 nternal tempe	20.72 heating p 20.35 gains for 0.96 erature in	20.89 periods ir 20.36 rest of d 0.89 the rest	ea T1 (f 20.98 n rest of 20.37 welling, 0.71 of dwell	ollo dw 2 h2,	w steps 21 elling fro 0.38 2 m (see 7 0.48 0 T2 (follo	3 to 7 ii 21 com Table 20.38 Table 9 0.33 cow steps	0.42 in Ta 21 ile 9 20.3 (a) 0.33	2 0.67 able 9c) 20.99 7, Th2 (°C) 88 20.37 7 0.61 to 7 in Table 88 20.37	0.92 20.89 20.37 0.89 e 9c) 20.25	20.69	20.5 20.36 0.99	0.48	(87) (88) (89)
Temper (88)m= :: Utilisation (89)m= :: Mean ir (90)m= ::	20.51 20.59 rature during 20.35 20.35 on factor for 0.99 0.98 nternal tempe	20.72 heating p 20.35 gains for 0.96 erature in 20	20.89 periods in 20.36 rest of d 0.89 the rest 20.23	ea T1 (f 20.98 rest of 20.37 welling, 0.71 of dwell 20.35	ollo dw 2 h2, (initial content of the content o	w steps 21 elling fro 0.38	3 to 7 ii 21 21 20.38 Table 9: 0.33 Ow step:	0.42 In Ta 21 In E 9 20.3 Da) 0.33 Es 3 20.3	2 0.67 able 9c) 20.99 7, Th2 (°C) 88 20.37 7 0.61 to 7 in Table 88 20.37	0.92 20.89 20.37 0.89 e 9c) 20.25	20.69 20.36 0.98	20.5 20.36 0.99	0.48	(87) (88) (89) (90)
Temper (88)m= 2 Utilisation (89)m= 4 Mean ir (90)m= 4 Mean ir	20.51 20.59 rature during 20.35 20.35 on factor for 0.99 0.98 nternal temper 19.7 19.81	20.72 heating p 20.35 gains for 0.96 erature in 20	20.89 periods in 20.36 rest of d 0.89 the rest 20.23	ea T1 (f 20.98 rest of 20.37 welling, 0.71 of dwell 20.35	ollo dw 2 h2, (diling) 2	w steps 21 elling fro 0.38	3 to 7 ii 21 com Table 20.38 Table 9 0.33 cow steps 20.38	0.42 In Ta 21 In E 9 20.3 Da) 0.33 Es 3 20.3	2 0.67 able 9c) 20.99 , Th2 (°C) 88 20.37 7 0.61 to 7 in Table 88 20.37 f -fLA) × T2	0.92 20.89 20.37 0.89 e 9c) 20.25	20.69 20.36 0.98	20.5 20.36 0.99	0.48	(87) (88) (89) (90)

(70)	1		T									ı	(00)
(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. Space hea				ro obtair	and at et	on 11 of	Table 0	n so tha	t Ti m-(76)m an	d ro-calc	vulato	
the utilisation			•		icu ai sii	5p 11 01	i abie 3i	J, 50 II Ia		r Ojili ali	u ie-caic	uiale	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	ctor for g	ains, hm	1:									•	
(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)
Useful gains,		W = (9)	4)m x (8	4)m			,				,	İ	
(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)
Monthly aver		T T	-									1	(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 (97)m= 548.76	e for me: 529.12	an intern 477.61	394.85	302.34	Lm , VV =	=[(39)m 135.24	x [(93)m	- (96)m 219.49	336.46	449.61	544.16		(97)
(97)m= 548.76 Space heating	l .	l	l		l		l				344.16		(97)
(98)m= 154.67	118.74	88.89	33.83	6.13	0	0.02	0	0	31.49	93.78	158.75		
(66)111= 161.61	1 110.71	00.00	00.00	0.10			_	·		r) = Sum(9	<u> </u>	686.29	(98)
Chase bestin	a roquir	omant in	Id\A/b/pp3	2hroor			7010	i poi you	(RVVIII) y Cal) = Cam(c	O/15,912 —		亅``
Space heating	• •											13.64	(99)
9b. Energy red			· ·	Ĭ									
This part is us Fraction of spa										unity sch	neme.	0	(301)
							(Table I	., 0	OHO				
Fraction of spa					•							1	(302)
The c <mark>ommu</mark> nity s inclu <mark>des boi</mark> lers, l									up to four	other heat	sources; to	he latter	
Fraction of he					ioni powei	Stations.	осс Аррсі	idix O.				1	(303a)
Fraction of tot					nilers				(3	02) x (303	a) –	1	(304a)
										02) X (000	u) –		Ⅎ`
Factor for con	trol and	charging	method	(Table	4c(3)) to	r commi	unity hea	iting sys	tem			1	(305)
Distribution los	ss factor	(Table '	12c) for o	commun	ity heatii	ng syste	m					1.1	(306)
Space heatin	g											kWh/yea	<u>r_</u>
Annual space	heating	requiren	nent									686.29	
Space heat fro	om Comi	munity b	oilers					(98) x (30	04a) x (30	5) x (306)	=	754.92	(307a)
Efficiency of s	econdar	y/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space heating	,	, , ,	•		•	,)1) x 100 ·	,		0	(309)
Space fleating	require	ineni no	111 366011	uaiy/su	эріспісп	lary sys	l C III	(30) X (30	71) X 100 ·	- (300) =		U	(303)
Water heating	-												_
Annual water	_	•										1885.76	
If DHW from o		•						(64) x (3(13a) v (30	5) x (306) :	_	2074.34	(310a)
		•					0.04						=
Electricity use							0.01	× [(307a).	(3U/e) +	· (310a)((310e)] =	28.29	(313)
Cooling Syste	m Energ	y Efficie	ncy Rati	0								0	(314)
Space cooling	(if there	is a fixe	d coolin	g systen	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electricity for p	oumps a	nd fans	within dv	velling (T	Γable 4f)	:							_ _
mechanical ve	entilation	- baland	ed, extra	act or po	sitive in	out 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) + (330	0b) + (330g) =		136.21	(331)
Energy for lighting (calculated in Appendix L)				248.2	(332)
12b. CO2 Emissions – Community heating scheme					
	Energy kWh/year	Emission fact kg CO2/kWh		nissions CO2/year	
CO2 from other sources of space and water heating (not C Efficiency of heat source 1 (%)	HP) Pusing two fuels repeat (363) to	(366) for the second	d fuel	96	(367a)
CO2 associated with heat source 1 [(3	.07b)+(310b)] 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	(363)(366) + (368)(37	2)	=	651.27	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instar	ntaneous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			651.27	(376)
CO2 associated with electricity for pumps and fans within o	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) =				850.77	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =				16.91	(384)
El rating (section 14)				88.04	(385)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 20	12		Strom Softwa				Versio	n: 1.0.1.24	
		Pı	roperty	Address	: Flat 3					
Address :										
1. Overall dwelling dimer	nsions:		•	(0)					V 1 /	٥١
Ground floor				a(m²) 66.88	(1a) x		ight(m) 2.5	(2a) =	Volume(m	(3a
Total floor area TFA = (1a	ı)+(1b)+(1c)+(1d)+(1	e)+(1n) 6	6.88	(4)					
Dwelling volume					(3a)+(3b	o)+(3c)+(3c	d)+(3e)+	.(3n) =	167.2	(5)
2. Ventilation rate:								'		
Number of chimneys		secondar heating	у П + Г	other 0	7 = F	total 0	x	40 =	m³ per hou	ır (6a
Number of open flues]]			20 =		╡`
·		0]	0] ⁻	0			0	(6b
Number of intermittent far	1S				Ĺ	0		10 =	0	(7a
Number of passive vents					L	0	X	10 =	0	(7b
Number of flueless gas fir	es					0	X ·	40 =	0	(70
								Air ch	anges per h	our
Infiltration due to chimney	o fluor and fano (62) ((6b) (7	a) (7b) (70) -	Г		_			
Infilt <mark>ration</mark> due to chimney If a pressurisation test has be					continue f	0 rom (9) to		÷ (5) =	0	(8)
Number of storeys in th		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(,			(2)	()		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10
Structural infiltration: 0.2	25 for steel or timber	frame or	0.35 fo	r mason	y const	ruction			0	(11
if both types of wall are pre deducting areas of opening		sponding to	the great	ter wall are	a (after					
If suspended wooden fl		aled) or 0.	1 (seale	ed), else	enter 0				0	(12
If no draught lobby, ento	er 0.05, else enter 0								0	(13
Percentage of windows	and doors draught s	stripped							0	(14
Window infiltration				0.25 - [0.2	. ,	-			0	(15
Infiltration rate				(8) + (10)					0	(16
Air permeability value, out of the Air permeability value, or air permeability and the Air permeability value, or air permeabilit	•		•	•	•	netre of e	envelope	area	3	(17
Air permeability value applies						is beina u	sed		0.15	(18
Number of sides sheltered			0 0, 4 40,	g. 00 a po		.o .og u	000		3	(19
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.78	(20
Infiltration rate incorporati	ng shelter factor			(21) = (18) x (20) =				0.12	(21
Infiltration rate modified for	or monthly wind spee	d							•	
Jan Feb I	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	m ÷ 4									
<u> </u>	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
,		1 0.00			<u> </u>	1				

Aujusteu IIIIItia	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m	•			1	
0.15 Calculate effect	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
If mechanica		_	iale ioi l	пе аррп	саыс са	13 <i>E</i>						0.5	(23
If exhaust air he	at pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	,
(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		(24
b) If balance	d mecha	anical ve	entilation	without	heat red	covery (N	ИV) (24b)m = (22	2b)m + (23b)	•	•	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole he				•	•				5 × (23b	D)	•	•	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural v					•				0.5]	!	!		
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	· (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. Heat losses	and he	at loss i	naramet	or.									
ELEMENT	Gros area	SS	Openin	gs	Net Ar A ,r		U-valı W/m2		A X U	K)	k-value		A X k kJ/K
Doo <mark>rs</mark>					2.1	x	2	= [4.2				(26
Vin <mark>dows</mark> Type	1				19.23	x1	/[1/(0.8)+	0.04] =	14.91	Ħ			(27
Vindows Type	2				9.5	x1.	/[1/(0.8)+	0.04] =	7.36	Ħ			(27
Vindows Type	3				20.61	x1	/[1/(0.8)+	0.04] =	15.98	5			(27
Valls	95.5	5	51.4	4	44.06	$\frac{1}{3}$ x	0.13		5.73	Ħ r		–	(29
otal area of el					95.5								`` (31
for windows and			effective wi	ndow U-va		l lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	1 3.2	(-
* include the area	s on both	sides of ir	nternal wal	ls and par	titions								
abric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				48.18	(33
Heat capacity (,						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35
For design assess an be used instea				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridge				usina Ar	pendix l	K						8.1	(36
details of therma	•	,		О.	•							0.1	(2.5
otal fabric hea	at loss							(33) +	(36) =			56.28	(37
entilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m= 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 c	oefficier	nt, 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]	
					•	•		-			•	†	(39

Heat loss para	ımeter (I	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		
				ı		ı	l		Average =	Sum(40) ₁	12 /12=	1.04	(40)
Number of day		nth (Tab	le 1a)					ı					
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. Water hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		17		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed i			se target o).2		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r 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		
							- (2)			m(44) ₁₁₂ =		1082.42	(44)
Energy content of													
(45)m= 147.14	128.69	132.8	115.78	111.09	95.86	88.83	101.94	103.15	120.21	131.22	142.5		(45)
If inst <mark>antane</mark> ous w	vater heati	ng at point	of use (no	hot water	storage).	enter 0 in	boxes (46		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 storage		10.02	17.01	10.00	11.00	,0.02	10.20	10.11	10.00	10.00	21.00		(- /
Storage volum	ne (litres	includir	ng any so	olar or W	WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	ınk in dw	/elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage a) If manufact		oclared I	occ fact	or ie kna	wn (k\//k	2/d2v/).							(40)
•				JI IS KIIO	WII (KVVI	i/uay).					0		(48)
Temperature f Energy lost fro				oor			(48) x (49)	\ _			0		(49)
b) If manufact		•			or is not		(40) X (49)	, –		1	10		(50)
Hot water stor			-							0.	02		(51)
If community h	_		on 4.3										
Volume factor Temperature f			2h							-	03		(52)
·							(47) (54)) (5 0) (E0)		.6		(53)
Energy lost fro Enter (50) or		_	, KVVII/ye	ear			(47) X (31)) x (52) x (oo) =		03 03		(54) (55)
Water storage	` , ` `	,	for each	month			((56)m = ((55) × (41)	m	1.	03		(00)
	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
(56)m= 32.01 If cylinder contains												ix H	(30)
	28.92		30.98	32.01	30.98	32.01	32.01		•				(57)
(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		
Primary circuit	•	,			50 \	(EO) 0.5	\ - / / / ·				0		(58)
Primary circuit (modified by				,		` '	, ,		r tharma	etat)			
(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)
(00)111- 20.20	21.01	20.20	22.01	20.20	22.01	20.20	20.20	22.01	20.20	22.01	20.20		(30)

Combi loss ca	alculated	for each	month ((61)m =	(60) ÷	. 365 🗴 (41)m							
(61)m= 0	0	0	0	0	00).	0))	0	0	0	0]	(61)
	uired for	water h	L eating ca	Lalculated	l for e	L ach month	(62)	m =	0.85 × ((45)m +	(46)m +	(57)m +	נ · (59)m + (61)m	
(62)m= 202.42	·	188.08	169.27	166.37	149.3		157		156.65	175.49	184.72	197.78]	(62)
Solar DHW input	calculated	using App	endix G o	r Appendix	H (neg	gative quantit	y) (ent	ter '0'	' if no sola	r contribu	tion to wate	er heating))	
(add additiona														
(63)m= 0	0	0	0	0	0	0	C)	0	0	0	0	1	(63)
Output from v	vater hea	ter		•		•						•	-	
(64)m= 202.42	178.62	188.08	169.27	166.37	149.3	36 144.11	157	.21	156.65	175.49	184.72	197.78	1	
						•		Outp	out from wa	ater heate	er (annual)	112	2070.06	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ´[0.	85 × (45)m	ı + (6	31)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	n]	
(65)m= 93.15	82.73	88.38	81.29	81.16	74.6	7 73.76	78.	11	77.09	84.19	86.43	91.6]	(65)
include (57	m in cal	culation	of (65)m	only if c	ylinde	er is in the	dwell	ling	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a):										
Metabolic gai	ns (Table	e 5), Wat	ts											
Jan	Feb	Mar	Apr	May	Ju	n Jul	А	ug	Sep	Oct	Nov	Dec]	
(66)m= 108.4	108.4	108.4	108.4	108.4	108.	4 108.4	108	3.4	108.4	108.4	108.4	108.4		(66)
Ligh <mark>ting gains</mark>	(calcula	ted in Ap	pendix	L, equat	ion L9	or L9a),	ılso s	see	Table 5					
(67)m= 16.93	15.04	12.23	9.26	6.92	5.84	6.31	8.2	21	11.01	13.99	16.32	17.4		(67)
App <mark>liance</mark> s ga	ains (ca <mark>lc</mark>	ulated ir	Append	dix L, eq	uatior	1 L13 or L1	<mark>3</mark> a),	also	see Ta	ble 5				
(68)m= 189.91	191.88	186.91	176.34	163	150.4	15 142.07	140	0.1	145.07	155.64	168.99	181.53		(68)
Cooking gains	s (calcula	ited in A	ppendix	L, equat	tion L	15 or L15a), als	o se	e Table	5		-		
(69)m= 33.84	33.84	33.84	33.84	33.84	33.8	4 33.84	33.	84	33.84	33.84	33.84	33.84		(69)
Pumps and fa	ans gains	(Table 5	5a)										_	
(70)m= 0	0	0	0	0	0	0	C)	0	0	0	0]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)									
(71)m= -86.72	-86.72	-86.72	-86.72	-86.72	-86.7	'2 -86.72	-86	.72	-86.72	-86.72	-86.72	-86.72		(71)
Water heating	gains (T	able 5)												
(72)m= 125.2	123.11	118.79	112.9	109.08	103.7	71 99.14	104	.99	107.07	113.16	120.04	123.12		(72)
Total interna	l gains =	:			(66)m + (67)n	n + (68	3)m +	+ (69)m + ((70)m + (71)m + (72))m	_	
(73)m= 387.56	385.55	373.45	354.02	334.52	315.5	303.05	308	.82	318.68	338.31	360.87	377.57		(73)
6. Solar gain	is:													
Solar gains are		•				•	ations	to co	nvert to th	e applica		tion.		
Orientation:	Access F Table 6d		Area m²			Flux Fable 6a		т	g_ able 6b	7	FF able 6c		Gains (W)	
							1						. ,	٦
East 0.9x		×	19.		×	19.64] X		0.4	×	0.7	_ =	51.4	(76)
East 0.9x		X	19.		X _	38.42	X		0.4	×	0.7	=	100.54	 (76)
East 0.9x		×	19.		X _	63.27	X		0.4	×	0.7	=	165.57	 (76) −−−
East 0.9x		X	19.		X _	92.28	X	<u> </u>	0.4	×	0.7	=	241.48	[(76)
East 0.9x	1	X	19.	23	X	113.09	X		0.4	X	0.7	=	295.94	(76)

Cost	г					1			1					_			٦
East	0.9x	1		X	19.23	J X		15.77	X	0.4	×		0.7	_	=	302.95	」 (76)
East	0.9x	1		X	19.23	J X		10.22	X	0.4	×		0.7	_	=	288.42	」 (76)
East	0.9x	1		X	19.23	X	9	4.68	X	0.4	×		0.7	_	=	247.75	<u> </u> (76)
East	0.9x	1		X	19.23	X	7	3.59	X	0.4	×		0.7	_	=	192.57	」 (76)
East	0.9x	1		X	19.23	X	4	5.59	X	0.4	X		0.7	_	=	119.3	(76)
East	0.9x	1		X	19.23	X	2	4.49	X	0.4	X		0.7		=	64.08	(76)
East	0.9x	1		X	19.23	X	1	6.15	X	0.4	X		0.7		=	42.26	(76)
South	0.9x	0.54		X	9.5	X	4	6.75	X	0.4	X		0.7		=	60.44	(78)
South	0.9x	0.54		X	9.5	X	7	6.57	X	0.4	X		0.7		=	98.98	(78)
South	0.9x	0.54		X	9.5	X	9	7.53	X	0.4	X		0.7		=	126.09	(78)
South	0.9x	0.54		X	9.5	X	1	10.23	X	0.4	X		0.7		=	142.51	(78)
South	0.9x	0.54		X	9.5	X	1	14.87	X	0.4	x		0.7		=	148.5	(78)
South	0.9x	0.54		X	9.5	x	1	10.55	x	0.4	X		0.7		=	142.91	(78)
South	0.9x	0.54		x	9.5	x	10	08.01	x	0.4	x		0.7		=	139.63	(78)
South	0.9x	0.54		X	9.5	x	10	04.89	x	0.4	x		0.7		=	135.6	(78)
South	0.9x	0.54		X	9.5	j x	10	01.89	x	0.4	×		0.7	一	=	131.71	(78)
South	0.9x	0.54		X	9.5	j ×	8	2.59	x	0.4	×		0.7		=	106.76	(78)
South	0.9x	0.54		X	9.5	X	5	5.42	Х	0.4	X		0.7		=	71.64	(78)
South	0.9x	0.54		x	9.5	j ×		10.4	x	0.4	X	F	0.7	=	_	52.23	(78)
West	0.9x	0.54		x	20.61	×		9.64	×	0.4	X	H	0.7	Ħ	=	55.08	(80)
West	0.9x	0.54		x	20.61	i x	_	8.42	X	0.4	×	H	0.7		=	107.75	(80)
West	0.9x	0.54		x	20.61	x		3.27	X	0.4	×	H	0.7		_	177.46] (80)
West	0.9x	0.54	7	x	20.61	i ×		2.28) X	0.4	×	H	0.7	=	_	258.81](80)
West	0.9x	0.54		X	20.61	X	\vdash	13.09] x	0.4	×	H	0.7	=	_	317.18](80)
West	0.9x	0.54		X	20.61] ×		15.77] x	0.4	X		0.7	\dashv	_	324.69](80)
West	0.9x	0.54		X	20.61]		10.22] ^] _x	0.4	= ^	\vdash	0.7	+	_	309.12](80)
West	0.9x	0.54		X	20.61]	_	4.68] ^] x	0.4	$=$ $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$		0.7	=	_	265.53](80)
West	0.9x			X		╡	\vdash] ^] x		\dashv $\hat{\ }$			\dashv	_	206.39](80)
West	0.9x	0.54			20.61] X		3.59]]	0.4	=	\vdash	0.7	=			╡ .
West	L	0.54		X	20.61] X	_	5.59] X]	0.4	x		0.7	_	=	127.86](80)
West	0.9x	0.54		X	20.61] X	\vdash	4.49	X	0.4	×		0.7	=	=	68.68	<u></u> (80)
west	0.9x	0.54		X	20.61	X	1	6.15	X	0.4	X		0.7		=	45.3	(80)
0 - 1		-11-			.	a.			(00)	0 (7.1)	(00)						
Solar (83)m=	166.92	307.28	469.1	$\overline{}$	for each mon 642.8 761.6	_	70.55	737.17	(83)m 648	n = Sum(74)m $0.88 = 530.67$	353.	-	204.41	139.7	79	1	(83)
` '		l .			(84)m = (73) r				040	.00 000.07	1 333.	³² ⁴	204.41	100.1			(00)
(84)m=	554.47	692.83	842.5	_	` ' 		086.08		957	.71 849.35	692.	23 5	565.27	517.3	36		(84)
				_							1 33-						. ,
				,	heating seas			ivana Tah	-l- 0	Th4 (9C)							7,05)
•		•	-	•	eriods in the li	_			ле 9	, IIII (°C)						21	(85)
Utilisa				\neg	ving area, h1	Ť				ua Car	T 0	, 	Novi	D-			
(96)m=	Jan 0.99	Feb 0.97	Ma 0.91	\rightarrow	Apr Ma 0.77 0.58	`	Jun 0.4	Jul 0.29	0.3	ug Sep 33 0.55	0.80	-	Nov 0.98	0.99			(86)
(86)m=		<u> </u>				!			<u> </u>	!	0.80		0.90	0.98	J		(30)
				$\overline{}$	iving area T1	` —		i –			_					l	(07)
(87)m=	20.1	20.34	20.64	-	20.89 20.98	3	21	21	2	1 20.99	20.8	2	20.4	20.0	5		(87)

T	4	al				al a III a a	f T.	.b.l. 0 T	LO (0 0)					
1 emp (88)m=	erature 20.04	20.04	neating p	20.05	20.05	20.06	20.06	20.06	n2 (°C) 20.06	20.05	20.05	20.04		(88)
` ′			jains for				ļ	ļ	20.06	20.05	20.05	20.04		(00)
(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 tempei	rature in	the rest	of dwelli	na 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	1) =	0.56	(91)
Mean	interna	l tempei	rature (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	interna	temper	ature fro	m Table	4e, whe	ere appro	priate	•	-		
(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)
•			uirement											
			ternal ter or gains			ed at ste	ep 11 of	Table 9l	b, 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	tion fac	tor for g	ains, hm	:										
(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)
			, W = (9											(05)
(95)m=	546.84	666.24	753.59	740.37	603.47	409.52	273.48	286.45	440.1	580.01	547.16	512.14		(95)
(96)m=	4.3	4.9	ernal tem	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		_	an intern											, ,
(97)m=		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 requir	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)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	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1608.23	(98)
Space	e heatin	g requir	ement in	kWh/m²	² /year								24.05	(99)
9b. En	ergy red	quireme	nts – Cor	nmunity	heating	scheme								
			pace hea t from se								unity sch	neme.	0	(301)
	-		from co	-		-	_	1 4515 1	., •	0110		[[1	(302)
	-			•	-			allows for	CUD and	un to four	other heat	sources: th		(002)
			ny obtain he s, geotherr							ир то тоит с	olitei tieal	sources, u	ie iallei	
Fractio	n of hea	at from (Commun	ity boiler	'S								1	(303a)
Fractio	n of tota	al space	heat fro	m Comn	nunity bo	oilers				(3	02) x (303	a) =	1	(304a)
Factor	for con	trol and	charging	method	(Table	4c(3)) fo	r commu	unity hea	ating sys	tem			1	(305)
Distribu	ution los	ss factor	(Table 1	2c) for c	commun	ity heatii	ng syste	m				Ī	1.1	(306)
Space	heatin	g											kWh/ye	ear
Annual	space	heating	requiren	nent									1608.23	
Space	heat fro	om Com	munity b	oilers					(98) x (30	04a) x (305	5) x (306) :	= [1769.06	(307a)
Efficier	ncy of s	econdar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)	Ī	0	(308
												•		

	(20) (201)			7,,,,,
Space heating requirement from secondary/supplementar	ry system (98) x (301) x	100 ÷ (308) =	0	(309)
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	(310a)
Electricity used for heat distribution	0.01 × [(307a)(30	77e) + (310a)(310e)] =	40.46	(313)
Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not ent	ter 0) = (107) ÷ (314	1) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive inpu	t from outside		234.58	
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (33	0b) + (330g) =	234.58	(331)
Energy for lighting (calculated in Appendix L)			299	(332)
				_
12b. CO2 Emissions – Community heating scheme				
12b. CO2 Emissions – Community heating scheme	Energy	Emission factor		
	kWh/year	Emission factor	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not	kWh/year	kg CO2/kWh	kg CO2/year	(367a)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)	kWh/year	kg CO2/kWh	kg CO2/year	(367a) (367)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)	kWh/year CHP) HP using two fuels repeat (363) to	kg CO2/kWh 0 (366) for the second fu	kg CO2/year	
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1	kWh/year CHP) HP using two fuels repeat (363) to (307b)+(310b)] x 100 ÷ (367b) x	kg CO2/kWh 0 (366) for the second fue 0 0.52	kg CO2/year 96 910.38	(367)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution	kWh/year CHP) HP using two fuels repeat (363) to (307b)+(310b)] x 100 ÷ (367b) x [(313) x	kg CO2/kWh 0 (366) for the second fue 0 0.52	kg CO2/year 96 910.38 21	(367)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Total CO2 associated with community systems	kWh/year CHP) HP using two fuels repeat (363) to (307b)+(310b)] x 100 ÷ (367b) x [(313) x (363)(366) + (368)(369) x	kg CO2/kWh 0 (366) for the second fue 0 0.52	kg CO2/year 96 910.38 21 931.38	(367) (372) (373)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Total CO2 associated with community systems CO2 associated with space heating (secondary)	kWh/year CHP) HP using two fuels repeat (363) to (307b)+(310b)] x 100 ÷ (367b) x [(313) x (363)(366) + (368)(369) x	kg CO2/kWh 0 (366) for the second fun 0 0.52	kg CO2/year 96 910.38 21 931.38	(367) (372) (373) (374)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1 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 insta	(307b)+(310b)] x 100 ÷ (367b) x [(313) x (363)(366) + (368)(369) x (309) x (373) + (374) + (375) =	kg CO2/kWh 0 (366) for the second function 0 0.52 72) 0 0.22	kg CO2/year 96 910.38 21 931.38 0 0	(367) (372) (373) (374) (375)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1 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 instance to the content of th	(307b)+(310b)] x 100 ÷ (367b) x [(313) x (363)(366) + (368)(369) x (309) x (373) + (374) + (375) =	kg CO2/kWh 0 (366) for the second function 0 0.52 72) 0 0.22	kg CO2/year 96 910.38 21 931.38 0 931.38	(367) (372) (373) (374) (375) (376)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%) CO2 associated with heat source 1 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 instance to the content of th	kWh/year CHP) HP using two fuels repeat (363) to (307b)+(310b)] x 100 ÷ (367b) x [(313) x (363)(366) + (368)(376) x (309) x antaneous heater (312) x (373) + (374) + (375) = dwelling (331)) x (332))) x	kg CO2/kWh 0 (366) for the second function 0 0.52 72) 0 0.22	kg CO2/year 96 910.38 21 931.38 0 931.38 121.75	(367) (372) (373) (374) (375) (376) (378)

El rating (section 14)

(385)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 20	12		Strom Softwa				Versio	on: 1.0.1.24	
		Pı	roperty	Address	Flat 4					
Address :										
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 71.18	(1a) x		2.5	(2a) =	Volume(m ²	(3a
Total floor area TFA = (1a	u)+(1b)+(1c)+(1d)+(1d	e)+(1n	1) 7	71.18	(4)					
Dwelling volume					(3a)+(3b	o)+(3c)+(3c	d)+(3e)+	.(3n) =	177.95	(5)
2. Ventilation rate:										
Number of chimneys	heating	econdar heating	у 7 + Г	other	7 = 6	total	x	40 =	m³ per hou	ı r
·		0	╛╘	0	╛╘	0		20 =	0	=
Number of open flues	0 +	0] + L	0] = [0			0	(6b
Number of intermittent far	ns				L	0	X	10 =	0	(7a
Number of passive vents						0	Х	10 =	0	(7b
Number of flueless gas fir	es				Γ	0	X ·	40 =	0	(7c)
								Air ch	nanges <mark>per</mark> he	our
Infilt <mark>ration</mark> due to chi <mark>mne</mark> y	s, flues and fans = (6	Sa)+(6b)+(7	a)+(7b)+((7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be		ed, proceed	d to (17),	otherwise (continue f	rom (9) to	(16)			
Number of storeys in th	e dw <mark>elling</mark> (ns)								0	(9)
Additional infiltration	OF for stool or timber	frame ar	0.25 to		n a a mad	w a4! a .a	[(9)	-1]x0.1 =	0	(10
Structural infiltration: 0.3 if both types of wall are pre					-	ruction			0	(11
deducting areas of opening		-,	3		- (
If suspended wooden floor	,	led) or 0.	1 (seale	ed), else	enter 0				0	(12
If no draught lobby, ento									0	(13
Percentage of windows	and doors draught s	tripped		0.25 - [0.2	v (14) · ·	1001 -			0	(14
Window infiltration Infiltration rate				(8) + (10)	,	-	± (15) =		0	(15
Air permeability value, o	n50 expressed in cul	hic metre	s ner ho					area	0	(16
If based on air permeabilit	•		•	•	•	ictic oi c	rivelope	arca	0.15	(17
Air permeability value applies						is being u	sed		0.10	(
Number of sides sheltered	b								3	(19
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.78	(20
Infiltration rate incorporati	ng shelter factor			(21) = (18) x (20) =				0.12	(21
Infiltration rate modified for	or monthly wind spee	d • • • • •						1	1	
Jan Feb I	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7							,	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	m ÷ 4									
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
, ,							1		I	

· —	ation rat	· `	ng for sr	nelter an	d wind s	speed) =	(21a) x	(22a)m	1	T		1	
0.15 Calculate effec	0.15	0.14	0.13	0.12 he annli	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
If mechanica		_	rate for t	пс аррп	cabic ca	30						0.5	(23
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	eiency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]	
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		(24
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (23b)	-	-	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n				•	•				.5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural if (22b)n				•	•				0.5]	•	•	•	
4d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)	-	-	-		
5)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. Heat losse	s and he	eat loss i	oaramet	er:								_	_
LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U		k-value		A X k kJ/K
oors					2.1	x	2	= [4.2	$\dot{\Box}$			(26
/in <mark>dows</mark> Type	1				8.25	x1.	/[1/(0.8)+	0.04] =	6.4	Ħ			(27
indows Type	2				15.71	x1.	/[1/(0.8)+	0.04] =	12.18	Ħ			(2
/alls	91.8	В	26.0	6	65.74	1 x	0.13	=	8.55	Ħ r			(2
oof	71.1	8	0		71.18	3 x	0.12	<u> </u>	8.54	F i			(3
otal area of e	lements	, m²			162.9	8							(3
or windows and			effective wi	ndow U-va			formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragraph	1 3.2	`
include the area	s on both	sides of ir	nternal wal	ls and par	titions								
abric heat los		•	U)				(26)(30)) + (32) =				39.86	(3
eat capacity		,						((28)	(30) + (32	2) + (32a).	(32e) =	0	(3
hermal mass	•	•		,					tive Value			250	(3
or design assess n be used inste				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f		
nermal bridge				using Ap	pendix I	K						13.8	(3
details of therma	ıl bridging	are not kn	own (36) =	= 0.15 x (3	1)								
otal fabric he	at loss							(33) +	(36) =			53.66	(3
entilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))	,	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
8)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		(3
eat transfer o	oefficier	nt, W/K						(39)m	= (37) + (38)m		_	
9)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		
·													

Heat loss para	ımeter (I	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		
							l		Average =	Sum(40) ₁	12 /12=	0.95	(40)
Number of day	1	nth (Tab	le 1a)		ı	1		ı					
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. Water heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		27		(42)
Annual averag Reduce the annua not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed i			se target o		.86		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage is	n litres pe	r day for ea	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		
						_				m(44) ₁₁₂ =		1114.33	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 151.48	132.49	136.71	119.19	114.37	98.69	91.45	104.94	106.19	123.76	135.09	146.7		_
If instantaneous w	vater heati	ng at point	of use (no	hot water	storage)	enter () in	hoxes (46		Total = Su	m(45) ₁₁₂ =		1461.06	(45)
(46)m= 22.72	19.87	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22.01		(46)
Water storage		20.51	17.00	17.15	14.0	13.12	15.74	15,93	16.50	20.26	22.01		(40)
Storage volum		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage			(- /1.14/1	. /.1 \					1		
a) If manufact				or is kno	wn (kvvr	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro b) If manufact		•			or is not		(48) x (49)) =		1	10		(50)
Hot water stor			-							0.	02		(51)
If community h	neating s	see secti	on 4.3										
Volume factor										1.	03		(52)
Temperature f	actor fro	m Table	2b							0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		03		(54)
Enter (50) or (` , ` `	,								1.	03		(55)
Water storage	loss cal	culated	or each	month	г	1	((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 cylinder contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	/)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	m Table	3							0		(58)
Primary circuit				,	•		, ,						
(modified by			ı —	ı —	ı —			<u> </u>		'			4-11
(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 o	ralculated	for each	month ((61)m –	(60) -	- 365 √ (41)m							
(61)m= 0	0	0	0	0	00)	0))	0	0	0	0]	(61)
	auired for	water h	Leating ca	L	l for e	ach month	(62)	m =	0.85 × (′45)m +		(57)m +	ı · (59)m + (61)m	
(62)m= 206.7		191.99	172.68	169.64	152.		160		159.69	179.04	188.59	201.98]	(62)
Solar DHW inpu	ıt calculated	using App	endix G o	· Appendix	H (ne	gative quantit	y) (ent	ter '0'	if no sola	r contribu	tion to wate	er heating)	.	
(add addition						-								
(63)m= 0	0	0	0	0	0	0)	0	0	0	0]	(63)
Output from	water hea	ter				•						•	•	
(64)m= 206.7	6 182.41	191.99	172.68	169.64	152.	18 146.73	160	.22	159.69	179.04	188.59	201.98]	
	•			•	•	•	•	Outp	out from wa	ater heate	er (annual)	I12	2111.9	(64)
Heat gains fi	om water	heating,	kWh/m	onth 0.2	5 ′ [0	.85 × (45)m	n + (6	31)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m	n]	
(65)m= 94.59	83.99	89.68	82.43	82.25	75.6	74.63	79.	11	78.1	85.37	87.71	93]	(65)
include (5	7)m in cald	culation	of (65)m	only if c	ylind	er is in the	dwell	ling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a):										
Metabolic ga	ins (Table	5). Wat	ts											
Jan	T ,	Mar	Apr	May	Ju	n Jul	А	ug	Sep	Oct	Nov	Dec]	
(66)m= 113.7	2 113.72	113.72	113.72	113.72	113.	72 113.72	113	.72	113.72	113.72	113.72	113.72		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equ <mark>at</mark>	ion L	9 or L9a),	also s	see	Table 5					
(67)m= 17.83	3 15.84	12.88	9.75	7.29	6.1	5 6.65	8.6	64	11.6	14.73	17.19	18.33		(67)
Appliances of	ains (ca <mark>lc</mark>	ulated ir	Append	dix L, eq	uatio	n L13 or L1	3a),	also	see Tal	ble 5				
(68)m= 200.0	4 202.11	196.88	185.74	171.69	158.	48 149.65	147	.57	152.81	163.94	178	191.21		(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	tion L	15 or L15a), als	o se	e Table	5		•		
(69)m= 34.37	34.37	34.37	34.37	34.37	34.3	34.37	34.	37	34.37	34.37	34.37	34.37		(69)
Pumps and f	ans gains	(Table 5	 Ба)									•	-	
(70)m= 0	0	0	0	0	0	0	()	0	0	0	0		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	•					•	•	•	
(71)m= -90.9	3 -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	ıg gains (T	able 5)									•	•	•	
(72)m= 127.1	4 124.99	120.54	114.48	110.55	105.	01 100.31	106	.34	108.48	114.75	121.82	125]	(72)
Total intern	al gains =	:	•			(66)m + (67)r	n + (68	3)m +	- (69)m + ((70)m + (71)m + (72))m	•	
(73)m= 402.1	2 400.06	387.41	367.09	346.64	326.	76 313.72	319	.67	330	350.53	374.13	391.65		(73)
6. Solar gai	ns:										•			
Solar gains are	e calculated	using sola	r flux from	Table 6a	and as	sociated equa	ations	to co	nvert to th	e applica	ble orienta	tion.		
Orientation:			Area			Flux		_	g_	-	FF		Gains	
	Table 6d		m²		_	Table 6a	_		able 6b	_ '	able 6c		(W)	_
North 0.9	0.54	х	15.	71	x	10.63	X		0.4	x	0.7	=	22.73	(74)
North 0.9		х	15.	71	x	20.32	X		0.4	X	0.7	=	43.44	(74)
North 0.9	0.54	x	15.	71	x	34.53	X		0.4	X	0.7	=	73.82	(74)
North 0.9	0.54	X	15.	71	x	55.46	X		0.4	x	0.7	=	118.57	(74)
North 0.9	0.54	X	15.	71	X	74.72	X		0.4	X	0.7	=	159.73	(74)

									_				_
	0.9x 0.54	X	15.71	1 ×		79.99	X	0.4	X	0.7	=	170.99	(74)
North	0.9x 0.54	X	15.71	1 ×	7	74.68	X	0.4	X	0.7	=	159.64	(74)
North	0.9x 0.54	X	15.71	1 ×	5	59.25	X	0.4	X	0.7	=	126.66	(74)
North	0.9x 0.54	X	15.71	1 ×	4	11.52	X	0.4	X	0.7	=	88.75	(74)
North	0.9x 0.54	x	15.71	1 ×	2	24.19	X	0.4	X	0.7	=	51.71	(74)
North	0.9x 0.54	×	15.71	1 ×	1	3.12	X	0.4	X	0.7	=	28.04	(74)
North	0.9x 0.54	×	15.71	1 ×		8.86	X	0.4	X	0.7	=	18.95	(74)
West	0.9x 0.54	X	8.25	X	1	9.64	X	0.4	X	0.7	=	22.05	(80)
West	0.9x 0.54	x	8.25	X	3	88.42	X	0.4	X	0.7		43.13	(80)
West	0.9x 0.54	X	8.25	X	(6	3.27	X	0.4	X	0.7	=	71.03	(80)
West	0.9x 0.54	X	8.25	X	(9	92.28	x	0.4	X	0.7	=	103.6	(80)
West	0.9x 0.54	X	8.25	X	1	13.09	X	0.4	X	0.7	=	126.96	(80)
West	0.9x 0.54	X	8.25	X	1	15.77	X	0.4	X	0.7	=	129.97	(80)
West	0.9x 0.54	X	8.25	X	1	10.22	X	0.4	X	0.7	=	123.74	(80)
West	0.9x 0.54	X	8.25	X	(9	94.68	X	0.4	X	0.7	=	106.29	(80)
West	0.9x 0.54	X	8.25	×	7	73.59	x	0.4	X	0.7	=	82.62	(80)
West	0.9x 0.54	X	8.25	×	4	15.59	x	0.4	X	0.7	=	51.18	(80)
West	0.9x 0.54	X	8.25	X	2	24.49	Х	0.4	X	0.7	=	27.49	(80)
West	0.9x 0.54	×	8.25	×	1	6.15	х	0.4	x	0.7	-	18.13	(80)
Solar gair	ns in watts, <mark>ca</mark>	alculated	for each	month			(83)m	= Sum(74)m .	(82)m				
(83)m= 4	4.78 86.58	144.85	222.17	286.69	300.96	283.38	232.	.95 171.37	102.89	55.54	37.08		(83)
Total gair	ns – internal a	ind solar	(84)m = ((73)m +	(83)m	, watts							
(84)m = 4	46.9 486.63	532.27	589.27	633.34	627.72	597.11	552.		150 1	429.67	428.74		
			_				552.	62 501.37	453.43	429.67	420.74		(84)
7. Mean	internal temp	erature ((heating s				552.	62 501.37	455.4	429.67	420.74		(84)
	internal temp		,	season)					453.4	429.07	420.74	21	(84)
Tempera		eating p	eriods in t	season) the living	g area	from Tab			453.44	3 429.07	420.74	21	
Tempera	ature during h	eating p	eriods in t	season) the living	g area	from Tab		Th1 (°C)	Oct		Dec	21	
Tempera	ature during h	eating pains for li	eriods in t	season) the living	g area (see Ta	from Tab	ole 9,	Th1 (°C)				21	
Tempera Utilisatio	ature during hon factor for gall Jan Feb	eating positions for line Mar	eriods in t iving area Apr 0.95	season) the living a, h1,m (May 0.85	g area (see Ta Jun 0.66	from Tab able 9a) Jul 0.49	ole 9,	Th1 (°C) ug Sep 5 0.82	Oct	Nov	Dec	21	(85)
Utilisatio	ature during hon factor for g	eating positions for line Mar	eriods in to iving area Apr 0.95	season) the living a, h1,m (May 0.85	g area (see Ta Jun 0.66	from Tab able 9a) Jul 0.49	ole 9,	Th1 (°C) ug Sep 5 0.82 able 9c)	Oct	Nov 0.99	Dec	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2	ature during hon factor for gallon Feb 1 1 1 ternal temper 10.04 20.15	eating prains for line Mar 0.99 ature in l	eriods in to iving area Apr 0.95 iving area 20.65	the living A, h1,m (May 0.85 a T1 (fol 20.88	g area (see Ta Jun 0.66 low ste	from Tab able 9a) Jul 0.49 ps 3 to 7	Ole 9, 0.5 7 in T	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93	Oct 0.97	Nov 0.99	Dec 1	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera	ature during hon factor for gan Feb 1 1 ternal temper	eating prains for line Mar 0.99 ature in l	eriods in to iving area Apr 0.95 iving area 20.65 eriods in to iving area area area area area area area are	the living A, h1,m (May 0.85 a T1 (fol 20.88	g area (see Ta Jun 0.66 low ste	from Tab able 9a) Jul 0.49 ps 3 to 7	Ole 9, 0.5 7 in T	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C)	Oct 0.97	Nov 0.99 20.29	Dec 1	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2	ature during hon factor for gauge Jan Feb 1 1 ternal temper 20.04 20.15 ature during hon 1 20.11	eating prains for line Mar 0.99 ature in large 20.36 seating prains 120.11	eriods in to iving area Apr 0.95 iving area 20.65 eriods in to 20.12	the living a, h1,m (May 0.85 a T1 (fol 20.88 a rest of d 20.12	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13	Ole 9, Au 0.57 in T 20.9 able 9	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C)	Oct 0.97 20.64	Nov 0.99 20.29	Dec 1 20.02	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio	ature during hon factor for games Jan Feb 1 1 ternal temper 0.04 20.15 ature during hon factor for games	eating prains for line Mar 0.99 ature in l 20.36 eating prains for r	eriods in to iving area Apr 0.95 iving area 20.65 eriods in to 20.12 est of dweeters are a six of the control o	the living a, h1,m (May 0.85 a T1 (fol 20.88 rest of de 20.12 relling, h	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13	Ole 9, Ole 9,	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13	Oct 0.97 20.64 20.12	Nov 0.99 20.29	Dec 1 20.02 20.12	21	(85) (86) (87) (88)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m=	ature during hon factor for game and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb temper	meating properties of the control of	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94	the living a, h1,m (May 0.85 a T1 (fol 20.88 cest of decent of de	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13 ee Table 0.39	Ole 9, Ole 9,	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13	Oct 0.97 20.64 20.12 0.96	Nov 0.99 20.29	Dec 1 20.02	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int	pature during heart for grans and feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at tempe	eating prains for line ature in late ating prains for rature in the at	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94 the rest of	the living a, h1,m (May 0.85 a T1 (fol 20.88 arest of d 20.12 arelling, h 0.81 are discounted by the second are discounted by the s	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13 ee Table 0.39 ollow ste	Ole 9, Au 0.5 in T 20.9 able 9 20.1 9a) 0.4	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 0, Th2 (°C) 14 20.13 5 0.75 to 7 in Table	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12	Dec 1 20.02 20.12	21	(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int	ature during hon factor for game and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb temper	meating properties of the control of	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94 the rest of	the living a, h1,m (May 0.85 a T1 (fol 20.88 cest of decent of de	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13 ee Table 0.39	Ole 9, Ole 9,	Th1 (°C) ug Sep 5 0.82 table 9c) 99 20.93 0, Th2 (°C) 14 20.13 5 0.75 to 7 in Table 13 20.07	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12 0.99	Dec 1 20.02 20.12 1 18.8		(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int	pature during heart for grans and feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at tempe	eating prains for line ature in late ating prains for rature in the at	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94 the rest of	the living a, h1,m (May 0.85 a T1 (fol 20.88 arest of d 20.12 arelling, h 0.81 are discounted by the second are discounted by the s	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13 ee Table 0.39 ollow ste	Ole 9, Au 0.5 in T 20.9 able 9 20.1 9a) 0.4	Th1 (°C) ug Sep 5 0.82 table 9c) 99 20.93 0, Th2 (°C) 14 20.13 5 0.75 to 7 in Table 13 20.07	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12	Dec 1 20.02 20.12 1 18.8	0.33	(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int (90)m= 1	pature during heart for grans and feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at tempe	eating prains for line of the control of the contro	eriods in to iving area and a second singular and a second singula	the living a, h1,m (May 0.85 a T1 (fol 20.88 rest of d 20.12 relling, h 0.81 f dwelling 20.01	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58 ng T2 (fr 20.12	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13 ee Table 0.39 ollow ste 20.13	ole 9, O.5 in T 20.9 able 9 0.4 eps 3	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13 5 0.75 to 7 in Table 13 20.07	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12 0.99	Dec 1 20.02 20.12 1 18.8		(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int (90)m= 1	ature during hon factor for games and seed of the factor for games	ains for line ature in lature in table 20.11 ains for rature in table 20.29 ature in table 20.29 ature in table 20.29 ature (for 19.64	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 120.12 est of dwo 0.94 the rest of 19.71 r the whole 20.02	the living a, h1,m (May 0.85 a T1 (fol 20.88 arest of d 20.12 arelling, h 0.81 arelling and decided are also a	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58 log T2 (fi 20.12 ling) = fi 20.41	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13 ee Table 0.39 ollow stee 20.13 LA × T1 20.42	9a) 0.4 0.5 0.5 0.6 0.5 0.6 0.6 0.6 0.7 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13 5 0.75 to 7 in Tabl 13 20.07 f	Oct 0.97 20.64 20.12 0.96 e 9c) 19.7 LA = Liv	Nov 0.99 20.29 20.12 0.99 19.2 ving area ÷ (-	Dec 1 20.02 20.12 1 18.8		(85) (86) (87) (88) (89)

(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. Space hea	ting req	uirement	i e										
Set Ti to the i					ned at ste	ep 11 of	Table 9	b, so tha	nt Ti,m=(76)m an	d re-calc	ulate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac		l		Iviay	Juli	Jui	L	Оер		INOV	Dec		
(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)
Useful gains,	hmGm	, W = (9	4)m x (8	4)m	!		<u> </u>	l	<u> </u>	l			
(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)
Monthly avera	age exte	rnal tem	perature	from T	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	for me	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 heatin		1	1	i e	1				i 	r -			
(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/yea	r) = Sum(9	08) _{15,912} =	2157.19	(98)
Space heatin	g require	ement in	kWh/m²	²/year							[30.31	(99)
9b. Energy red	quiremer	nts – Coi	mmunity	heating	scheme								
This part is us							.	•		unity scl	neme.		_
Fraction of spa	ace heat	from se	condary	/suppler	nentary I	neating	(Table 1	1) '0' if n	one			0	(301)
Fraction of spa	ace heat	from co	<mark>mmu</mark> nity	y syste <mark>m</mark>	1 - (30	1) =						1	(302)
The community so					-				up to four	other heat	sources; th	ne latter	
includes boilers, h Fraction of hea					from powe	r stations.	See Appe	ndix C.			Г	1	(303a)
											. [1	= ` ` `
Fraction of total	al space	heat fro	m Comn	nunity b	oilers				(3	02) x (303	sa) =	1	(304a)
Factor for cont	rol and	charging	method	l (Table	4c(3)) fo	r commi	unity hea	ating sys	tem			1	(305)
Distribution los	s factor	(Table 1	12c) for (commun	ity heatii	ng syste	m				ſ	1.1	(306)
Space heating	9										_	kWh/yea	 r
Annual space	heating	requiren	nent								ſ	2157.19	
Space heat fro	m Comi	munity b	oilers					(98) x (3	04a) x (30	5) x (306)	= [2372.91	(307a)
Efficiency of se	econdar	v/supple	mentarv	heating	svstem	in % (fro	om Table	e 4a or A	ppendix	E)	Ţ	0	(308
Space heating	,		•	•	•	,			' ' 01) x 100 ·	,	L T	0	(309)
opace nearing	require	nont no	111 300011	idai y/3d	ppicificii	tary 3y3	CIII	(00) // (0	01) X 100	. (666) –	L		(000)
Water heating											Г		\neg
Annual water h	_	-									L	2111.9	
If DHW from co Water heat fro								(64) x (3	03a) x (30	5) x (306)	_ [2323.09	(310a)
Electricity used		•					0.01	× [(307a)			L	46.96	(313)
Cooling System				0				[()	()	(0.700)	[0	(314)
	_	•	•		n if not a	ontor (1)		_ (107) :	_ (214) =		[r		(314)
Space cooling	,					,		= (107) ÷	- (314) =		Ĺ	0	(313)
Electricity for p mechanical ve							outside				Г	249.66	(330a)
vo		Jaiaile	, OAH	o, pc		- 5 0111	22.0140				L	2-70.00	()

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b	b) + (330g) =		249.66	(331)
Energy for lighting (calculated in Appendix L)				314.94	(332)
12b. CO2 Emissions – Community heating scheme					
	Energy kWh/year	Emission fact kg CO2/kWh		nissions CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using	g two fuels repeat (363) to	(366) for the second	d fuel	96	(367a)
CO2 associated with heat source 1 [(307b)+((310b)] 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	(363)(366) + (368)(372	2)	=	1080.97	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantane	eous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1080.97	(376)
CO2 associated with electricity for pumps and fans within dwelling	ng (331)) x	0.52	=	129.58	(378)
CO2 associated with electricity for lighting	(332))) 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	Details:						
Assessor Name: Software Name:	Stroma FSA	AP 2012		Strom Softwa				Versic	on: 1.0.1.24	
		Р	roperty	Address	: Flat 5					
Address: 1. Overall dwelling dimen	nsions:									
The Overall awailing alliner	1010110.		Are	a(m²)		Av. Hei	ight(m)		Volume(m³)	
Ground floor			4	12.57	(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)+(1d)+(1e)+(1ı	n) <u> </u>	06.14	(4)			1		_
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	265.35	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hour	
Number of chimneys	0	+ 0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fan	ıs					0	X '	10 =	0	(7a)
Number of passive vents						0	x '	10 =	0	(7b)
Number of flueless gas fire	es					0	X 4	40 =	0	(7c)
Infiltration due to chimneys					continue fr	0 om (9) to (Air ch	nanges per hou	ur](8)
Number of storeys in the	e dwelling (ns))					r(a)		0	(9)
Additional infiltration Structural infiltration: 0.2	25 for steel or	timber frame or	0 35 fo	r masoni	v constr	uction	[(9)	-1]x0.1 =	0	(10) (11)
if both types of wall are pre deducting areas of opening	esent, use the val	ue corresponding to			•	401.011			0	」 (、,)
If suspended wooden flo			.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else e	nter 0							0	(13)
Percentage of windows	and doors dra	aught stripped		0.05 10.0		201			0	(14)
Window infiltration Infiltration rate				0.25 - [0.2] (8) + (10)	. ,	-	L (15) —		0	(15)
Air permeability value, o	150 expressed	d in cubic metre	s per ho	. , , , ,	, , ,	, , ,	, ,	area	3	(16) (17)
If based on air permeabilit	•		•		•	00	0.0 p 0	u. • u	0.15	(18)
Air permeability value applies	if a pressurisation	n test has been dor	ne or a de	gree air pe	rmeability	is being us	sed			
Number of sides sheltered Shelter factor	d			(20) = 1 -	[0 075 x (1	9)1 =			2	(19)
Infiltration rate incorporating	na shelter fact	or		(21) = (18		/ 1			0.85	(20)
Infiltration rate modified fo	•			•	• •				0.10	۱٬۳۰/
	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table								_	
(22)m= 5.1 5 4	1.9 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			
	!	!			ļ	!	<u> </u>			J		
Adjusted infiltration rate (allowing				<u> </u>	`	` ´				1		
0.16 0.16 0.16 Calculate effective air change ra	0.14 ote for th	0.14 ne applio	0.12 cable ca	0.12 Se	0.12	0.13	0.14	0.14	0.15			
If mechanical ventilation:	110 101 11	то арртс	Jabio oa	00							0.5	(23a)
If exhaust air heat pump using Append	dix N, (23	3b) = (23a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)				0.5	(23b)
If balanced with heat recovery: efficien	ncy in %	allowing fo	or in-use f	actor (from	n Table 4h) =				6	3.7	(23c)
a) If balanced mechanical ven	itilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1	1 – (23c)	÷ 100]		_
(24a)m= 0.34 0.34 0.34	0.32	0.32	0.3	0.3	0.3	0.31	0.32	0.32	0.33			(24a)
b) If balanced mechanical ven	itilation	without	heat rec	covery (N	/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 ventil		•	-									
if $(22b)m < 0.5 \times (23b)$, the	<u> </u>			· ` `	ŕ		5 × (23b	i e		1		
(24c)m = 0 0 0	0	0	0	0	0	0	0	0	0			(24c)
d) If natural ventilation or wholif (22b)m = 1, then (24d)m		•	•				0.51					
$(24d)_{m=0} 0 0 0$	0	0	0	0	0.5 + [(2	0	0.5]	0	0			(24d)
Effective air change rate - ente			-				Ü					
(25)m= 0.34 0.34 0.34	0.32	0.32	0.3	0.3	0.3	0.31	0.32	0.32	0.33	l		(25)
										ı		
3. Heat losses and heat loss pa			Not Ar	00	Llvol	110	A V I I	_	k volus	,	A V	`le
	aramete Openino m²	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	〈)	k-value kJ/m²-ł		A X kJ/ł	
ELEMENT Gross	Openin	gs						<)				
ELEMENT Gross area (m²)	Openin	gs	A ,r	m ²	W/m2	=	(W/I	<) 				K
ELEMENT Gross area (m²) Doors	Openin	gs	A ,r	m ² x x1/	W/m2 2	0.04] =	4.2	<) 				(26)
ELEMENT Gross area (m²) Doors Windows Type 1	Openin	gs	A ,r 2.1 6.21	x1/	W/m2 2 /[1/(0.8)+	0.04] = [0.04] = [4.2 4.81	<) 				(26) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2	Openin	gs	A ,r 2.1 6.21 9.55	x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+	$ \begin{array}{ccc} & & & \\ & & \\ & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\$	4.2 4.81 7.4	<) 				(26) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3	Openin	gs	A ,r 2.1 6.21 9.55 9.82	x1/ x1/ x1/ x1/	W/m ² 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	4.2 4.81 7.4 7.61	<)				(26) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77	x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [4.2 4.81 7.4 7.61 4.47	\$) 				(26) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55	x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [(W/I 4.2 4.81 7.4 7.61 4.47 7.4	<)				(26) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	$ \begin{array}{ccc} & & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & & & & \\ & & & & \\ & & & & $	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04	<)				(26) (27) (27) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	$ \begin{vmatrix} 0.04 \\ 0.04 \end{vmatrix} = \begin{vmatrix} 0.04 \\ $	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	$ \begin{vmatrix} $	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10	Opening m	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36	\(\) \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\				(26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 40.22	Opening m ²	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type1 Walls Type2 39.17	25.58 21.82	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 3 39.17 Walls Type 3 39.17	25.58 21.82 20.5	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64 17.35	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8	0.04] = [0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26 2.43	•) ——————————————————————————————————				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 40.22 Walls Type 3 39.17 Walls Type 3 39.17 Roof 31.06	25.58 21.82	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64 17.35 18.67 31.06	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26	\(\) \((26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 3 39.17 Walls Type 3 39.17	25.58 21.82 20.5	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64 17.35	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8	0.04] = [0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26 2.43	\$)				(26) (27) (27) (27) (27) (27) (27) (27) (27

* for windows and roof wind ** include the areas on both	h sides of ir	nternal wali	ls and par	titions								
Fabric heat loss, W/K						(26)(30)	+ (32) =				67.15	(33)
Heat capacity Cm = S	S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass parame	eter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
For design assessments w can be used instead of a de			construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridges : S (I	_xY) cal	culated ι	using Ap	pendix I	<						11.1	(36)
if details of thermal bridging	g are not kn	own (36) =	= 0.15 x (3	11)								_
Total fabric heat loss							(33) +	(36) =			78.25	(37)
Ventilation heat loss of	alculated	d monthly	/	ī	ı	Γ		= 0.33 × (25)m x (5)	·	1	
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 transfer coefficie	ent, 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		_
Llast lass novemeter /	7 II D) AV	/ma 21/						Average =		12 /12=	106.35	(39)
Heat loss parameter ((40)m= 1.02 1.02	` 	1	1	0.00	0.99	0.98	0.99	= (39)m ÷		1.01		
(40)m= 1.02 1.02	1.02			0.99	0.99	0.96		Average =	1.01	1.01	1	(40)
Number of days in mo	onth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 / 12=		(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 Water heating ene	erav reau	irement:								k\Wh/ve	ar.	
4. Water heating end	ergy requ	irement:						ŧ		kWh/ye	ear:	
Assumed occupancy, if TFA > 13.9, N = 1	N + 1.76 x		(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (⁷	ΓFA -13.		kWh/ye	ear:	(42)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1	N + 1.76 x	[1 - exp						ΓFA -13.	9)	79	ear:	
Assumed occupancy, if TFA > 13.9, N = 1	N + 1.76 x vater usage hot water	[1 - exp ge in litre usage by s	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		9)		ear:	(42)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per	N + 1.76 x rater usage to hot water r person per	ge in litre usage by a day (all w	es per da 5% if the d rater use, i	ay Vd,av dwelling is thot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	9)	79	ear:	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average.	N + 1.76 x rater usage to hot water r person per	[1 - exp ge in litre usage by s r day (all w Apr	es per da 5% if the d rater use, i May	ay Vd,av dwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36		9)	79	ear:	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per Jan Feb	N + 1.76 x rater usage hot water reperson per Mar er day for ea	ge in litre usage by s r day (all w Apr ach month	es per da 5% if the c rater use, i May Vd,m = fa	ay Vd,av dwelling is thot and co Jun ctor from	erage = designed in display Jul	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Ge target of	9) 10: Nov	79 5.74 Dec	ear:	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb	N + 1.76 x rater usage hot water r person per Mar er day for ea	[1 - exp ge in litre usage by s r day (all w Apr	es per da 5% if the d rater use, i May	ay Vd,av dwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us Sep	Oct	Nov	79 5.74 Dec		(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per Jan Feb	+ 1.76 x rater usage hot water reperson per Mar er day for ea	ge in litre usage by s r day (all w Apr ach month	es per da 5% if the o rater use, i May Vd,m = fa 99.39	ay Vd,av dwelling is hot and co Jun ctor from 1	erage = designed id) Jul Table 1c x 95.17	(25 x N) to achieve Aug (43) 99.39	+ 36 a water us Sep 103.62	Oct 107.85 Total = Sur	Nov 112.08 m(44) ₁₁₂ =	79 5.74 Dec	1268.87	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08	N + 1.76 x rater usage hot water reperson per Mar er day for each 107.85	ge in litre usage by s r day (all w Apr ach month	es per da 5% if the o rater use, i May Vd,m = fa 99.39	ay Vd,av dwelling is hot and co Jun ctor from 1	erage = designed id) Jul Table 1c x 95.17	(25 x N) to achieve Aug (43) 99.39	+ 36 a water us Sep 103.62	Oct 107.85 Total = Sur	Nov 112.08 m(44) ₁₁₂ =	79 5.74 Dec		(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08	N + 1.76 x rater usage hot water reperson per Mar er day for each 107.85	ge in litre usage by s r day (all w Apr ach month 103.62	es per da 5% if the d rater use, i May Vd,m = fa 99.39	ay Vd,av twelling is hot and co Jun ctor from 7 95.17	erage = designed id) Jul Table 1c x 95.17	(25 x N) to achieve Aug (43) 99.39	+ 36 a water us Sep 103.62 0 kWh/mon 120.92	Oct 107.85 Total = Suith (see Ta	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83	79 5.74 Dec 116.31 c, 1d) 167.05		(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08	N + 1.76 x rater usage hot water reperson per Mar 107.85 rused - cal	ge in litre usage by ser day (all wash month 103.62	es per da 5% if the coater use, I May Vd,m = fa 99.39 onthly = 4.	ay Vd,av dwelling is hot and co Jun ctor from 7 95.17 190 x Vd,r	erage = designed and ld) Jul Table 1c x 95.17 m x nm x E 104.13	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49	+ 36 a water us Sep 103.62 0 kWh/mon 120.92	Oct 107.85 Total = Sun 140.92	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83	79 5.74 Dec 116.31 c, 1d) 167.05	1268.87	(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86	N + 1.76 x rater usage hot water reperson per Mar 107.85 rused - cal	ge in litre usage by ser day (all wash month 103.62	es per da 5% if the coater use, I May Vd,m = fa 99.39 onthly = 4.	ay Vd,av dwelling is hot and co Jun ctor from 7 95.17 190 x Vd,r	erage = designed and ld) Jul Table 1c x 95.17 m x nm x E 104.13	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49	+ 36 a water us Sep 103.62 0 kWh/mon 120.92	Oct 107.85 Total = Sun 140.92	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83	79 5.74 Dec 116.31 c, 1d) 167.05	1268.87	(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63	N + 1.76 x rater usage hot water reperson per Mar 107.85 107.85 r used - cal 155.67 ting at point 23.35	ge in litre usage by s r day (all w Apr ach month 103.62 culated mo 135.72 f of use (no	Pes per da 5% if the content use, if the conte	ay Vd,av dwelling is hot and co Jun ctor from 7 95.17 190 x Vd,r 112.38 r storage), 16.86	erage = designed to ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92	+ 36 a water us Sep 103.62 0 kWh/more 120.92 0 to (61) 18.14	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (21.14)	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 = c, 1d) 167.05	1268.87	(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss:	N + 1.76 x rater usage hot water reperson per Mar 107.85 107.85 155.67 155.67 155.67 23.35	ge in litre usage by sor day (all was Apr ach month 103.62 culated month 135.72 cof use (not 20.36)	es per da 5% if the coater use,	ay Vd,av dwelling is hot and co Jun ctor from 7 190 x Vd,r 112.38 r storage), 16.86	erage = designed and ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa	+ 36 a water us Sep 103.62 0 kWh/more 120.92 0 to (61) 18.14	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (21.14)	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb. Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss: Storage volume (litres of the storage volume) (116.31 112.08)	N + 1.76 x rater usage hot water reperson per Mar 107.85 107.85 rused - cal 155.67 ting at point 23.35 s) includir and no tal	ge in litre usage by s r day (all w Apr ach month 103.62 culated mo 135.72 f of use (no 20.36 and any so ank in dw	es per da 5% if the content use, if May Vd,m = fa 99.39 onthly = 4. 130.23 o hot water 19.53 olar or Water velling, e	ay Vd,av dwelling is hot and co Jun ctor from 1 95.17 190 x Vd,r 112.38 r storage), 16.86 WHRS	erage = designed idd) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa (47)	+ 36 a water us Sep 103.62 0 kWh/mor 120.92 0 to (61) 18.14 ame vess	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (see Tail 140.92) Total = Sunth (see Tail 140.92)	Nov 112.08 m(44) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot we reduce the annual average not more that 125 litres per Jan Feb. Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss: Storage volume (litres of the litres rater usage hot water reperson per Mar 107.85 107.85 155.67 123.35 1 includir and no tall hot water states at hot water states and no tall hot water states at hot water states and no tall hot water states at hot water states and no tall hot water states at hot water	ge in litre usage by strated month 103.62 culated month 20.36 gany so ank in dwer (this in	es per da 5% if the co tater use, i May Vd,m = fa 99.39 onthly = 4. 130.23 o hot water 19.53 olar or W yelling, e	ay Vd,av dwelling is hot and co Jun ctor from 1 95.17 190 x Vd,r 112.38 r storage), 16.86 WHRS enter 110 nstantar	erage = designed of ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa (47)	+ 36 a water us Sep 103.62 0 kWh/mor 120.92 0 to (61) 18.14 ame vess	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (see Tail 140.92) Total = Sunth (see Tail 140.92)	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46) (47)	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb. Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss: Storage volume (litres of the storage volume) (116.31 112.08)	N + 1.76 x rater usage hot water reperson per larger day for ear larg	ge in litre usage by s r day (all w Apr 103.62 culated mo 135.72 cof use (no 20.36 and any so ank in dw er (this in	es per da 5% if the co tater use, i May Vd,m = fa 99.39 onthly = 4. 130.23 o hot water 19.53 olar or W yelling, e	ay Vd,av dwelling is hot and co Jun ctor from 1 95.17 190 x Vd,r 112.38 r storage), 16.86 WHRS enter 110 nstantar	erage = designed of ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa (47)	+ 36 a water us Sep 103.62 0 kWh/mor 120.92 0 to (61) 18.14 ame vess	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (see Tail 140.92) Total = Sunth (see Tail 140.92)	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46)

. 9,) x (49) =	110		(50)
b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02		(51)
If community heating see section 4.3		0.02		(31)
Volume factor from Table 2a		1.03		(52)
Temperature factor from Table 2b		0.6		(53)
Energy lost from water storage, kWh/year (47	(i) x (51) x (52) x (53) =	1.03		(54)
Enter (50) or (54) in (55)		1.03		(55)
Water storage loss calculated for each month ((56)	$6)m = (55) \times (41)m$			
(56)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 3	32.01 30.98 32.01	30.98 32.01		(56)
If cylinder contains dedicated solar storage, (57) m = (56) m x $[(50) - (H11)] \div (50)$, (50)	else (57)m = (56)m where (I	H11) is from Append	ix H	
(57)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 3	32.01 30.98 32.01	30.98 32.01		(57)
Primary circuit loss (annual) from Table 3		0		(58)
Primary circuit loss calculated for each month (59)m = $(58) \div 365$	× (41)m			
(modified by factor from Table H5 if there is solar water heating		stat)		
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 2	23.26 22.51 23.26	22.51 23.26		(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m		•		
(61)m= 0 0 0 0 0 0 0 0	0 0 0	0 0		(61)
Total heat required for water heating calculated for each month (62)	$2 \text{ m} = 0.85 \times (45) \text{ m} + 0.000 \text{ m}$	(46)m + (57)m +	(59)m + (61)m	
	74.77 174.41 196.2	207.32 222.32		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (e				
(add additional lines if FGHRS and/or WWHRS applies, see Appe		on to mater meaning,		
(63)m= 0 0 0 0 0 0	0 0 0	0 0		(63)
Output from water heater		<u> </u>		
	74.77 174.41 196.2	207.32 222.32		
	Output from water heater	(annual) ₁₁₂	2314.53	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m +	(61)m] + 0.8 x [(46)m	+ (57)m + (59)m	1	
	33.95 83 91.08	93.94 99.76		(65)
include (57)m in calculation of (65)m only if cylinder is in the dwe	elling or hot water is fr	om community h	eating	
5. Internal gains (see Table 5 and 5a):	oming or mot mater to m		- Coming	
,				
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul	Aug Sep Oct	Nov Dec		
	39.48 139.48 139.48	139.48 139.48		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also				` '
	1.49 15.42 19.58	22.85 24.36		(67)
		22.00		()
Appliances gains (calculated in Appendix L, equation L13 or L13a) (68)m= 265.89 268.65 261.7 246.89 228.21 210.65 198.92 19	96.16 203.11 217.91	236.6 254.16		(68)
		230.0 234.10		(00)
Cooking gains (calculated in Appendix L, equation L15 or L15a), a		20.05		(60)
` '	36.95 36.95 36.95	36.95 36.95		(69)
Pumps and fans gains (Table 5a)		0 0		(70)
(70)m= 0 0 0 0 0 0 0	0 0 0	0 0		(70)
Losses e.g. evaporation (negative values) (Table 5)				
	11.58 -111.58 -111.58	-111.58 -111.58		(71)

Water	heating	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	2 130.48	134.09]	(72)
Total	internal	gains =				•	(66)	m + (67)m	1 + (68	3)m + (69)m +	(70)m +	(71)m + (72))m	4	
(73)m=	490.96	488.63	472.67	446.81	420.38	3	95.01	378.57	385	.33 398.65	424.7	'5 454.77	477.46]	(73)
6. So	lar gains	S:													
Solar	gains are o	calculated u	using solai	flux from	Table 6a	and	l assoc	iated equa	tions	to convert to t	he appli	cable orientat	tion.		
Orient		ccess F	actor	Area			Flu			g_ 		FF		Gains	
	_	Table 6d		m²			I al	ble 6a		Table 6b) 	Table 6c		(W)	
East	0.9x	1	X	6.2	21	X	1	9.64	X	0.4	X	0.7	=	16.6	(76)
East	0.9x	1	X	9.8	32	X	1	9.64	X	0.4	X	0.7	=	26.25	(76)
East	0.9x	1	X	6.	5	X	1	9.64	X	0.4	x	0.7	=	17.37	(76)
East	0.9x	1	X	5.6	62	X	1	9.64	X	0.4	X	0.7	=	15.02	(76)
East	0.9x	1	X	6.2	21	X	3	88.42	X	0.4	X	0.7	=	32.47	(76)
East	0.9x	1	X	9.8	32	X	3	88.42	X	0.4	X	0.7	=	51.34	(76)
East	0.9x	1	X	6.	5	X	3	88.42	x	0.4	X	0.7	=	33.98	(76)
East	0.9x	1	X	5.6	52	X	3	88.42	x	0.4	X	0.7	=	29.38	(76)
East	0.9x	1	X	6.2	21	X	6	3.27	X	0.4	X	0.7		53.47	(76)
East	0.9x	1	x	9.8	32	х	6	3.27	x	0.4	X	0.7		84.55	(76)
East	0.9x	1	X	6.	5	Х	6	33.27	x	0.4	X	0.7	=	55.97	(76)
East	0.9x	1	X	5.6	52	X	6	33.27	X	0.4	X	0.7	=	48.39	(76)
East	0.9x	1	X	6.2	21	X	9	2.28	X	0.4	X	0.7	=	77.98	(76)
East	0.9x	1	X	9.8	32	x	9	2.28	Х	0.4	X	0.7	=	123.31	(76)
East	0.9x	1	X	6.	5	Х	9	2.28	X	0.4	х	0.7	=	81.62	(76)
East	0.9x	1	X	5.6	62	Х	9	2.28	X	0.4	х	0.7	=	70.57	(76)
East	0.9x	1	X	6.2	21	X	1	13.09	X	0.4	X	0.7	=	95.57	(76)
East	0.9x	1	X	9.8	32	X	1	13.09	X	0.4	X	0.7	=	151.13	(76)
East	0.9x	1	X	6.	5	X	1	13.09	X	0.4	X	0.7	=	100.03	(76)
East	0.9x	1	X	5.6	32	X	1	13.09	X	0.4	X	0.7	=	86.49	(76)
East	0.9x	1	X	6.2	21	X	1	15.77	X	0.4	X	0.7	=	97.83	(76)
East	0.9x	1	X	9.8	32	X	1	15.77	X	0.4	X	0.7	=	154.7	(76)
East	0.9x	1	X	6.	5	X	1	15.77	X	0.4	X	0.7	=	102.4	(76)
East	0.9x	1	X	5.6	62	X	1	15.77	X	0.4	X	0.7	=	88.54	(76)
East	0.9x	1	X	6.2	21	X	1	10.22	X	0.4	X	0.7	=	93.14	(76)
East	0.9x	1	X	9.8	32	X	1	10.22	X	0.4	X	0.7	=	147.29	(76)
East	0.9x	1	X	6.	5	X	1	10.22	x	0.4	X	0.7	=	97.49	(76)
East	0.9x	1	X	5.6	52	X	1	10.22	x	0.4	X	0.7	=	84.29	(76)
East	0.9x	1	X	6.2	21	X		94.68	x	0.4	x	0.7	=	80.01	(76)
East	0.9x	1	X	9.8	32	X		94.68	x	0.4	x	0.7	=	126.52	(76)
East	0.9x	1	X	6.	5	X	9	94.68	x	0.4	x	0.7	=	83.74	(76)
East	0.9x	1	x	5.6	52	x	9	94.68	x	0.4	×	0.7	=	72.41	(76)

	_												_
East	0.9x	1	X	6.21	X	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	х	5.62	x	45.59	x	0.4	X	0.7	=	34.87	(76)
East	0.9x	1	х	6.21	x	24.49	x	0.4	X	0.7	=	20.69	(76)
East	0.9x	1	х	9.82	x	24.49	x	0.4	X	0.7	=	32.72	(76)
East	0.9x	1	х	6.5	x	24.49	x	0.4	x	0.7] =	21.66	(76)
East	0.9x	1	х	5.62	x	24.49	x	0.4	x	0.7] =	18.73	(76)
East	0.9x	1	х	6.21	x	16.15	x	0.4	x	0.7] =	13.65	(76)
East	0.9x	1	х	9.82	x	16.15	х	0.4	x	0.7] =	21.58	(76)
East	0.9x	1	х	6.5	x	16.15	x	0.4	X	0.7	=	14.29	(76)
East	0.9x	1	х	5.62	x	16.15	x	0.4	x	0.7] =	12.35	(76)
South	0.9x	0.54	х	9.55	x	46.75	x	0.4	X	0.7	=	60.76	(78)
South	0.9x	0.54	x	9.55	X	46.75	Х	0.4	X	0.7	=	60.76	(78)
South	0.9x	0.54	х	5.57	х	46.75	x	0.4	x	0.7	=	35.44	(78)
South	0.9x	0.54	х	4.07	х	46.75	x	0.4	x	0.7	=	25.89	(78)
South	0.9x	0.54	х	9.55	x	76.57	x	0.4	x	0.7	=	99.5	(78)
South	0.9x	0.54	x	9.55	x	76.5 <mark>7</mark>	Х	0.4	x	0.7] =	99.5	(78)
South	0.9x	0.54	х	5.57	x	76.57	X	0.4	x	0.7] =	58.04	(78)
South	0.9x	0.54	х	4.07	х	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	х	9.55	x	114.87	x	0.4	X	0.7	=	149.28	(78)
South	0.9x	0.54	х	9.55	x	114.87	x	0.4	X	0.7	=	149.28	(78)
South	0.9x	0.54	х	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	х	9.55	x	110.55	x	0.4	x	0.7] =	143.66	(78)
South	0.9x	0.54	х	9.55	x	110.55	x	0.4	x	0.7	j =	143.66	(78)
South	0.9x	0.54	x	5.57	x	110.55	x	0.4	x	0.7	j =	83.79	(78)
South	0.9x	0.54	х	4.07	х	110.55	x	0.4	x	0.7	j =	61.23	(78)
South	0.9x	0.54	x	9.55	x	108.01	x	0.4	X	0.7	j =	140.37	(78)
	_						-				_		_

South	ا م م	0.54	1	0.55	1	400.04	1 .,	0.4	۱	0.7	1 _	440.07	7(70)
South	0.9x	0.54] X	9.55	X 1	108.01	X 1	0.4	X	0.7	= 	140.37	(78)
South	0.9x	0.54	X	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	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	X	101.89] X]	0.4	X	0.7	= 	77.23	(78)
	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	l X	82.59] X 1	0.4	X	0.7	= 	107.33	[78]
South South	0.9x	0.54	X	9.55	X	82.59	X 1	0.4	X	0.7	= 	107.33	(78)
	0.9x	0.54	X	5.57	X	82.59	J X I	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	<u> </u> (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	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	Х	0.4	X	0.7	=	42	<u> </u> (78)
South	0.9x	0.54	X	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	X	0.4	X	0.7	=	52.5	<u> </u> (78)
South	0.9x	0.54	X	9.55	X	40.4	X	0.4	X	0.7	=	52.5	<u> </u> (78)
South	0.9x	0.54	X	5.57	X	40.4	Х	0.4	X	0.7	=	30.62	<u> </u> (78)
South	0.9x	0.54	X	4.07	Х	40.4	X	0.4	X	0.7	=	22.37	(78)
West	0.9x	0.54	X	5.77	Х	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	X	5.24	X	110.22	X	0.4	X	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	x	94.68	x	0.4	X	0.7	=	67.51	(80)
West	0.9x	0.54	X	5.77	x	73.59	x	0.4	X	0.7	=	57.78	(80)
West	0.9x	0.54	X	5.24	X	73.59	X	0.4	X	0.7	=	52.47	(80)

West	0.9x	0.54	X	5.7	77	x	4	5.59	x		0.4	X	0.7	=	35.8	(80)
West	0.9x	0.54	х	5.2	24	x	4	5.59	x		0.4	X	0.7	=	32.51	(80)
West	0.9x	0.54	Х	5.7	77	x	2	24.49	x		0.4	X	0.7	=	19.23	(80)
West	0.9x	0.54	Х	5.2	24	x	2	24.49	x		0.4	X	0.7	=	17.46	(80)
West	0.9x	0.54	Х	5.7	77	x	1	6.15	X		0.4	X	0.7	=	12.68	(80)
West	0.9x	0.54	Х	5.2	24	x	1	6.15	x		0.4	X	0.7	=	11.52	(80)
	_			'		•			-							
Solar g	ains in	watts, ca	alculated	d for eac	h month				(83)n	n = Si	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	565.93	347.23	244.06		(83)
Total ga	ains – ii	nternal a	nd sola	r (84)m =	= (73)m ·	+ (8	33)m	, watts					_		1	
(84)m=	778.47	992.82	1191.29	1369.68	1472.29	14	44.28	1388.34	130	80.0	1189.27	990.68	802	721.52		(84)
7. Mea	an inter	nal temp	erature	(heating	season)										
Tempe	erature	during h	eating p	periods ir	n the livii	ng	area t	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisa	tion fac	tor for g	ains for	living are	ea, h1,m	(s	ee Ta	ble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.94	0.82	0.65	(0.46	0.33	0.3	37	0.6	0.89	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollo	w ste	ps 3 to 7	7 in 1	able	e 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)
Tomp	oroturo	during h	ooting r	eriods ir	roct of	dw	olling	from To	blo (0 T					•	
(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	1	(88)
L						_	'		_		20.00		20.00	1 =0.0.		(==)
		0.97		rest of d		_	m (se _{0.4}		_	2 7	0.52	0.86	0.98	1	1	(89)
(89)m= [0.99	0.97	0.92	0.78	0.59		0.4	0.26	0.	3	0.52	0.86	0.96	1		(89)
				the rest		_	·		 	$\overline{}$			_		1	
(90)m=	18.82	19.18	19.58	19.93	20.05	2	0.09	20.09	20	.1	20.08	19.87		18.77		(90)
											Ť	LA = Liv	ving area ÷ (4) =	0.19	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	LA × T1	+ (1	– fL	A) x T2				_	
(92)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.	27	20.25	20.05	19.49	19		(92)
Apply	adjustn	nent to t		n interna	temper	_		m Table	4e,	whe	re appro	priate			1	
(93)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.	27	20.25	20.05	19.49	19		(93)
		ting requ														
				•		ned	at ste	ep 11 of	Tab	le 9t	o, so tha	t Ti,m=	=(76)m an	d re-cal	culate	
	Jan	Feb	Mar	using Ta	May	Г	Jun	Jul	Ι ,	ug	Sep	Oct	Nov	Dec	1	
L Utilisa		tor for g	!	<u> </u>	Iviay	_	Juli	Jui		ug	Sep	Oci	1100	l Dec	J	
(94)m=	0.99	0.97	0.91	0.78	0.6		0.41	0.28	0.3	31	0.54	0.85	0.98	0.99]	(94)
L	l gains,	hmGm .	W = (9	4)m x (8	L 4)m	<u> </u>			<u> </u>						J	
(95)m=		962.29	· `	1074.27	881.78	59	91.12	383.92	403	.79	638.2	846.37	7 782.11	716.67]	(95)
Month	ly aver	age exte	rnal ten	nperature	from Ta	abl	e 8		!					•	J	
(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 le	oss rate	e for mea	an interr	nal tempe	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	– (96)m]			•	
(97)m=	1599.67	1566.47	1431.35	1192.18	905.28	59	93.34	384.11	404	.14	647.8	1002.9	3 1321.96	1587.9		(97)
Space	heatin	g require	ement fo	r each n	nonth, k	Wh	/mon	th = 0.02	24 x	[(97)	m – (95)m] x (41)m		1	
(98)m=	616.55	406.01	255.16	84.89	17.48		0	0	()	0	116.49	388.69	648.19		

			_
	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 he Fraction of space heat from secondary/supplementary heating		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedu	re allows for CHP and up to four other heat sources; t	he latter	
includes boilers, heat pumps, geothermal and waste heat from power station			7(000-)
Fraction of heat from Community boilers	(202) (202-)	1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for comr	, , ,	1	(305)
Distribution loss factor (Table 12c) for community heating sys	tem	1.1	(306)
Space heating Annual space heating requirement		kWh/year 2533.47	기
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2786.81	 ☐(307a)
Efficiency of secondary/supplementary heating system in % (1		0	」` ′ □(308
Space heating requirement from secondary/supplementary sy		0	(309)
Water heating Annual water heating requirement		2314.53	٦
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) + (310a)(310e)] =	53.33	(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 fro	m 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		110.02	
125. CO2 Emissions Community hearing constitu	Energy Emission factor	Emissions	
	kWh/year kg CO2/kWh	kg CO2/year	
CO2 from other sources of space and water heating (not CHF Efficiency of heat source 1 (%) If there is CHP us	P) sing two fuels repeat (363) to (366) for the second fue	96	(367a)
CO2 associated with heat source 1 [(307b)	o)+(310b)] x 100 ÷ (367b) x	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	sion heater or instant	aneous 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 dw	velling (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)

Appendix C - Step Three - 'Clean' Output Document and Energy Report Figures

		Harri Baratta				
		User Details:				
Assessor Name:	0. 5015.0010	Stroma N		., .		
Software Name:	Stroma FSAP 2012	Software '		Versio	n: 1.0.1.24	
A dalam a a	Р	roperty Address: flat	1			
Address: 1. Overall dwelling dimens	sions:					
1. Overall awelling aiment	5013.	Area(m²)	Av. Height(m)	Volume(m³)	
Ground floor		57.7 (1a)		(2a) =	144.25	(3a)
First floor		45.67 (1b)	x 2.5	(2b) =	114.17] (3b)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1e)+(1r	1) 103.37 (4)				_
Dwelling volume		,	+(3b)+(3c)+(3d)+(3e)+.	(3n) =	258.42	(5)
2. Ventilation rate:					200.42](0)
2. Ventilation rate.	main secondar heating heating	y other	total		m³ per hour	
Number of chimneys	heating heating + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fans	S		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	anges <mark>per</mark> hou	ır
Infiltration due to chimneys	, flues and fans = $(6a)+(6b)+(7a)$	7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
	en ca <mark>rried o</mark> ut or is int <mark>ended,</mark> procee	d to (17), otherwise continu	ue from (9) to (16)	r		_
Number of storeys in the	dwelling (ns)			2) 41 0 4	0	(9)
Additional infiltration	E for atool or timber frame or	. 0 25 for magazini aq		9)-1]x0.1 =	0](10)](44)
	5 for steel or timber frame or sent, use the value corresponding to set, if equal user 0.35			l	0	<u>(11)</u>
	or, enter 0.2 (unsealed) or 0	.1 (sealed), else ente	r 0		0	(12)
If no draught lobby, enter	r 0.05, else enter 0			Ī	0	(13)
Percentage of windows a	and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11)	+ (12) + (13) + (15) =	Ţ	0	(16)
Air permeability value, q	50, expressed in cubic metre	es per hour per square	e metre of envelop	e area	3	(17)
If based on air permeability	value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		Ī	0.15	(18)
Air permeability value applies in	f a pressurisation test has been dor	ne or a degree air permeal	ility is being used			_
Number of sides sheltered		(22)	(40)7	[3	(19)
Shelter factor		(20) = 1 - [0.075]		Ī	0.78	(20)
Infiltration rate incorporating	g shelter factor	$(21) = (18) \times (20)$)) =		0.12	(21)
Infiltration rate modified for		, , , , , , , , , , , , , , , , , , , 				
Jan Feb M	lar Apr May Jun	Jul Aug S	ep Oct Nov	/ Dec		
Monthly average wind spee	ed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

M* - 1 = - ((00-) (00) 4		
Wind Factor $(22a)m = (22)m \div 4$ $(22a)m = 1.27 $	95 0.92 1 1.08 1.12 1.18	
Adjusted infiltration rate (allowing for shelter and wind spee	<u>, , , , , , , , , , , , , , , , , , , </u>	
0.15 0.15 0.14 0.13 0.12 0.11 0. Calculate effective air change rate for the applicable case	1 0.11 0.12 0.12 0.13 0.14	
If mechanical ventilation:		0.5 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) \times Fmv (equation of the second of the sec	on (N5)) , otherwise (23b) = (23a)	0.5 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor	(from Table 4h) =	77.35 (23c)
a) If balanced mechanical ventilation with heat recovery	MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$]
(24a)m= 0.26 0.26 0.26 0.24 0.24 0.22 0.		(24a)
b) If balanced mechanical ventilation without heat recove		
		(24b)
c) If whole house extract ventilation or positive input vent if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise		
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(24c)
d) If natural ventilation or whole house positive input vent		,
if $(22b)m = 1$, then $(24d)m = (22b)m$ otherwise $(24d)m$		
(24d)m= 0 0 0 0 0		(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or	(24d) in box (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. Heat losses and heat loss parameter:		
ELEMENT Gross Openings Net Area	U-value A X U k-value	A X k
ELEMENT Gross Openings Net Area A ,m²	W/m2K (W/K) kJ/m²-K	kJ/K
ELEMENT Gross Openings Met Area A, m² Doors 2.1	W/m2K (W/K) kJ/m ² -K x 2 = 4.2	kJ/K (26)
ELEMENT Gross Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69		kJ/K (26) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 2 Openings m² A, m² 2.1 Net Area A, m² 2.1 3.69 4.83		kJ/K (26) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01	W/m2K	kJ/K (26) (27) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Vindows Type 4 5.01	W/m2K	kJ/K (26) (27) (27) (27) (27)
ELEMENTGross area (m²)Openings m²Net Area A ,m²Doors2.1Windows Type 13.69Windows Type 24.83Windows Type 33.01Windows Type 45.01Floor57.7		kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type 1 54.06 8.52 45.54	W/m2K (W/K) kJ/m²-K x 2 = 4.2 x1/[1/(0.8)+0.04] = 2.86 x1/[1/(0.8)+0.04] = 3.74 x1/[1/(0.8)+0.04] = 2.33 x1/[1/(0.8)+0.04] = 3.88 x 0.13 = 7.501 x 0.13 = 5.92	kJ/K (26) (27) (27) (27) (27) (27) (28)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Walls Type2 48.74 Walls Type2 40.72		kJ/K (26) (27) (27) (27) (27) (28) (29)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Total area of elements, m² 162.61	W/m2K (W/K) kJ/m²-K x 2 = 4.2 x1/[1/(0.8) + 0.04] = 2.86 x1/[1/(0.8) + 0.04] = 3.74 x1/[1/(0.8) + 0.04] = 2.33 x1/[1/(0.8) + 0.04] = 3.88 x 0.13 = 7.501 x 0.13 = 5.92 x 0.13 = 5.29	kJ/K (26) (27) (27) (27) (27) (28) (29) (31)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Total area of elements, m² 162.61 Party wall 44.05	W/m2K (W/K) kJ/m²-K x 2 = 4.2 x1/[1/(0.8)+0.04] = 2.86 x1/[1/(0.8)+0.04] = 3.74 x1/[1/(0.8)+0.04] = 2.33 x1/[1/(0.8)+0.04] = 3.88 x 0.13 = 7.501 x 0.13 = 5.92 x 0.13 = 5.92 x 0.13 = 5.29	kJ/K (26) (27) (27) (27) (27) (28) (29)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 Walls Type2 48.74 Total area of elements, m² 162.61	W/m2K (W/K) kJ/m²-K x 2 = 4.2 x1/[1/(0.8)+0.04] = 2.86 x1/[1/(0.8)+0.04] = 3.74 x1/[1/(0.8)+0.04] = 2.33 x1/[1/(0.8)+0.04] = 3.88 x 0.13 = 7.501 x 0.13 = 5.92 x 0.13 = 5.92 x 0.13 = 5.29	kJ/K (26) (27) (27) (27) (27) (28) (29) (31)
ELEMENT Gross area (m²) Openings m² Net Area A , m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 8.52 45.54 Walls Type2 48.74 8.02 40.72 Total area of elements, m² 162.61 Party wall 44.05	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	kJ/K (26) (27) (27) (27) (27) (28) (29) (31)
Party wall Poors Gross area (m²) Doors Quantification (m²) Poors Quantification (m²) Poors Quantification (m²) Quantification	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)
Party wall FLEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Floor Walls Type 1 Total area of elements, m² Party wall * for windows and roof windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U)	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Floor Walls Type 1 Total area of elements, m ² Party wall * for windows and roof windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K For design assessments where the details of the construction are not kno	W/m2K x 2 = 4.2 x1/[1/(0.8) + 0.04] = 2.86 x1/[1/(0.8) + 0.04] = 3.74 x1/[1/(0.8) + 0.04] = 2.33 x1/[1/(0.8) + 0.04] = 3.88 x 0.13 = 7.501 x 0.13 = 5.92 x 0.13 = 5.92 x 0.13 = 5.29 x 0.13 = 5.29 x 0.13 = 5.29 x 0.13 = 5.29 3 x 1/[1/(0.8) + 0.04] = 3.88 x 1/[1/(0.8) + 0.04] = 3.88 x 0.13 =	kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)
ELEMENT Gross area (m²) Openings m² Net Area A ,m² Doors 2.1 Windows Type 1 3.69 Windows Type 2 4.83 Windows Type 3 3.01 Windows Type 4 5.01 Floor 57.7 Walls Type1 54.06 8.52 45.54 Walls Type2 48.74 8.02 40.72 Total area of elements, m² 162.61 Party wall 44.05 * for windows and roof windows, use effective window U-value calculated ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	W/m2K x 2 = 4.2 x1/[1/(0.8)+0.04] = 2.86 x1/[1/(0.8)+0.04] = 3.74 x1/[1/(0.8)+0.04] = 2.33 x1/[1/(0.8)+0.04] = 3.88 x 0.13 = 7.501 x 0.13 = 5.92 x 0.13 = 5.92 x 0.13 = 5.29 x 0.13 = 5.29 x 0.13 = 5.29 x 0.13 = 5.29 x 0.13 = 3.88 x 0	kJ/K (26) (27) (27) (27) (27) (28) (29) (31) (32)

if details of therma	0 0	are not kn	own (36) =	= 0.15 x (3	1)			(22)	(0.0)				-
Total fabric he				_				` '	(36) =	(OE) (E)		48.94	(37)
Ventilation hea				<u> </u>		Ι	Α.	` '		25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(38)
(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		(30)
Heat transfer of	coefficier	nt, W/K			·	1		(39)m	= (37) + (38)m	1	1	
(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		_
Heet less nors	motor (l	JI D) \\\	/m2l/						_	Sum(39) ₁	12 /12=	69.44	(39)
Heat loss para (40)m= 0.69	0.69	0.68	0.67	0.67	0.66	0.66	0.66	0.66	= (39)m ÷	0.67	0.68	1	
(40)m= 0.69	0.69	0.66	0.67	0.67	0.66	0.66	0.66					0.67	(40)
Number of day	/s in moi	nth (Tab	le 1a)					,	average =	Sum(40) ₁	12 / 1 Z=	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. Water heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
Veerimed occi	inanay l	NI										1	(40)
Assumed occu if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)1 + 0.0	0013 x (ΓFA -13		.77		(42)
if TFA £ 13.9			L	())			,_,	(
Annual averag											5.22		(43)
Redu <mark>ce the</mark> annua	\					-	to achieve	a water us	se target o	f			
		_							0.1			1	
Jan Hot water usage is	Feb	Mar day for or	Apr	May	Jun	Jul Table 10 x	Aug	Sep	Oct	Nov	Dec		
							` ′					1	
(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		–
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x C	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		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		
			•	•	•	•			Γotal = Su	m(45) ₁₁₂ =	=	1655.45	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46 ₎) to (61)					_
(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)
Water storage												1	
Storage volum	, ,		•			•		ame ves	sel		0		(47)
If community h	•			•			` '		(01 ! - /	(47)			
Otherwise if no Water storage		not wate	er (tnis in	iciudes i	nstantar	neous co	iloa iamo	ers) ente	er o in (47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day).					0	l	(48)
Temperature f				51 10 IUI	("aay).]]	(49)
•				oor			(49) v (40)				0] 1	, ,
Energy lost from b) If manufact		•	-		or is not		(48) x (49)	, =		1	10	J	(50)
Hot water stora			-							0.	.02]	(51)
If community h	-			`								ı	` '
Volume factor	from Ta	ble 2a								1.	.03		(52)
Temperature 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	55)								1.	.03		(55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	Н
(57)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (58)m + (48)m + (58)m + (48)m$	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 DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(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	
Output from water heater (annual) ₁₁₂	2306.29 (64)
Heat gains from water heating, kWh/month $0.25^{\circ}[0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$	
(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)
	(00)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community hea	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community hea	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat. 5. Internal gains (see Table 5 and 5a):	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat. 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	ating
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43 138.43	ating
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	ating (66)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	ating (66)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat states of the community from the community heat states of the community from the community fr	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat states of the community of the c	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 138.43	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heat 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67) (68) (69) (70)

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

North	
North	(74)
North	(74)
North	(74)
North	(74)
North	(74)
North 0.9x 0.77 x 5.01 x 20.32 x 0.4 x 0.7 = 19.75 North 0.9x 0.77 x 3.69 x 34.53 x 0.4 x 0.7 = 24.72 North 0.9x 0.77 x 4.83 x 34.53 x 0.4 x 0.7 = 32.36 North 0.9x 0.77 x 3.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 <tr< td=""><td>(74)</td></tr<>	(74)
North 0.9x 0.77 x 3.69 x 34.53 x 0.4 x 0.7 = 24.72 North 0.9x 0.77 x 4.83 x 34.53 x 0.4 x 0.7 = 32.36 North 0.9x 0.77 x 3.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 33.57 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 51.98 <td>(74)</td>	(74)
North 0.9x 0.77 x 4.83 x 34.53 x 0.4 x 0.7 = 32.36 North 0.9x 0.77 x 3.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 33.57 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 51.98	(74)
North 0.9x 0.77 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 20.17 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 5.01 x 34.53 x 0.4 x 0.7 = 33.57 North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 3.69 x 55.46 x 0.4 x 0.7 = 39.71 North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 4.83 x 55.46 x 0.4 x 0.7 = 51.98 North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
North 0.9x 0.77 x 3.01 x 55.46 x 0.4 x 0.7 = 32.39	(74)
3.40	(74)
	(74)
North 0.9x 0.77 x 5.01 x 55.46 x 0.4 x 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 x 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 x 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 x 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 x 41.52 x 0.4 x 0.7 = 40.36	(74)
North 0.9x 0.77 x 3.69 x 24.19 x 0.4 x 0.7 = 17.32	(74)
North 0.9x 0.77 x 4.83 x 24.19 x 0.4 x 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	X	2	4.19	X		0.4	X	0.7	=	23.52	(74)
North	0.9x	0.77	X	3.6	69	X	1	3.12	X		0.4	x	0.7	=	9.39	(74)
North	0.9x	0.77	X	4.8	33	X	1	3.12	x		0.4	x	0.7	=	12.29	(74)
North	0.9x	0.77	X	3.0)1	x	1	3.12	X		0.4	х	0.7	=	7.66	(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	3.6	69	x	8	3.86	х		0.4	_ x [0.7	_ =	6.35	(74)
North	0.9x	0.77	X	4.8	33	x	8	8.86	x		0.4	x	0.7	_ =	8.31	(74)
North	0.9x	0.77	x	3.0)1	x	8	3.86	x		0.4	_ x [0.7	_ =	5.18	(74)
North	0.9x	0.77	x	5.0)1	x	8	3.86	x		0.4	= x	0.7	_ =	8.62	(74)
	_															
Solar g	ains in	watts, ca	alculated	d for eac	h month				(83)m	n = Su	ım(74)m .	(82)m				
(83)m=	34.13	65.22	110.82	178.01	239.79	_	56.71	239.67	190	.15	133.24	77.63	42.1	28.45		(83)
Total g	ains – i	nternal a	nd sola	r (84)m =	= (73)m	+ (8	33)m	, watts					•			
(84)m=	521.49	550.07	579.63	621	656.48	64	48.25	615.03	572	.42	528.94	499.39	493.72	502.54		(84)
7 Mea	an inter	nal temp	erature	(heating	seasor)							•			
		during h		,		<i>'</i>	area f	from Tah	۵ مار	Th	1 (°C)				21	(85)
		tor for g	•			-			oic o	,	i (O)				21	(00)
Utilisa		Feb	Mar		l .	ΤÌ		Jul			Sep	Oct	Nov	Dec		
(96)	Jan	1	0.99	Apr 0.97	May 0.88	-	Jun 0.66	0.49	0.5	ug	0.83	0.98	1	Dec 1		(86)
(86)m=			0.99	0.97	0.00		J.66	0.49	0.0	04	0.03	0.96				(00)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	in T	able	9c)					
(87)m=	20.34	20.41	20.55	20.77	20.93	2	0.99	21	2	1	20.97	20.77	20.53	20.33		(87)
Temp	erature	during h	eating p	periods in	n rest of	dw	elling	from Ta	ble 9	9, Th	12 (°C)					
(88)m=	20.35	20.35	20.35	20.37	20.37	2	20.38	20.38	20.	38	20.37	20.37	20.36	20.36		(88)
Utilisa	tion fac	tor for g	ains for	rest of d	welling	h2	m (se	e Table	9a)							
(89)m=	1	1	0.99	0.97	0.84	_	0.6	0.42	0.4	17	0.78	0.97	1	1	1	(89)
` ′ L						<u>. </u>	T0 //	" ,				- ·		l	J	
г		l temper		1	1	Ť	·			$\overline{}$			1 40 70	10.44	1	(00)
(90)m=	19.45	19.56	19.77	20.08	20.3	2	20.37	20.38	20.	38	20.35	20.09	19.73	19.44		(90)
											·	LA = LIVI	ng area ÷ (4	+) =	0.29	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	LA × T1	+ (1	– fL	A) × T2		_	-	_	
(92)m=	19.71	19.81	20	20.28	20.49	2	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(92)
Apply	adjustr	nent to th	ne meai	n interna	l temper	atu	re fro	m Table	4e,	whe	re appro	priate			-	
(93)m=	19.71	19.81	20	20.28	20.49	2	0.56	20.56	20.	56	20.53	20.29	19.96	19.7		(93)
8. Spa	ace hea	ting requ	ıiremen	t												
						ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=	(76)m an	d re-cal	culate	
the uti		factor fo		T T	i -			1					1	ı	1	
[Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
г		tor for g		T .		_									1	(0.1)
(94)m=	1	1	0.99	0.96	0.85	(0.62	0.44	0.4	19	0.79	0.97	1	1		(94)
г		hmGm ,	<u> </u>	, ` `	' 	_		i		-					1	
(95)m=	520.61	548.39	574.84	598.56	558.81	_	01.52	269.11	281	.49	419.27	486.09	491.68	501.9		(95)
г	-	age exte		ri e	ı	_				. 1			1		1	(00)
(96)m=	4.3	4.9	6.5	8.9	11.7		14.6	16.6	16		14.1	10.6	7.1	4.2		(96)
г		for mea											T		1	(07)
(97)m=	1097.49	1058.13	954.76	790.83	608.41	40	05.04	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	5)ml 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	l per year	(kWh/year	r) = 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 heating Fraction of space heat from secondary/supplementary heating (T	.	•		unity scheme.	0	(301)
Fraction of space heat from community system $1 - (301) =$., •			1	(302)
The community scheme may obtain heat from several sources. The procedure all	lows for	CHP and	up to four	 other heat sources; ti		
includes boilers, heat pumps, geothermal and waste heat from power stations. Se			•	, 		7(202-)
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			•	02) x (303a) =	0.6	(304a)
Fraction of total space heat from community heat source 2			•	02) x (303b) =	0.4	(304b)
Factor for control and charging method (Table 4c(3)) for commun	•	ating sys	tem		1	(305)
Distribution loss factor (Table 12c) for community heating system					1.1	(306)
Space heating Annual space heating requirement					kWh/yea 2095.88	r
Space heat from Community CHP		(09) v (2	040) v (20)	5) x (306) =		(307a)
					1383.28	(307b)
Space heat from heat source 2	Toble			5) x (306) =	922.19	╡` ′
Efficiency of secondary/supplementary heating system in % (from				,	0	(308
Space heating requirement from secondary/supplementary system	m	(90) X (3	01) x 100 -	(306) =	0	(309)
Water heating Annual water heating requirement					2306.29	7
If DHW from community scheme: Water heat from Community CHP		(64) x (3	03a) x (30	5) x (306) =	1522.15	一 (310a)
Water heat from heat source 2		(64) x (3	03b) x (30	5) x (306) =	1014.77	(310b)
Electricity used for heat distribution	0.01			(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 o	utside				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)
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) × 100 ÷ (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) × 100 ÷ (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 fu	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	on	[(313) x	0.52	= 25.13	(372)
Total CO2 associated with commun	nity systems	(363)(366) + (368)(372	2)	= 687.57	(373)
CO2 associated with space heating	g (secondary)	(309) x	0	= 0	(374)
CO2 associated with water from im	mersion heater or instantane	ous heater (312) x	0.22	= 0	(375)
Total CO2 associated with space a	nd water heating	(373) + (374) + (375) =		687.57	(376)
CO2 associated with electricity for	pumps and fans within dwelli	ng (331)) x	0.52	= 163.63	(378)
CO2 associated with electricity for	lighting	(332))) x	0.52	= 229.38	(379)
Tot <mark>al C</mark> O2, kg/year	sum of (376)(382) =			1080.58	(383)
Dwelling CO2 Emission Ra	te (383) ÷ (4) =			10.45	(384)
El rating (section 14)				90.24	(385)

			User [Details:						
Assessor Name: Software Name:	Stroma FSAP 20°	12		Strom				Versio	on: 1.0.1.24	
		Pi	roperty	Address	Flat 2					
Address :										
1. Overall dwelling dimer	nsions:									
Ground floor				ea(m²) 50.32	(1a) x		ight(m) 2.5	(2a) =	Volume(mi	³) (3a
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1d	e)+(1n) [50.32	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	125.8	(5)
2. Ventilation rate:										
Number of chimneys	heating	econdar heating	у 7 + Г	other	7 = 6	total		40 =	m³ per hou	_
•		0	╛╘	0	╛╘	0		20 =	0	(6a
Number of open flues	0 +	0]	0] = [0			0	(6b
Number of intermittent fan	S				L	0	X	10 =	0	(7a
Number of passive vents					L	0	X	10 =	0	(7b
Number of flueless gas fir	es					0	X	40 =	0	(7c
								Air ch	nanges <mark>per</mark> he	our
Infilt <mark>ration</mark> due to chi <mark>mne</mark> y	s, flues and fans = (Sa)+(6b)+(7	a)+(7b)+	(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be	en ca <mark>rried o</mark> ut or is intend	ed, proceed	d to (17),	otherwise of	continue f	rom (9) to	(16)			_
Number of storeys in the	e dw <mark>elling</mark> (ns)								0	(9)
Additional infiltration Structural infiltration: 0.2	OF for otaal or timber	frame ar	0.25 fo				[(9)	-1]x0.1 =	0	(10
if both types of wall are pre					•	ruction			0	(11
deducting areas of opening		-,	g		(
If suspended wooden flo	•	led) or 0.	1 (seal	ed), else	enter 0				0	(12
If no draught lobby, ente									0	(13
Percentage of windows Window infiltration	and doors draught s	tripped		0.25 - [0.2	v (14) ± 1	1001 -			0	(14
Infiltration rate				(8) + (10)	, ,		+ (15) =		0	(15
Air permeability value, of	150 expressed in cul	oic metre	s per h					area	3	(17
If based on air permeabilit			•	•	•			u. • u.	0.15	(18
Air permeability value applies	-					is being u	sed			`
Number of sides sheltered	İ								3	(19
Shelter factor				(20) = 1 -		19)] =			0.78	(20
Infiltration rate incorporation				(21) = (18) x (20) =				0.12	(21
Infiltration rate modified fo		1 1		Τ.			1		1	
Jan Feb I	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ed from Table 7						1		•	
Monthly average wind spe	- 1			1						
	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
 	1.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

0.15	0.15	0.14	0.13	0.12	d wind s	0.11	0.11	0.12	0.12	0.13	0.14	1	
alculate effec			l	-		l -	0.11	0.12	0.12	0.10	0.11]	
If mechanica	al ventila	ition:										0.5	(2
If exhaust air he) = (23a)			0.5	(2
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(2
a) If balance	d mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	m = (22)	2b)m + (23b) × [′	1 – (23c)	÷ 100]	
la)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		(
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (2	23b)		1	
b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
c) If whole h				•	•				F (22h	.\			
if (22b)m	0.5 ×	(230), t	nen (240	(230) = (230)	o); otnerv	wise (24)	C) = (220)	0) m + 0.	5 × (230	0	0	1	(
,								,	0	U		J	(
d) If natural i if (22b)m				•	•				0.5]				
d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(
Effective air	change	rate - er	nter (24a	or (24k	o) or (24	c) or (24	d) in box	(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		(
I look loops	and be	t loss	0 11 0 12 0 1										
. Heat losse: _EMENT	Gros		Openin		Net Ar	93	U-valu	10	AXU		k-value	2	ΑΧk
	area		r		A ,r		W/m2		(W/I	<)	kJ/m ² ·		kJ/K
oo <mark>rs</mark>					2.1	x	2	= [4.2				(
n <mark>dows</mark> Type	1				3.33	x1.	/[1/(0.8)+	0.04] =	2.58	Ħ			(
ndows Type	2				5.01	x1.	/[1/(0.8)+	0.04] =	3.88	Ħ			(
alls	59.4	19	10.4	4	49.05	5 X	0.13] = [6.38	٦ſ		7 –	
tal area of e	lements	, m²			59.49								(
rty wall					17.5	x	0		0				
or windows and	roof wind	ows, use e	effective wi	ndow U-va				L /[(1/U-valu		⊥ ∟ ns given in	paragrapl	 n 3.2	`
nclude the area	s on both	sides of in	nternal wal	ls and par	titions								
bric heat los		•	U)				(26)(30)	+ (32) =				17.04	(
at capacity	•	,						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(
ermal mass	•	•		,					tive Value			250	(
r design assess n be used instea				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
ermal bridge				usina Ar	pendix l	<						5.35	
etails of therma	•	,		• .	•							0.00	
tal fabric he	at loss							(33) +	(36) =			22.39	
ntilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
s)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]	(
eat transfer o	oefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
)m= 33.25	33.13	33	32.4	32.28	31.68	31.68	31.56	31.92	32.28	32.52	32.76]	
,													

Heat loss para	ımeter (I	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		
				ı	ı	ı	ı		Average =	Sum(40) ₁	12 /12=	0.64	(40)
Number of day	1	nth (Tab	le 1a)					1	1		1	ı	
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. Water hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TI	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		.7		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the c	lwelling is	designed i			se target o		3.49		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	!	!	•		l	
(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		
_						_				ım(44) ₁₁₂ =		941.86	(44)
Energy content of							OTm / 3600				c, 1d)		
(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		— ,
If inst <mark>antane</mark> ous w	vater heati	ng at point	of use (no	n hot water	r storage).	enter 0 in	boxes (46		Total = Su	ım(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)
Water storage		17.55	10.11	14.5	12.51	11.00	10.0	13.40	15.05	17.13	10.0		(1.5)
Storage volum	ne (litres	includir	ng any so	olar or <mark>V</mark>	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	ınk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no		hot water	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage		الممسمام	ft-	مماد الم	/1.\^/1	- /-l -> -\ .						1	(40)
a) If manufact				or is kno	wn (Kvvi	1/day):					0		(48)
Temperature f							(40) (40)				0		(49)
Energy lost from b) If manufact		•			or is not		(48) x (49)) =		1	10		(50)
Hot water stor			-							0.	.02		(51)
If community h	_		on 4.3										
Volume factor			0.1							1.	.03		(52)
Temperature f										0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	03		(54)
Enter (50) or	` , ` `	,	for ooob	manth			//EC\m /	'EE\ (44)		1.	.03		(55)
Water storage					1			(55) × (41)	ı	1		ı	(=0)
(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 cylinder contains									ını where ((HII) IS IIC		ıx n	
(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	m Table	e 3							0		(58)
Primary circuit				,	•	` '	, ,		(1.	-1-1			
(modified by			ı —					<u> </u>		- 	00.00	1	(50)
(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 loca	, coloulato	d for oach	month	(61)m –	(60) · 2(SE v. (41	\m						
Combi loss		0	1 11101111111 1 0	0 1)111 =	00) + 3	05 × (41)	0	0	0	0	0	1	(61)
()	<u> </u>							<u> </u>		ļ		J · (59)m + (61)m	(0.7)
(62)m= 183	-i		154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27	(39)111 + (01)1111	(62)
Solar DHW in			<u> </u>	<u> </u>		<u> </u>]	(-)
(add addition											5ag/		
(63)m= 0	<u> </u>	0	0	0	0	0	0	0	0	0	0	1	(63)
Output fron	n water he	ater		Į.				·!		•	l	1	
(64)m= 183			154.24	151.94	136.91	132.57	143.97	143.25	159.88	167.68	179.27]	
	 						Out	put from w	ater heate	r (annual) ₁	12	1885.76	(64)
Heat gains	from water	r heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)r	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	 1]	
(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	1	(65)
include (57)m in ca	lculation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Interna	al gains (se	ee Table 5	5 and 5a):									
Metabolic o	gains (Tab	le 5), Wa	tts										
Ja			Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 84.	98 84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98	84.98		(66)
Ligh <mark>ting g</mark> a	ins (calcul	ated in A	ppendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(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)
App <mark>liance</mark> s	gains (ca	<mark>culat</mark> ed ir	n Append	dix L, eq	uation L	13 or L1	3a), als	see Ta	ble 5				
(68)m= 148	.07 149.6	145.73	137.49	127.08	117.3	110.77	109.23	113.11	121.35	131.75	141.53		(68)
Cooking ga	ains (calcu	lated in A	ppendix	L, equat	ion L15	or L15a), also s	ee Table	5		-		
(69)m= 31	.5 31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5		(69)
Pumps and	d fans gain	s (Table	5a)									_	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses e.g	. evaporat	ion (nega	tive valu	es) (Tab	le 5)								
(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 heat	ing gains	(Table 5)										_	
(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 inter	nal gains	=			(66))m + (67)m	n + (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. Solar g													
•	are calculate	•				•	itions to c	onvert to th	ne applical		tion.		
Orientation	: Access Table 6		Area m²		Flu Tal	ıx ble 6a	_	g_ Fable 6b	т	FF able 6c		Gains (W)	
Namth							, –						1
	9x 0.7			==		10.63	X	0.4	×	0.7	=	6.87	(74)
	9x 0.7					10.63	X	0.4		0.7	_ =	10.34](74)
	9x 0.7					20.32) ×	0.4	×	0.7	=	13.13](74)
	9x 0.7				-	20.32	X	0.4	×	0.7	=	19.75	(74)
North 0.	9x 0.7	7 ×	3.3	33	x 3	34.53	X	0.4	Х	0.7	=	22.31	(74)

	_														
North	0.9x	0.77	X	5.0)1	X	3	4.53	X	0.4	X	0.7	=	33.57	(74)
North	0.9x	0.77	X	3.3	33	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	X	0.4	X	0.7	=	53.92	(74)
North	0.9x	0.77	Х	3.3	33	X	7-	4.72	X	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	33	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	х	3.3	33	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	33	x	5	9.25	X	0.4	x	0.7	=	38.28	(74)
North	0.9x	0.77	x	5.0)1	x	5	9.25	x	0.4	x	0.7	=	57.6	(74)
North	0.9x	0.77	х	3.3	33	X	4	1.52	X	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	33	x	2	4.19	x	0.4	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	5.0)1	x	2	4.19	x	0.4	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	3.3	33	x	1:	3.12	x	0.4	x	0.7	=	8.48	(74)
North	0.9x	0.77	x	5.0)1	x	1:	3.12	x	0.4	×	0.7		12.75	(74)
North	0.9x	0.77	x	3.3	33	X	8	3.86	Х	0.4	X	0.7	=	5.73	(74)
North	0.9x	0.77	x	5.0)1	x	8	3.86	х	0.4	x	0.7	_	8.62	(74)
			ΤΙ												
Solar g	ains in	watts, calc	ulated	for eac	h mont	h			(83)m	= Sum(74)m .	(82)m				
(83)m=	<mark>1</mark> 7.21		55.88	89.76	120.91	_	29.44	120.85	95.8	88 67.19	39.15	21.23	14.35		(83)
r		nternal and	solar	(84)m =	= (73)m	+ (8	83)m ,	watts					,	,	
(84)m=	344.48	358.31	371.33	389.38	404.87	3:	98.04	379.33	359.	.49 338.82	326.78	327.19	333.67		(84)
7. Me	an inter	nal temper	rature	(heating	seaso	n)									
Temp	erature	during hea	ating p	eriods ir	the liv	ing	area f	rom Tab	ole 9,	Th1 (°C)				21	(85)
Utilisa	tion fac	tor for gair	ns for I	iving are	ea, h1,r	n (s	ee Ta	ble 9a)					-		
	Jan	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.97	0.89	0.72		0.51	0.37	0.4	4 0.64	0.9	0.98	0.99		(86)
Mean	interna	l temperati	ure in I	iving ar	ea T1 (follo	w step	os 3 to 7	in T	able 9c)					
(87)m=	20.56	20.63	20.76	20.91	20.99		21	21	21	1 21	20.92	20.73	20.55		(87)
Temp	erature	during hea	ating p	eriods ir	rest o	f dw	/ellina	from Ta	able 9), Th2 (°C)		•	•	•	
(88)m=	20.38		20.38	20.39	20.39		20.4	20.4	20.4		20.39	20.39	20.38]	(88)
ı دوilitil	tion fac	tor for gair	ns for r	est of d	welling	h2	m (se	e Table	0a)					ı	
(89)m=	0.99		0.96	0.87	0.68		0.46	0.32	0.3	5 0.59	0.88	0.97	0.99]	(89)
	****									<u> </u>		1		J	, ,
			ure in t	ne rest	ot dwe	iiing	<u> </u>		i –	to 7 in Tabl	·	20.05	10.70	1	(00)
Mean			1	20.20	20.20	Ι,	ററം I	20.4	1 aa						
	interna 19.79	· · ·	20.07	20.29	20.38] :	20.4	20.4	20.4		20.3		19.78	0.40	(90)
Mean			1	20.29	20.38		20.4	20.4	20.4		<u> </u>	ving area ÷ (ļ	0.48	(90)
Mean (90)m=	19.79	19.9 2	20.07 ure (fo	r the wh	ole dw	ellin	g) = fL	-A × T1	+ (1	– fLA) × T2	LA = Liv	ving area ÷ (4) =	0.48	(91)
Mean (90)m= Mean (92)m=	19.79 interna 20.16	19.9 2 1 temperate 20.25	20.07 ure (fo	r the wh	ole dw	ellin	g) = fL	_A × T1	+ (1 -	– fLA) × T2	ELA = Liv 20.6	ving area ÷ (ļ	0.48	 ` ′

	,	r	•					ı	•	•	 		
(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. Space hea									. —. ,				
Set Ti to the the utilisation					ed at ste	ep 11 of	Table 9	o, so tha	t II,m=(/6)m an	d re-calc	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	ains, hm	<u> </u>	,				•				l	
(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)
Useful gains,	hmGm	, W = (9	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)
Monthly aver	age exte	r	·	from Ta								I	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	1		· ·			- ,	· · ·	``		101.71	500.00	1	(07)
(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 heatin (98)m= 139.09	105.35	76.31	26.41	4.09	0	n = 0.02	24 X [(97))m – (95 0	24.74	81.7	143.01		
(30)111= 133.03	100.00	70.51	20.41	4.00	U	0		l per year	<u> </u>	<u> </u>	<u> </u>	600.7	(98)
On the last the section			1.10/1./	1/			Tota	ii pei yeai	(KVVII/yeai) = Sum(9	O)15,912 —		닠``
Space heating	ig require	ement in	KVVh/m²	/year								11.94	(99)
9b. Energy red			The state of the s	Ĭ									
This part is us Fraction of spa							.	•		unity sch	neme.	0	(301)
Fraction of spa	ace heat	from co	mmunity	system	1 - (301	1) =						1	(302)
The community s							allows for	CHP and i	up to four	other heat	sources: ti	he latter	
inclu <mark>des boi</mark> lers, l													_
Fraction of he	at from C	commun	ity CHP									0.6	(303a)
Fraction of co	mmunity	heat fro	m heat s	source 2								0.4	(303b)
Fraction of tot	al space	heat fro	m Comn	nunity C	HP				(3	02) x (303	a) =	0.6	(304a)
Fraction of total	al space	heat fro	m comm	unity he	at sourc	e 2			(3	02) x (303	b) =	0.4	(304b)
Factor for con	trol and	charging	method	(Table	4c(3)) fo	r commu	unity hea	ating sys	tem			1	(305)
Distribution los	ss factor	(Table 1	12c) for o	commun	ity heatir	ng syste	m					1.1	(306)
Space heatin	g											kWh/yea	<u>r_</u>
Annual space	heating	requiren	nent									600.7	
Space heat fro	om Comr	munity C	HP					(98) x (30	04a) x (30	5) x (306) :	=	396.46	(307a)
Space heat fro	m heat	source 2	2					(98) x (30	04b) x (30	5) x (306) :	=	264.31	(307b)
Efficiency of s	econdar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 ·	÷ (308) =		0	(309)
Water heating Annual water		equirem	ent									1885.76	7
If DHW from o								(64) x (30	03a) x (30	5) x (306) :	=	1244.6	
Water heat fro		•								5) x (306) :		829.74	(310b)
Electricity use							0.01	× [(307a).				27.35	(313)
		GIOGIDI					3.01	. [(557 a)	.(20.0)	(= : 0 \(\text{\tin}\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tint{\text{\tin\text{\tin}\tin}\text{\text{\text{\text{\text{\text{\text{\text{\text{\texi}\text{\text{\text{\text{\texi}\text{\text{\text{\text{\texi}\text{\text{\texit{\texit{\texit{\texi\texit{\texit{\texi}\text{\texit{\texi}\texit{\texi}\texitit{\texit{\texi{\texi{\tet	(- : - 0)] =	21.00	

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):				<u>-</u> -
mechanical ventilation - balanced, extract or positive input from o	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				_
Electrical efficiency of CHP unit			32	(361)
Heat efficiency of CHP unit	_		64	(362)
	0,	Emission factor kg CO2/kWh	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 $(310a) \times 100 \div (362) =$	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 CHP using	two fuels repeat (363) to (3	66) for the second fu	iel 96	(367b)
CO2 associated with heat source 2 [(307b)+(3	310b)] x 100 ÷ (367b) x	0.22	246.16	(368)
Electrical energy for heat distribution	313) x	0.52	14.2	(372)
Total CO2 associated with community systems (3	863)(366) + (368)(372)		388.36	(373)
CO2 associated with space heating (secondary)	809) 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) =		388.36	(376)
CO2 associated with electricity for pumps and fans within dwellin	g (331)) x	0.52	70.69	(378)
CO2 associated with electricity for lighting (3	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)

			User E	etails:						
Assessor Name: Software Name:	Stroma FSAP 20	12		Stroma Softwa				Versi	on: 1.0.1.24	
		Р	roperty	Address:	Flat 3					
Address :	:									
1. Overall dwelling dime	nsions:		۸ro	o/m²\		Λν. Ц ο	iaht/m\		Volume/m	3\
Ground floor				a(m²) 66.88	(1a) x		ight(m) 2.5	(2a) =	Volume(m	-) (3:
Total floor area TFA = (1a	a)+(1h)+(1c)+(1d)+(1	۵\⊥ (1r			(4)](")	101.2	
	1)1(10)1(10)1(10)1(1	C) 1(11	''	00.00)	4) 1 (30) 1	(2n) -		— ,_,
Owelling volume					(3a)+(3b)+(3c)+(3c	ı)+(3e)+	(311) =	167.2	(5)
2. Ventilation rate:	main s	secondar	v	other		total			m³ per hou	ır
	heating	heating			, ,			40	m per not	
Number of chimneys	0 +	0	<u></u>	0] = [0		40 =	0	(6
Number of open flues	0 +	0	+	0] = [0	X	20 =	0	(61
Number of intermittent far	าร					0	X	10 =	0	(7:
Number of passive vents						0	X	10 =	0	(7
Number of flueless gas fir	res				Ī	0	X ·	40 =	0	(70
					_			Air c	hanges per h	our
nfiltration due to chimney	s, flues and fans = (6a)+(6b)+(7	a)+(7b)+((7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be					continue fr			· /		``
Number of storeys in the	ie dw <mark>elling</mark> (ns)								0	(9)
Additional infiltration	25.6		2.25 ([(9)	-1]x0.1 =	0	(10
Structural infiltration: 0. if both types of wall are pr					•	ruction			0	(1
deducting areas of opening		operium g te	uno groa	or wan are	a (artor					
If suspended wooden f	•	aled) or 0.	1 (seale	ed), else	enter 0				0	(1:
If no draught lobby, ent	•								0	(1:
Percentage of windows	and doors draught s	stripped		0.25 - [0.2	v (14) · 1	1001 -			0	(14
Window infiltration Infiltration rate				(8) + (10)	` '	-	+ (15) =		0	(1!
Air permeability value,	a50 expressed in cu	ihic metre	s ner ho					area	3	(1)
f based on air permeabili				•	•	0110 01 0	лиоюро	aroa	0.15	(1)
Air permeability value applies	•					is being u	sed		00	`
Number of sides sheltere	d								3	(19
Shelter factor				(20) = 1 -		19)] =			0.78	(20
nfiltration rate incorporat	ing shelter factor			(21) = (18)	x (20) =				0.12	(2
•	or monthly wind enge	ed				<u> </u>	1	i	7	
Infiltration rate modified for						. 0-4		_		
nfiltration rate modified fo	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Jan Feb Monthly average wind sp	Mar Apr May	i			•				J ¬	
Jan Feb Monthly average wind spe	Mar Apr May	3.8	Jul 3.8	Aug	Sep 4	4.3	4.5	4.7]	
nfiltration rate modified for Jan Feb Monthly average wind spe	Mar Apr May eed from Table 7 4.9 4.4 4.3	i			•]	

Adjusted infiltr	ation rat	e (allowi	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		
Calculate effecture of the Calculate of		_	rate for t	he appli	cable ca	se						0.5	(23
If exhaust air h			endix N, (2	(3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with												77.35	(23
a) If balance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	a)m = (22	2b)m + (23b) x [1	1 – (23c)		(
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]	(24
b) If balance	d mech	anical ve	entilation	without	heat red	overy (N	лV) (24b	m = (22)	2b)m + (23b)			
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h			ntilation on the contract of t	•	•				5 × (23b))		•	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural if (22b)n			ole hous m = (221						0.5]	!	!	1	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(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. Heat losse	s and he	eat loss i	narameto	er.					_				
LEMENT	Gros		Openin		Net Ar	ea	U-val	ue	AXU		k-value	9	AXk
	area		n		A ,r		W/m2		(W/	K)	kJ/m².		kJ/K
Doo <mark>rs</mark>					2.1	х	2	= [4.2				(26
Vin <mark>dows</mark> Type	1				19.23	x1.	/[1/(0.8)+	0.04] =	14.91				(27
Vindows Type	2				9.5	x1.	/[1/(0.8)+	0.04] =	7.36				(27
Vindows Type	3	'			20.61	x1.	/[1/(0.8)+	0.04] =	15.98				(27
Valls	95.	5	51.4	4	44.06	x	0.13	= [5.73				(29
otal area of e	lements	, m²			95.5								(3
for windows and * include the area						ated using	ı formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragrapl	1 3.2	
abric heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				48.18	(33
leat capacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
hermal mass	parame	ter (TMF	o = Cm -	: TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
an be used inste				uoina An	nondiy l	/							
hermal bridge details of therma	`	,		Ο.	•	`						8.1	(36
otal fabric he		are not ki	10WH (30) =	= 0.73 X (3	1)			(33) +	(36) =			56.28	(37
entilation hea	at loss ca	alculated	d monthly	У				(38)m	= 0.33 × ((25)m x (5))		`
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
38)m= 14.43	14.27	14.11	13.3	13.14	12.34	12.34	12.18	12.66	13.14	13.46	13.79	1	(38
ـــــــــــا leat transfer o	coefficier	nt, W/K	•		•		•	(39)m	= (37) + (38)m			
	70.54	70.38	69.58	69.42	68.62	68.62	68.46	68.94	69.42	69.74	70.06]	
39)m= 70.7	70.54	, , , , , ,	00.00	I 00		00.0=			I 00	00.7	, , ,,,,,		

leat loss pa	arameter (I	HLP), W	/m²K				_	(40)m	= (39)m ÷	÷ (4)		i	
1.06 1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05		_
umbor of a	days in mo	nth (Tab	lo 1a)					,	Average =	: Sum(40) ₁	12 /12=	1.04	(40
Jai	<u> </u>	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
11)m= 31	_	31	30	31	30	31	31	30	31	30	31		(4
,	<u> </u>		<u> </u>										
4. Water h	eating ene	rgy requ	irement:								kWh/ye	ear:	
agumad a		N I										1	,,
if TFA > 1	3.9, N = 1 3.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		.17		(4
	rage hot wa										0.2		(4
	nual average 125 litres per				_	-	to achieve	a water us	se target c	of .			
Jai	<u> </u>	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ge in litres pe			,				Сор		1 1101			
4)m= 99.2	2 95.61	92.01	88.4	84.79	81.18	81.18	84.79	88.4	92.01	95.61	99.22		
										ım(44) ₁₁₂ =		1082.42	(4
nergy conten	t of hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x D	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
5)m= 147.	14 128.69	132.8	115.78	111.09	95.86	88.83	101.94	103.15	120.21	131.22	142.5		
nstantaneou	ıs water heati	ing at poin	of use (no	hot water	storage).	enter 0 in	boxes (46		Total = Su	ım(45) ₁₁₂ =	=	1419.22	(4
6)m= 22.0		19.92	17.37	16.66	14.38	13.32	15.29	15.47	18.03	19.68	21.38		(4
/ater stora		10.02	17.07	10.00	14.00	10.02	10.20	10.47	10.00	10.00	21.00		•
torage vol	ume (litres) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
	y heating a			_									
	no stored	hot wate	er (this ir	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
ater stora	ge ioss: acturer's d	aclarad l	nee fact	nr ie kna	wn (k\//k	v(qəv).					0	1	(4
	e factor fro			JI IS KIIU	wii (Kvvi	i/uay).					0		
-	from water			oor			(48) x (49)	١ _			0		(4
• • •	acturer's d	_	-		or is not		(40) X (49)	,		1	10		(5
•	torage loss		-							0.	.02		(5
	y heating s		on 4.3									•	
	or from Ta		O.L								.03		(5
•	e factor fro									0	.6		(;
0,	from water	•	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	.03		(!
` '	or (54) in (•	طممم سما				(/50) /	EE) (44).		1.	.03		(!
	ge loss cal				i		((56)m = (1		I	
6)m= 32.0		32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(5
	ains dedicate	u solar sto		ıı = (56)M		· · · · ·	υ), eise (5	· · ·	ın wnere ((mili) is fro	ın Append	IX H	
7)m= 32.0	1 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(5
rimary circ	uit loss (ar	nnual) fro	om Table	e 3							0		(5
-	uit loss ca			,	•	. ,	, ,						
	by factor f	1		i	solar wat	i		cylinde	i —	ostat)		Ī	
)m= 23.2	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(

Combi loss calculated for each worth (61)m = (60) = 365 × (41)m (61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Combi loss (alculated	for oach	month	(61)m -	(60) ·	265 × (41	\m							
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m 20.242 178.62 188.08 189.27 166.37 149.36 144.11 157.21 156.65 175.49 184.72 197.76 (62) Solar DHV input calculated using Appendix G or Appendix H (registive quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS appliess, see Appendix G) (63)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					ì	ì		Í	,	Ι ο	Ι	Το	Ι ο	1	(61)
(62) Column														(50) : (61)	(01)
Scalar DHW input calculated using Appendix G or Appendix H (regative quantity) (enter 0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m		-i						`			` 	ì 	`	(59)m + (61)m]	(62)
Company Comp	` '				<u> </u>	<u> </u>						1			(02)
(63)me											r contribu	tion to wate	er neaung,	1	
Output from water heater (64)m= 202.42	`		r		r	- · ·	 	i 	_	. 	0	Ι ο	0	1	(63)
Column C		!						`						J	(00)
Company Comp				169 27	166 37	149	86 144 11	157	21	156 65	175 49	184 72	197 78	1	
Heat gains from water heating, kWh/month 0.25 ′ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (65)m 93.15 82.73 88.38 81.29 81.16 74.67 73.76 78.11 77.09 84.19 86.43 91.6 (65) include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (See Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m 108.4 108.	(01)= 202.1	2 170.02	100.00	100.27	100.07	1.0.	70 111111	<u> </u>				<u> </u>	l	2070.06	(64)
665 m 93.15 82.73 88.38 81.29 81.16 74.67 73.76 78.11 77.09 84.19 86.43 91.6 (65) Include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating S. Internal gains (See Table 5 and 5a):	Heat gains f	rom water	heating	k\Mh/m	onth 0.2	5 ′ [0	85 v (45)m								J` ′
include (67)m in calculation of (66)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan						-		`	<u> </u>		r ` ´ ´	1 ` ´ 	- ` 	' ,]	(65)
Metabolic gains (Table 5), Watts Jan	` ′					<u> </u>	!						l] peating	()
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	·	<u> </u>				yiiride		uwen	iiiig	or not w	alei is i	TOTTI COTTI	irriuriity i	leating	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		`).										
Cooking gains (calculated in Appendix L, equation L13 of L13a), also see Table 5 Cooking gains (calculated in Appendix L, equation L13 of L13a), also see Table 5 Cooking gains (calculated in Appendix L, equation L13 of L13a), also see Table 5 Cooking gains (calculated in Appendix L, equation L13 of L13a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 Cooking gains (calculated gains (Table 5a) Cooking gains gains (Table 5a) Cooking gains gains (Table 5a) Cooking gains gains (Table 5a) Cooking gains gains (Table 5a) Cooking gains gains (Table		1			May	.lu	n Jul	ΙΔ	ша	Sen	Oct	Nov	Dec	1	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)					<u> </u>	_						_			(66)
(67)	` '	_			<u> </u>					<u> </u>				,	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 189.91 191.88 186.91 176.34 163 150.45 142.07 140.1 145.07 155.64 168.99 181.53 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 33.84 (69) Pumps and fans gains (Table 5a) (70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				_				\rightarrow			13.99	16.32	17.4	1	(67)
(68) 189.91 191.88 186.91 176.34 163 150.45 142.07 140.1 145.07 155.64 168.99 181.53 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69) 33.84						<u> </u>		_	$\overline{}$			10.02		J	` '
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 33.84 (69) Pumps and fans gains (Table 5a) (70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		· `	_			г —		<u> </u>	$\overline{}$		_	168 99	181 53	1	(68)
Pumps and fans gains (Table 5a)	` ' -	_										100.00	101.00	1	()
Pumps and fans gains (Table 5a) (70)m=		_	•				_	-			_	33.84	33.84	1	(69)
Comparison of the comparison o	. ,				00.01	00.0		1 00.	•	00.01	00.01	1 00.0	1 00.0 .		()
Losses e.g. evaporation (negative values) (Table 5) (71)m=			<u> </u>	 	n	0	0		,	n	<u> </u>	Ι ο	<u></u> ο	1	(70)
(71)m=		_	<u> </u>	<u> </u>	<u> </u>			`						J	(- /
Water heating gains (Table 5) (72)m=			` 			r –	72 -86.72	-86	72	-86.72	-86.72	-86.72	-86.72	1	(71)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m				00.72	00.72		2 00.72			00.72	00.72	00.72	00.72	J	()
Total internal gains =		~~		112 9	109.08	103	71 99 14	104	99	107.07	113 16	120.04	123 12	1	(72)
(73)m= 387.56 385.55 373.45 354.02 334.52 315.52 303.05 308.82 318.68 338.31 360.87 377.57 (73) 6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Table 6d Area Mark Flux Flux Flux Frable 6b Table 6b Table 6c (W) East 0.9x 1 x 19.23 x 19.64 x 0.4 x 0.7 = 51.4 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76)	` '		l	112.0	100.00	l .	<u> </u>					l	l .	J	()
6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Area Flux g_ FF Gains Table 6d Table 6c (W) East 0.9x 1 x 19.23 x 19.64 x 0.4 x 0.7 = 51.4 (76) East 0.9x 1 x 19.23 x 38.42 x 0.4 x 0.7 = 100.54 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 92.28 x 0.4 x 0.7 = 241.48 (76)				354 02	334 52	_	· / · /	·	_			, 	· •	1	(73)
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Table 6d m^2 Table 6a $Table 6b$ Table 6b Table 6c m^2 Table 6a Table 6b Table 6c m^2 Table 6a Table 6b Table 6c m^2 Table 6b Table 6c m^2 Table 6b Table 6c m^2 Table 6c	` '		070.40	004.02	004.02	010.	92 000.00	000	.02	010.00	000.01	000.07	077.07		()
Table 6d m ² Table 6a Table 6b Table 6c (W) East 0.9x 1 x 19.23 x 19.64 x 0.4 x 0.7 = 51.4 (76) East 0.9x 1 x 19.23 x 38.42 x 0.4 x 0.7 = 100.54 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 92.28 x 0.4 x 0.7 = 241.48 (76)	<u> </u>		using sola	r flux from	Table 6a	and as	sociated equa	ations	to co	onvert to th	ne applica	ble orientat	tion.		
Table 6d m² Table 6a Table 6b Table 6c (W) East 0.9x 1 x 19.23 x 19.64 x 0.4 x 0.7 = 51.4 (76) East 0.9x 1 x 19.23 x 38.42 x 0.4 x 0.7 = 100.54 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 92.28 x 0.4 x 0.7 = 241.48 (76)	Orientation:	Access F	actor	Area			Flux			g_		FF		Gains	
East 0.9x 1 x 19.23 x 38.42 x 0.4 x 0.7 = 100.54 (76) East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 92.28 x 0.4 x 0.7 = 241.48 (76)		Table 6d		m²			Table 6a		Т		T	able 6c		(W)	
East 0.9x 1 x 19.23 x 63.27 x 0.4 x 0.7 = 165.57 (76) East 0.9x 1 x 19.23 x 92.28 x 0.4 x 0.7 = 241.48 (76)	East 0.9	x 1	x	19.	23	х	19.64	X		0.4	x	0.7	=	51.4	(76)
East 0.9x 1 x 19.23 x 92.28 x 0.4 x 0.7 = 241.48 (76)	East 0.9	x 1	x	19.	23	х	38.42	j x		0.4		0.7	=	100.54	(76)
	East 0.9	x 1	x	19.	23	х 🗀	63.27	X		0.4		0.7	<u> </u>	165.57	(76)
East 0.9x 1 x 19.23 x 113.09 x 0.4 x 0.7 = 295.94 (76)	East 0.9	x 1	x	19.	23	х 🗀	92.28	Īx		0.4		0.7	<u> </u>	241.48	(76)
	East 0.9	x 1	x	19.	23	x $$	113.09	x		0.4	x [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	19.23	×	1	10.22	X		0.4	X	0.7	=	288.42	(76)
East	0.9x	1		X	19.23	×	9	94.68	X		0.4	X	0.7	=	247.75	(76)
East	0.9x	1		X	19.23	X	7	'3.59	X		0.4	×	0.7	=	192.57	(76)
East	0.9x	1		X	19.23	X	4	5.59	X		0.4	X	0.7	=	119.3	(76)
East	0.9x	1		X	19.23	X	2	24.49	X		0.4	X	0.7	=	64.08	(76)
East	0.9x	1		X	19.23	X	1	6.15	X		0.4	X	0.7	=	42.26	(76)
South	0.9x	0.54		X	9.5	X	4	6.75	X		0.4	X	0.7	=	60.44	(78)
South	0.9x	0.54		X	9.5	X	7	6.57	X		0.4	X	0.7	=	98.98	(78)
South	0.9x	0.54		X	9.5	X	9	7.53	X		0.4	X	0.7	=	126.09	(78)
South	0.9x	0.54		X	9.5	X	1	10.23	X		0.4	X	0.7	=	142.51	(78)
South	0.9x	0.54		X	9.5	X	1	14.87	X		0.4	X	0.7	=	148.5	(78)
South	0.9x	0.54		X	9.5	X	1	10.55	X		0.4	X	0.7	=	142.91	(78)
South	0.9x	0.54		X	9.5	X	1	08.01	X		0.4	X	0.7	=	139.63	(78)
South	0.9x	0.54		X	9.5	X	1	04.89	X		0.4	X	0.7	=	135.6	(78)
South	0.9x	0.54		X	9.5	×	1	01.89	X		0.4	X	0.7	=	131.71	(78)
South	0.9x	0.54		X	9.5	X	8	32.59	X		0.4	X	0.7	=	106.76	(78)
South	0.9x	0.54		X	9.5	X	5	55.42	Х		0.4	X	0.7		71.64	(78)
South	0.9x	0.54		x	9.5	×		40.4] x		0.4	х	0.7	=	52.23	(78)
West	0.9x	0.54		X	20.61	x		9.64	x		0.4	x	0.7	=	55.08	(80)
West	0.9x	0.54		X	20.61	X	3	88.42	x		0.4	x	0.7	=	107.75	(80)
West	0.9x	0.54		x	20.61	X	6	3.2 <mark>7</mark>	Х		0.4	х	0.7	=	177.46	(80)
West	0.9x	0.54		x	20.61	X	9	2.28	X		0.4	х	0.7	=	258.81	(80)
West	0.9x	0.54		X	20.61	X	1	13.09	X		0.4	x	0.7	=	3 <mark>17.18</mark>	(80)
West	0.9x	0.54		X	20.61	X	1	15.77	X		0.4	X	0.7	=	324.69	(80)
West	0.9x	0.54		X	20.61	X	1	10.22	X		0.4	X	0.7	=	309.12	(80)
West	0.9x	0.54		X	20.61	X	9	94.68	X		0.4	×	0.7	=	265.53	(80)
West	0.9x	0.54		X	20.61	X	7	'3.59	X		0.4	×	0.7	=	206.39	(80)
West	0.9x	0.54		X	20.61	×	4	5.59	X		0.4	×	0.7	=	127.86	(80)
West	0.9x	0.54		X	20.61	X	2	24.49	X		0.4	X	0.7	=	68.68	(80)
West	0.9x	0.54		X	20.61	X	1	6.15	X		0.4	X	0.7	=	45.3	(80)
7-			-	$\overline{}$	for each mor			l			n(74)m .		-		1	(00)
` ′	166.92	307.28	469.		642.8 761.0 (9.4) m (7.3)		770.55	737.17	648	5.88	530.67	353.9	2 204.41	139.79]	(83)
Ĭ,	554.47	692.83	842.	_	$\frac{(84)m = (73)}{996.82 1096}$	_	` '	1040.22	957	74	849.35	692.2	3 565.27	517.36	1	(84)
`		l .		_	<u> </u>		1000.00	1040.22	957	./	649.35	692.2	3 505.27	517.30		(04)
				,	heating seas					- . 4	(0.0)					7
•		•		• •	eriods in the	-			ole 9	, Th1	(°C)				21	(85)
Utilisat F				-	ving area, h1	T							. NJ -		1	
(96)~	Jan	Feb	Ma	\rightarrow	Apr Ma	- +	Jun	Jul 0.29	_	ug	Sep	Oct	_	Dec	1	(86)
(86)m=	0.99	0.97	0.9				0.4	ļ	0.3		0.55	0.86	0.98	0.99	J	(00)
				-	ving area T1	·-		i –						00.5=	1	(07)
(87)m=	20.1	20.34	20.6	54	20.89 20.9	8	21	21	2	1	20.99	20.82	2 20.4	20.05	J	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°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)
Utilisation factor for gains for rest of dwelling, h2,m (see 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 internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 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)
$fLA = Living area \div (4) = 0.5$	6 (91)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$	
(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 adjustment to the mean internal temperature from Table 4e, where appropriate	
(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. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Utilisation factor for gains, hm:	
(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)
Useful gains, hmGm , W = (94)m x (84)m	
(95)m= 546.84 666.24 753.59 740.37 603.47 409.52 273.48 286.45 440.1 580.01 547.16 512.14	(95)
Monthly average external temperature from Table 8	(96)
(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 Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m - (96)m]	(90)
(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 heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	
(98)m= 395.43 260.44 156.19 46.51 8.79 0 0 0 74.75 249.75 416.38	_
Total per year (kWh/year) = Sum(98) _{15,912} = 1608	.23 (98)
Space heating requirement in kWh/m²/year 24.0)5 (99)
9b. Energy requirements – Community heating scheme	
This part is used for space heating, space cooling or water heating provided by a community scheme.	
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0	
Fraction of space heat from community system 1 – (301) =	(302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community CHP	(303a)
Fraction of community heat from heat source 2	(303b)
Fraction of total space heat from Community CHP (302) x (303a) = 0.6	
Fraction of total space heat from community heat source 2 (302) x (303b) = 0.4	(22 (1)
Factor for control and charging method (Table 4c(3)) for community heating system	
Distribution loss factor (Table 12c) for community heating system	
Space heating Annual space heating requirement to 1608	n/year
1000	

	r		_
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 Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary	y system (98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement		2070.06	
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)(307e) + (310a)(310e)] =	40.46	(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	from outside	234.58	(330a)
warm air heating system fans	Ī	0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (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)
Electrical efficiency of CHP unit Heat efficiency of CHP unit		32 64	(361) (362)
	Energy Emission factor kWh/year kg CO2/kWh	64	」 ```
		64 Emissions	」 ```
Heat efficiency of CHP unit	kWh/year kg CO2/kWh	64 Emiss <mark>ions</mark> kg CO2/year	(362)
Heat efficiency of CHP unit Space heating from CHP) (307a) × 100 ÷ (362) =	kWh/year kg CO2/kWh 1658.49 × 0.22	Emissions kg CO2/year	(362)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$	kWh/year kg CO2/kWh 1658.49 X 0.22 530.72 X 0.52	64 Emissions kg CO2/year 358.23	(362) (363) (364)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$ Water heated by CHP $(310a) \times 100 \div (362) =$ less credit emissions for electricity $-(310a) \times (361) \div (362) =$	kWh/year kg CO2/kWh 1658.49 X 0.22 530.72 X 0.52 2134.75 X 0.22	64 Emissions kg CO2/year 358.23 -275.44 461.11	(362) (363) (364) (365)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$ Water heated by CHP $(310a) \times 100 \div (362) =$ less credit emissions for electricity $-(310a) \times (361) \div (362) =$ Efficiency of heat source 2 (%) If there is CHF	kWh/year kg CO2/kWh 1658.49 × 0.22 530.72 × 0.52 2134.75 × 0.22 683.12 × 0.52	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54	(362) (363) (364) (365) (366)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$ Water heated by CHP $(310a) \times 100 \div (362) =$ less credit emissions for electricity $-(310a) \times (361) \div (362) =$ Efficiency of heat source 2 (%) If there is CHF	kWh/year kg CO2/kWh 1658.49 X 0.22 530.72 X 0.52 2134.75 X 0.22 683.12 X 0.52 P using two fuels repeat (363) to (366) for the second fuel	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54	(362) (363) (364) (365) (366) (367b)
Heat efficiency of CHP unit Space heating from CHP) less credit emissions for electricity Water heated by CHP less credit emissions for electricity (307a) \times 100 \div (362) = (310a) \times 100 \div (362) = less credit emissions for electricity (310a) \times 100 \div (362) = (310a) \times (361) \div (362) = Efficiency of heat source 2 (%) If there is CHE CO2 associated with heat source 2	kWh/year kg CO2/kWh 1658.49	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54 96 364.15	(362) (363) (364) (365) (366) (367b) (368)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$ Water heated by CHP $(310a) \times 100 \div (362) =$ less credit emissions for electricity $-(310a) \times (361) \div (362) =$ Efficiency of heat source 2 (%) CO2 associated with heat source 2 Electrical energy for heat distribution	kWh/year kg CO2/kWh 1658.49	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54 96 364.15	(362) (363) (364) (365) (366) (367b) (368) (372)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$ Water heated by CHP $(310a) \times 100 \div (362) =$ less credit emissions for electricity $-(310a) \times (361) \div (362) =$ Efficiency of heat source 2 (%) If there is CHR CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with community systems	kWh/year kg CO2/kWh 1658.49	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54 96 364.15 21 574.51	(362) (363) (364) (365) (366) (367b) (368) (372) (373)
Heat efficiency of CHP unit Space heating from CHP) $(307a) \times 100 \div (362) =$ less credit emissions for electricity $-(307a) \times (361) \div (362) =$ Water heated by CHP $(310a) \times 100 \div (362) =$ less credit emissions for electricity $-(310a) \times (361) \div (362) =$ Efficiency of heat source 2 (%) If there is CHR CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with community systems CO2 associated with space heating (secondary)	kWh/year kg CO2/kWh 1658.49	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54 96 364.15 21 574.51	(362) (363) (364) (365) (366) (367b) (368) (372) (373) (374)
Space heating from CHP) less credit emissions for electricity Water heated by CHP less credit emissions for electricity (310a) × 100 ÷ (362) = Water heated by CHP (310a) × 100 ÷ (362) = less credit emissions for electricity -(310a) × (361) ÷ (362) = Efficiency of heat source 2 (%) CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with space heating (secondary) CO2 associated with water from immersion heater or instal	kWh/year kg CO2/kWh 1658.49	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54 96 364.15 21 574.51 0	(362) (363) (364) (365) (366) (367b) (368) (372) (373) (374) (375)
Space heating from CHP) less credit emissions for electricity Water heated by CHP less credit emissions for electricity (307a) × 100 ÷ (362) = (307a) × (361) ÷ (362) = Water heated by CHP (310a) × 100 ÷ (362) = (310a) × (361) ÷ (362) = Efficiency of heat source 2 (%) If there is CHR CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with space heating (secondary) CO2 associated with water from immersion heater or instantal Total CO2 associated with space and water heating	kWh/year kg CO2/kWh 1658.49	64 Emissions kg CO2/year 358.23 -275.44 461.11 -354.54 96 364.15 21 574.51 0 0 574.51	(362) (363) (364) (365) (366) (367b) (368) (372) (373) (374) (375) (376)

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 FSAP 20	12		Strom Softwa				Versio	on: 1.0.1.24	
		Pı	roperty	Address	Flat 4					
Address :										
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 71.18	(1a) x		2.5	(2a) =	Volume(m ²	(3a
Total floor area TFA = (1a	u)+(1b)+(1c)+(1d)+(1d	e)+(1n	1) 7	71.18	(4)					
Dwelling volume					(3a)+(3b	o)+(3c)+(3c	d)+(3e)+	.(3n) =	177.95	(5)
2. Ventilation rate:										
Number of chimneys	heating	econdar heating	у 기 + Г	other	7 = 6	total	x	40 =	m³ per hou	ı r
·		0	╛╘	0	╛╘	0		20 =	0	=
Number of open flues	0 +	0] + L	0] = [0			0	(6b
Number of intermittent far	ns				L	0	X	10 =	0	(7a
Number of passive vents						0	Х	10 =	0	(7b
Number of flueless gas fir	es				Γ	0	X ·	40 =	0	(7c)
								Air ch	nanges <mark>per</mark> he	our
Infilt <mark>ration</mark> due to chi <mark>mne</mark> y	s, flues and fans = (6	Sa)+(6b)+(7	a)+(7b)+((7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be		ed, proceed	d to (17),	otherwise (continue f	rom (9) to	(16)			
Number of storeys in th	e dw <mark>elling</mark> (ns)								0	(9)
Additional infiltration	OF for stool or timber	frame ar	0.25 to		n a a mad	w a4! a .a	[(9)	-1]x0.1 =	0	(10
Structural infiltration: 0.3 if both types of wall are pre					-	ruction			0	(11
deducting areas of opening		-,	3		- (
If suspended wooden floor	,	led) or 0.	1 (seale	ed), else	enter 0				0	(12
If no draught lobby, ento									0	(13
Percentage of windows	and doors draught s	tripped		0.25 - [0.2	v (14) · ·	1001 -			0	(14
Window infiltration Infiltration rate				(8) + (10)	,	-	± (15) =		0	(15
Air permeability value, o	n50 expressed in cul	hic metre	s ner ho					area	0	(16
If based on air permeabilit	•		•	•	•	ictic oi c	rivelope	arca	0.15	(17
Air permeability value applies						is being u	sed		0.10	(
Number of sides sheltered	b								3	(19
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.78	(20
Infiltration rate incorporati	ng shelter factor			(21) = (18) x (20) =				0.12	(21
Infiltration rate modified for	or monthly wind spee	d • • • • •						1	1	
Jan Feb I	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7							,	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	m ÷ 4									
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
, ,							1		I	

· —	ation rat	· `	ng for sr	nelter an	d wind s	speed) =	(21a) x	(22a)m	1	T		1	
0.15 Calculate effec	0.15	0.14	0.13	0.12 he annli	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
If mechanica		_	rate for t	пс аррп	cabic ca	30						0.5	(23
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	eiency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]	
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		(24
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (23b)	-	-	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n				•	•				.5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n				•	•				0.5]	•	•	•	
4d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)	-	-	-		
5)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. Heat losse	s and he	eat loss i	oaramet	er:								_	_
LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U		k-value		A X k kJ/K
oors					2.1	x	2	= [4.2	$\dot{\Box}$			(26
/in <mark>dows</mark> Type	1				8.25	x1.	/[1/(0.8)+	0.04] =	6.4	Ħ			(27
indows Type	2				15.71	x1.	/[1/(0.8)+	0.04] =	12.18	Ħ			(2
/alls	91.8	В	26.0	6	65.74	1 x	0.13	=	8.55	Ħ r			(2
oof	71.1	8	0		71.18	3 x	0.12	<u> </u>	8.54	F i			(3
otal area of e	lements	, m²			162.9	8							(3
or windows and			effective wi	ndow U-va			formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragraph	1 3.2	`
include the area	s on both	sides of ir	nternal wal	ls and par	titions								
abric heat los		•	U)				(26)(30)) + (32) =				39.86	(3
eat capacity		,						((28)	(30) + (32	2) + (32a).	(32e) =	0	(3
hermal mass	•	•		,					tive Value			250	(3
or design assess n be used inste				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f		
nermal bridge				using Ap	pendix I	K						13.8	(3
details of therma	ıl bridging	are not kn	own (36) =	= 0.15 x (3	1)								
otal fabric he	at loss							(33) +	(36) =			53.66	(3
entilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))	,	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
8)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		(3
eat transfer o	oefficier	nt, W/K						(39)m	= (37) + (38)m		_	
9)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		
·													

Heat loss para	ımeter (I	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		
							l		Average =	Sum(40) ₁	12 /12=	0.95	(40)
Number of day	1	nth (Tab	le 1a)		ı	1		ı					
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. Water heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		27		(42)
Annual averag Reduce the annua not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed i			se target o		.86		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage is	n litres pe	r day for ea	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		
						_				m(44) ₁₁₂ =		1114.33	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 151.48	132.49	136.71	119.19	114.37	98.69	91.45	104.94	106.19	123.76	135.09	146.7		_
If instantaneous w	vater heati	ng at point	of use (no	hot water	storage)	enter () in	hoxes (46		Total = Su	m(45) ₁₁₂ =		1461.06	(45)
(46)m= 22.72	19.87	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22.01		(46)
Water storage		20.51	17.00	17.15	14.0	13.12	15.74	15,93	16.50	20.26	22.01		(40)
Storage volum		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage			(- /1.14/1	. /.1 \					1		
a) If manufact				or is kno	wn (kvvr	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro b) If manufact		•			or is not		(48) x (49)) =		1	10		(50)
Hot water stor			-							0.	02		(51)
If community h	neating s	see secti	on 4.3										
Volume factor										1.	03		(52)
Temperature f	actor fro	m Table	2b							0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		03		(54)
Enter (50) or (` , ` `	,								1.	03		(55)
Water storage	loss cal	culated	or each	month	г	1	((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 cylinder contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	/)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	m Table	3							0		(58)
Primary circuit				,	•		, ,						
(modified by			ı —	ı —	ı —			<u> </u>		'			4-11
(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 o	ralculated	for each	month ((61)m –	(60) -	- 365 √ (41)m							
(61)m= 0	0	0	0	0	00)	0))	0	0	0	0]	(61)
	auired for	water h	Leating ca	L	l for e	ach month	(62)	m =	0.85 × (′45)m +		(57)m +	ı · (59)m + (61)m	
(62)m= 206.7		191.99	172.68	169.64	152.		160		159.69	179.04	188.59	201.98]	(62)
Solar DHW inpu	ıt calculated	using App	endix G o	· Appendix	H (ne	gative quantit	y) (ent	ter '0'	if no sola	r contribu	tion to wate	er heating)	.	
(add addition						-								
(63)m= 0	0	0	0	0	0	0)	0	0	0	0]	(63)
Output from	water hea	ter				•						•	•	
(64)m= 206.7	6 182.41	191.99	172.68	169.64	152.	18 146.73	160	.22	159.69	179.04	188.59	201.98]	
	•			•	•	•	•	Outp	out from wa	ater heate	er (annual)	I12	2111.9	(64)
Heat gains fi	om water	heating,	kWh/m	onth 0.2	5 ′ [0	.85 × (45)m	n + (6	31)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m	n]	
(65)m= 94.59	83.99	89.68	82.43	82.25	75.6	74.63	79.	11	78.1	85.37	87.71	93]	(65)
include (5	7)m in cald	culation	of (65)m	only if c	ylind	er is in the	dwell	ling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a):										
Metabolic ga	ins (Table	5). Wat	ts											
Jan	T ,	Mar	Apr	May	Ju	n Jul	А	ug	Sep	Oct	Nov	Dec]	
(66)m= 113.7	2 113.72	113.72	113.72	113.72	113.	72 113.72	113	.72	113.72	113.72	113.72	113.72		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equ <mark>at</mark>	ion L	9 or L9a),	also s	see	Table 5					
(67)m= 17.83	3 15.84	12.88	9.75	7.29	6.1	5 6.65	8.6	64	11.6	14.73	17.19	18.33		(67)
Appliances of	ains (ca <mark>lc</mark>	ulated ir	Append	dix L, eq	uatio	n L13 or L1	3a),	also	see Tal	ble 5				
(68)m= 200.0	4 202.11	196.88	185.74	171.69	158.	48 149.65	147	.57	152.81	163.94	178	191.21		(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	tion L	15 or L15a), als	o se	e Table	5		•		
(69)m= 34.37	34.37	34.37	34.37	34.37	34.3	34.37	34.	37	34.37	34.37	34.37	34.37		(69)
Pumps and f	ans gains	(Table 5	 Ба)									•	-	
(70)m= 0	0	0	0	0	0	0	()	0	0	0	0		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	•					•	•	•	
(71)m= -90.9	3 -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	ıg gains (T	able 5)									•	•	•	
(72)m= 127.1	4 124.99	120.54	114.48	110.55	105.	01 100.31	106	.34	108.48	114.75	121.82	125]	(72)
Total intern	al gains =	:	•			(66)m + (67)r	n + (68	3)m +	- (69)m + ((70)m + (71)m + (72))m	•	
(73)m= 402.1	2 400.06	387.41	367.09	346.64	326.	76 313.72	319	.67	330	350.53	374.13	391.65		(73)
6. Solar gai	ns:										•			
Solar gains are	e calculated	using sola	r flux from	Table 6a	and as	sociated equa	ations	to co	nvert to th	e applica	ble orienta	tion.		
Orientation:			Area			Flux		_	g_	-	FF		Gains	
	Table 6d		m²		_	Table 6a	_		able 6b	_ '	able 6c		(W)	_
North 0.9	0.54	х	15.	71	x	10.63	X		0.4	x	0.7	=	22.73	(74)
North 0.9		х	15.	71	x	20.32	X		0.4	X	0.7	=	43.44	(74)
North 0.9	0.54	x	15.	71	x	34.53	X		0.4	X	0.7	=	73.82	(74)
North 0.9	0.54	X	15.	71	x	55.46	X		0.4	x	0.7	=	118.57	(74)
North 0.9	0.54	X	15.	71	X	74.72	X		0.4	X	0.7	=	159.73	(74)

									_				_
	0.9x 0.54	X	15.71	1 ×		79.99	X	0.4	X	0.7	=	170.99	(74)
North	0.9x 0.54	X	15.71	1 ×	7	74.68	X	0.4	X	0.7	=	159.64	(74)
North	0.9x 0.54	X	15.71	1 ×	5	59.25	X	0.4	X	0.7	=	126.66	(74)
North	0.9x 0.54	X	15.71	1 ×	4	11.52	X	0.4	X	0.7	=	88.75	(74)
North	0.9x 0.54	x	15.71	1 ×	2	24.19	X	0.4	X	0.7	=	51.71	(74)
North	0.9x 0.54	×	15.71	1 ×	1	3.12	X	0.4	X	0.7	=	28.04	(74)
North	0.9x 0.54	×	15.71	1 ×		8.86	X	0.4	X	0.7	=	18.95	(74)
West	0.9x 0.54	X	8.25	X	1	9.64	X	0.4	X	0.7	=	22.05	(80)
West	0.9x 0.54	x	8.25	X	3	88.42	X	0.4	X	0.7		43.13	(80)
West	0.9x 0.54	X	8.25	X	(6	3.27	X	0.4	X	0.7	=	71.03	(80)
West	0.9x 0.54	X	8.25	X	(9	92.28	x	0.4	X	0.7	=	103.6	(80)
West	0.9x 0.54	X	8.25	X	1	13.09	X	0.4	X	0.7	=	126.96	(80)
West	0.9x 0.54	X	8.25	X	1	15.77	X	0.4	X	0.7	=	129.97	(80)
West	0.9x 0.54	X	8.25	X	1	10.22	X	0.4	X	0.7	=	123.74	(80)
West	0.9x 0.54	X	8.25	X	(9	94.68	X	0.4	X	0.7	=	106.29	(80)
West	0.9x 0.54	X	8.25	×	7	73.59	x	0.4	X	0.7	=	82.62	(80)
West	0.9x 0.54	X	8.25	×	4	15.59	x	0.4	X	0.7	=	51.18	(80)
West	0.9x 0.54	X	8.25	X	2	24.49	Х	0.4	X	0.7	=	27.49	(80)
West	0.9x 0.54	×	8.25	×	1	6.15	х	0.4	x	0.7	-	18.13	(80)
Solar gair	ns in watts, <mark>ca</mark>	alculated	for each	month			(83)m	= Sum(74)m .	(82)m				
(83)m= 4	4.78 86.58	144.85	222.17	286.69	300.96	283.38	232.	.95 171.37	102.89	55.54	37.08		(83)
Total gair	ns – internal a	ind solar	(84)m = ((73)m +	(83)m	, watts							
(84)m = 4	46.9 486.63	532.27	589.27	633.34	627.72	597.11	552.		450 4	429.67	428.74		
			_				552.	62 501.37	453.43	429.67	420.74		(84)
7. Mean	internal temp	erature ((heating s				552.	62 501.37	455.4	429.67	420.74		(84)
	internal temp		,	season)					453.4	429.07	420.74	21	(84)
Tempera		eating p	eriods in t	season) the living	g area	from Tab			453.4	3 429.07	420.74	21	
Tempera	ature during h	eating p	eriods in t	season) the living	g area	from Tab		Th1 (°C)	Oct		Dec	21	
Tempera	ature during h	eating pains for li	eriods in t	season) the living	g area (see Ta	from Tab	ole 9,	Th1 (°C)				21	
Tempera Utilisatio	ature during hon factor for gall Jan Feb	eating positions for line Mar	eriods in t iving area Apr 0.95	season) the living a, h1,m (May 0.85	g area (see Ta Jun 0.66	from Tab able 9a) Jul 0.49	ole 9,	Th1 (°C) ug Sep 5 0.82	Oct	Nov	Dec	21	(85)
Utilisatio	ature during hon factor for g	eating positions for line Mar	eriods in to iving area Apr 0.95 iving area	season) the living a, h1,m (May 0.85	g area (see Ta Jun 0.66	from Tab able 9a) Jul 0.49	ole 9,	Th1 (°C) ug Sep 5 0.82 able 9c)	Oct	Nov 0.99	Dec	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2	ature during hon factor for gallon Feb 1 1 1 ternal temper 10.04 20.15	eating prains for line Mar 0.99 ature in l	eriods in to iving area Apr 0.95 iving area 20.65	the living A, h1,m (May 0.85 a T1 (fol 20.88	g area (see Ta Jun 0.66 low ste	from Tab able 9a) Jul 0.49 ps 3 to 7	Ole 9, 0.5 7 in T	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93	Oct 0.97	Nov 0.99	Dec 1	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera	ature during hon factor for gan Feb 1 1 ternal temper	eating prains for line Mar 0.99 ature in l	eriods in to iving area Apr 0.95 iving area 20.65 eriods in to iving area area area area area area area are	the living A, h1,m (May 0.85 a T1 (fol 20.88	g area (see Ta Jun 0.66 low ste	from Tab able 9a) Jul 0.49 ps 3 to 7	Ole 9, 0.5 7 in T	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C)	Oct 0.97	Nov 0.99 20.29	Dec 1	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2	ature during hon factor for gauge Jan Feb 1 1 ternal temper 20.04 20.15 ature during hon 1 20.11	eating prains for line Mar 0.99 ature in large 20.36 seating prains 120.11	eriods in to iving area Apr 0.95 iving area 20.65 eriods in to 20.12	the living a, h1,m (May 0.85 a T1 (fol 20.88 a rest of d 20.12	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13	Ole 9, Au 0.57 in T 20.9 able 9	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C)	Oct 0.97 20.64	Nov 0.99 20.29	Dec 1 20.02	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio	ature during hon factor for games Jan Feb 1 1 ternal temper 0.04 20.15 ature during hon factor for games	eating prains for line Mar 0.99 ature in l 20.36 eating prains for r	eriods in to iving area Apr 0.95 iving area 20.65 eriods in to 20.12 est of dweeters are a six of the control o	the living a, h1,m (May 0.85 a T1 (fol 20.88 rest of de 20.12 relling, h	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13	Ole 9, Ole 9,	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13	Oct 0.97 20.64 20.12	Nov 0.99 20.29	Dec 1 20.02 20.12	21	(85) (86) (87) (88)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m=	ature during hon factor for game and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb temper	meating properties of the control of	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94	the living a, h1,m (May 0.85 a T1 (fol 20.88 cest of decent of de	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13 ee Table 0.39	Ole 9, Ole 9,	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13	Oct 0.97 20.64 20.12 0.96	Nov 0.99 20.29	Dec 1 20.02	21	(85)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int	pature during heart for grans and feb ternal tempers and feb ternal tempers and feb ternal tempers and feb ternal tempers and feb ternal tempers and feb ternal tempers and feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb ternal tempers and feature during heart feb tempers an	eating positions for II Mar 0.99 ature in II 20.36 eating positions for r 0.98 ature in t	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94 the rest of	the living a, h1,m (May 0.85 a T1 (fol 20.88 arest of d 20.12 arelling, h 0.81 are discounted by the second are discounted by the s	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13 ee Table 0.39 ollow ste	Ole 9, Au 0.5 in T 20.9 able 9 20.1 9a) 0.4	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 0, Th2 (°C) 14 20.13 5 0.75 to 7 in Table	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12	Dec 1 20.02 20.12	21	(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int	ature during hon factor for game and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb ternal temper and feb temper	meating properties of the control of	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94 the rest of	the living a, h1,m (May 0.85 a T1 (fol 20.88 cest of decent of de	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13 ee Table 0.39	Ole 9, Ole 9,	Th1 (°C) ug Sep 5 0.82 table 9c) 99 20.93 0, Th2 (°C) 14 20.13 5 0.75 to 7 in Table 13 20.07	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12 0.99	Dec 1 20.02 20.12 1 18.8		(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int	pature during heart for grans and feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at tempe	eating positions for II Mar 0.99 ature in II 20.36 eating positions for r 0.98 ature in t	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 1 20.12 est of dwo 0.94 the rest of	the living a, h1,m (May 0.85 a T1 (fol 20.88 arest of d 20.12 arelling, h 0.81 are discounted by the second are discounted by the s	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13 ee Table 0.39 ollow ste	Ole 9, Au 0.5 in T 20.9 able 9 20.1 9a) 0.4	Th1 (°C) ug Sep 5 0.82 table 9c) 99 20.93 0, Th2 (°C) 14 20.13 5 0.75 to 7 in Table 13 20.07	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12	Dec 1 20.02 20.12 1 18.8	0.33	(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int (90)m= 1	pature during heart for grans and feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at the feb ternal tempers at tempe	eating prains for line ature in land 20.36 leating prains for range 20.11 leating for range 20.11 leat	eriods in to iving area and a second singular and a second singula	the living a, h1,m (May 0.85 a T1 (fol 20.88 rest of d 20.12 relling, h 0.81 f dwelling 20.01	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58 ng T2 (fr 20.12	from Table 9a) Jul 0.49 ps 3 to 7 21 from Ta 20.13 ee Table 0.39 ollow ste 20.13	ole 9, O.5 in T 20.9 able 9 0.4 eps 3	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13 5 0.75 to 7 in Table 13 20.07	Oct 0.97 20.64 20.12 0.96 e 9c)	Nov 0.99 20.29 20.12 0.99	Dec 1 20.02 20.12 1 18.8		(85) (86) (87) (88) (89)
Tempera Utilisatio (86)m= Mean int (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean int (90)m= 1	ature during hon factor for games and seed of the factor for games	ains for line ature in lature in table 20.11 ains for rature in table 20.29 ature in table 20.29 ature in table 20.29 ature (for 19.64	eriods in to iving area Apr 0.95 iving area 20.65 eriods in 120.12 est of dwo 0.94 the rest of 19.71 r the whole 20.02	the living a, h1,m (May 0.85 a T1 (fol 20.88 arest of d 20.12 arelling, h 0.81 arelling and decided are also a	g area (see Ta Jun 0.66 low ste 20.98 lwelling 20.13 2,m (se 0.58 log T2 (fi 20.12 ling) = fi 20.41	from Table 9a) Jul 0.49 ps 3 to 7 21 from Table 20.13 ee Table 0.39 ollow stee 20.13 LA × T1 20.42	9a) 0.4 0.5 0.5 0.6 0.5 0.6 0.6 0.6 0.7 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Th1 (°C) ug Sep 5 0.82 able 9c) 99 20.93 9, Th2 (°C) 14 20.13 5 0.75 to 7 in Tabl 13 20.07 f	Oct 0.97 20.64 20.12 0.96 e 9c) 19.7 LA = Liv	Nov 0.99 20.29 20.12 0.99 19.2 ving area ÷ (-	Dec 1 20.02 20.12 1 18.8		(85) (86) (87) (88) (89)

												ı	
(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. Space hea						44 -4	Table O	41	4 T: /	70)	-11-		
Set Ti to the the utilisation			•		ed at ste	ер 11 от	i abie 9i	o, so tna	t 11,m=(76)m an	a re-caic	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	ains, hm						•				l	
(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)
Useful gains,	hmGm	, W = (9	4)m x (8	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)
Monthly aver			i 			1			1			ı	
(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	ì	an intern	 			-``	-``	<u> </u>		0.47.44	4005.04	1	(07)
(97)m= 1029.9	996.22		754.08	581.44	387.84	255.19	267.84	420.1	636.93	847.41	1025.04		(97)
Space heatin (98)m= 435.27	345.11	283.4	145.46	48.3	0	0.02	0	0 0	151.16	303.68	444.81		
(00)=	1 0 10.11		1 10.10	10.0				l per year	<u> </u>			2157.19	(98)
Casas bastin			. I.s\ A / Ib / 100 S	2/			1010	i poi youi	(KVVIII y Cal) = Odin(o	0/15,912		<u> </u>
Space heatin	• •											30.31	(99)
9b. Energy red			· ·	Ĭ									
This part is us Fraction of spa					_		.	•		unity sch	neme.	0	(301)
Fraction of spa							(1000	., •					(302)
										L		1	(302)
The c <mark>ommu</mark> nity so includes boilers, h									up to four	other heat	sources; ti	he latter	
Fraction of hea												0.6	(303a)
Fraction of cor	mmunity	heat fro	m heat s	source 2								0.4	(303b)
Fraction of total					HP				(3	02) x (303	a) =	0.6	(304a)
Fraction of total	-			-		e 2			·	02) x (303	,	0.4	(304b)
Factor for conf	•			•			unitv hea	ıtina svs		, ,	, 	1	
Distribution los				,	. ,,		•	3 ,				1.1	(306)
Space heating		(,	.9 -,						kWh/year	
Annual space	_	requiren	nent									2157.19	7
Space heat fro	m Com	munity C	HP					(98) x (30	04a) x (30	5) x (306)	=	1423.75	(307a)
Space heat fro	m heat	source 2	2					(98) x (30	04b) x (30	5) x (306)	=	949.17	(307b)
Efficiency of se	econdar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/sup	plemen	tary sys	tem	(98) x (30	01) x 100 ·	÷ (308) =		0	(309)
Water heating	a										'		_
Annual water		requirem	ent									2111.9	
If DHW from c Water heat fro								(64) x (30	03a) x (30	5) x (306)	=	1393.85	(310a)
Water heat fro	m heat	source 2						(64) x (30	03b) x (30	5) x (306)	=	929.24	(310b)
Electricity use	d for hea	at distrib	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) =	Ē	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):		_		_
mechanical ventilation - balanced, extract or positive input 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) + (330c)	g) =	249.66	(331)
Energy for lighting (calculated in Appendix L)			314.94	(332)
12b. CO2 Emissions – Community heating scheme				
Electrical efficiency of CHP unit			32	(361)
Heat efficiency of CHP unit			64	(362)
	0,	sion factor E 02/kWh k	missions g CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	2224.61 ^X 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) × 100 ÷ (362) =	2177.9 × 0	.22	470.43	(365)
less credit emissions for electricity —(310a) × (361) ÷ (362) =	696.93 ×	.52	-361.71	(366)
Efficiency of heat source 2 (%)	two fuels repeat (363) to (366) for	the second fuel	96	(367b)
CO2 associated with heat source 2 [(307b)+((310b)] x 100 ÷ (367b) x	.22	422.64	(368)
Electrical energy for heat distribution	((313) x	.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 instantane	ous 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	ng (331)) x 0	.52 =	129.58	(378)
CO2 associated with electricity for lighting	(332))) x	.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	Details:						
Assessor Name: Software Name:	Stroma FSA	AP 2012		Strom Softwa				Versic	on: 1.0.1.24	
		Р	roperty	Address	: Flat 5					
Address: 1. Overall dwelling dimen	nsions:									
The Overall awailing alliner	1010110.		Are	a(m²)		Av. Hei	ight(m)		Volume(m³)	
Ground floor			4	12.57	(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)+(1d)+(1e)+(1ı	n) <u> </u>	06.14	(4)			1		_
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	265.35	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hour	
Number of chimneys	0	+ 0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fan	ıs					0	X '	10 =	0	(7a)
Number of passive vents						0	x '	10 =	0	(7b)
Number of flueless gas fire	es					0	X 4	40 =	0	(7c)
Infiltration due to chimneys					continue fr	0 om (9) to (Air ch	nanges per hou	ur](8)
Number of storeys in the	e dwelling (ns))					r(a)		0	(9)
Additional infiltration Structural infiltration: 0.2	25 for steel or	timber frame or	0 35 fo	r masoni	v constr	uction	[(9)	-1]x0.1 =	0	(10) (11)
if both types of wall are pre deducting areas of opening	esent, use the val	ue corresponding to			•	401.011			0	」 (、,)
If suspended wooden flo			.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else e	nter 0							0	(13)
Percentage of windows	and doors dra	aught stripped		0.05 10.0		201			0	(14)
Window infiltration Infiltration rate				0.25 - [0.2] (8) + (10)	. ,	-	L (15) —		0	(15)
Air permeability value, o	150 expressed	d in cubic metre	s per ho	. , , , ,	, , ,	, , ,	, ,	area	3	(16) (17)
If based on air permeabilit	•		•		•	00	0.0 p 0	u. • u	0.15	(18)
Air permeability value applies	if a pressurisation	n test has been dor	ne or a de	gree air pe	rmeability	is being us	sed			
Number of sides sheltered Shelter factor	d			(20) = 1 -	[0 075 x (1	9)1 =			2	(19)
Infiltration rate incorporating	na shelter fact	or		(21) = (18		/ 1			0.85	(20)
Infiltration rate modified fo	•			•	• •				0.10	۱٬۳۰/
	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table								_	
(22)m= 5.1 5 4	1.9 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			
	!	!			ļ	!	<u> </u>			J		
Adjusted infiltration rate (allowing				<u> </u>	`	` ´				1		
0.16 0.16 0.16 Calculate effective air change ra	0.14 ote for th	0.14 ne applio	0.12 cable ca	0.12 Se	0.12	0.13	0.14	0.14	0.15			
If mechanical ventilation:	110 101 11	то арртс	Jabio oa	00							0.5	(23a)
If exhaust air heat pump using Append	dix N, (23	3b) = (23a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)				0.5	(23b)
If balanced with heat recovery: efficien	ncy in %	allowing fo	or in-use f	actor (from	n Table 4h) =				6	3.7	(23c)
a) If balanced mechanical ven	itilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1	1 – (23c)	÷ 100]		_
(24a)m= 0.34 0.34 0.34	0.32	0.32	0.3	0.3	0.3	0.31	0.32	0.32	0.33			(24a)
b) If balanced mechanical ven	itilation	without	heat rec	covery (N	/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 ventil		•	-									
if $(22b)m < 0.5 \times (23b)$, the	<u> </u>			· ` `	ŕ		5 × (23b	i e		1		
(24c)m = 0 0 0	0	0	0	0	0	0	0	0	0			(24c)
d) If natural ventilation or wholif (22b)m = 1, then (24d)m		•	•				0.51					
$(24d)_{m=0} 0 0 0$	0	0	0	0	0.5 + [(2	0	0.5]	0	0			(24d)
Effective air change rate - ente			-				Ü					
(25)m= 0.34 0.34 0.34	0.32	0.32	0.3	0.3	0.3	0.31	0.32	0.32	0.33	l		(25)
										ı		
3. Heat losses and heat loss pa			Not Ar	00	Llvol	110	A V I I	_	k volus	,	A V	` le
	aramete Openino m²	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	〈)	k-value kJ/m²-ł		A X kJ/ł	
ELEMENT Gross	Openin	gs						<)				
ELEMENT Gross area (m²)	Openin	gs	A ,r	m ²	W/m2	=	(W/I	<) 				K
ELEMENT Gross area (m²) Doors	Openin	gs	A ,r	m ² x x1/	W/m2 2	0.04] =	4.2	<) 				(26)
ELEMENT Gross area (m²) Doors Windows Type 1	Openin	gs	A ,r 2.1 6.21	x1/	W/m2 2 /[1/(0.8)+	0.04] = [0.04] = [4.2 4.81	<) 				(26) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2	Openin	gs	A ,r 2.1 6.21 9.55	x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+	$ \begin{array}{ccc} & & & \\ & & \\ & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\$	4.2 4.81 7.4	<) 				(26) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3	Openin	gs	A ,r 2.1 6.21 9.55 9.82	x1/ x1/ x1/ x1/	W/m ² 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	4.2 4.81 7.4 7.61	<)				(26) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77	x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [4.2 4.81 7.4 7.61 4.47	\$) 				(26) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55	x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [(W/I 4.2 4.81 7.4 7.61 4.47 7.4	<)				(26) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	$ \begin{array}{ccc} & & & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\ & 0.04 & & & \\$	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04	<)				(26) (27) (27) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	$ \begin{vmatrix} 0.04 \\ 0.04 \end{vmatrix} = \begin{vmatrix} 0.04 \\ $	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9	Openin	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	$ \begin{vmatrix} $	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10	Opening m	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36	<)				(26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 40.22	Opening m ²	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type1 Walls Type2 39.17	25.58 21.82	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26	\$) 				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 3 39.17 Walls Type 3 39.17	25.58 21.82 20.5	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64 17.35	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8	0.04] = [0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26 2.43	•) ——————————————————————————————————				(26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 40.22 Walls Type 3 39.17 Walls Type 3 39.17 Roof 31.06	25.58 21.82	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64 17.35 18.67 31.06	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+ /[1/(0.8)+	0.04] = 0.04]	4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26	\(\) \((26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Windows Type 9 Windows Type 10 Walls Type 1 Walls Type 3 39.17 Walls Type 3 39.17	25.58 21.82 20.5	gs	A ,r 2.1 6.21 9.55 9.82 5.77 9.55 6.5 5.24 5.57 4.07 5.62 14.64 17.35	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 2 /[1/(0.8)+ /[1/(0.8	0.04] = [0.04]	(W/I 4.2 4.81 7.4 7.61 4.47 7.4 5.04 4.06 4.32 3.16 4.36 1.9 2.26 2.43	\$				(26) (27) (27) (27) (27) (27) (27) (27) (27

* for windows and roof wind ** include the areas on both	h sides of ir	nternal wali	ls and par	titions								
Fabric heat loss, W/K						(26)(30)	+ (32) =				67.15	(33)
Heat capacity Cm = S	S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass parame	eter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
For design assessments w can be used instead of a de			construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridges : S (I	_xY) cal	culated ι	using Ap	pendix I	<						11.1	(36)
if details of thermal bridging	g are not kn	own (36) =	= 0.15 x (3	11)								_
Total fabric heat loss							(33) +	(36) =			78.25	(37)
Ventilation heat loss of	alculated	d monthly	/	ī	ı	Γ		= 0.33 × (25)m x (5)	·	1	
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 transfer coefficie	ent, 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		_
Llast lass novemeter /	7 H D) AV	/ma 21/						Average =		12 /12=	106.35	(39)
Heat loss parameter ((40)m= 1.02 1.02	` 	1	1	0.00	0.99	0.98	0.99	= (39)m ÷		1.01		
(40)m= 1.02 1.02	1.02			0.99	0.99	0.96		Average =	1.01	1.01	1	(40)
Number of days in mo	onth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 / 12=		(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 Water heating ene	erav reau	irement:								k\Wh/ve	ar.	
4. Water heating end	ergy requ	irement:						ŧ		kWh/ye	ear:	
Assumed occupancy, if TFA > 13.9, N = 1	N + 1.76 x		(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (⁷	ΓFA -13.		kWh/ye	ear:	(42)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1	N + 1.76 x	[1 - exp						ΓFA -13.	9)	79	ear:	
Assumed occupancy, if TFA > 13.9, N = 1	N + 1.76 x vater usage hot water	[1 - exp ge in litre usage by s	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		9)		ear:	(42)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per	N + 1.76 x rater usage to hot water r person per	ge in litre usage by a day (all w	es per da 5% if the d rater use, i	ay Vd,av dwelling is thot and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	9)	79	ear:	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average.	N + 1.76 x rater usage to hot water r person per	[1 - exp ge in litre usage by s r day (all w Apr	es per da 5% if the d rater use, i May	ay Vd,av dwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36		9)	79	ear:	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per Jan Feb	N + 1.76 x rater usage hot water reperson per Mar er day for ea	ge in litre usage by s r day (all w Apr ach month	es per da 5% if the c rater use, i May Vd,m = fa	ay Vd,av dwelling is thot and co Jun ctor from	erage = designed in display Jul	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Ge target of	9) 10: Nov	79 5.74 Dec	ear:	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb	N + 1.76 x rater usage hot water reperson per Mar er day for ea	[1 - exp ge in litre usage by s r day (all w Apr	es per da 5% if the d rater use, i May	ay Vd,av dwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us Sep	Oct	Nov	79 5.74 Dec		(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per Jan Feb	+ 1.76 x rater usage hot water reperson per Mar er day for ea	ge in litre usage by s r day (all w Apr ach month	es per da 5% if the o rater use, i May Vd,m = fa 99.39	ay Vd,av dwelling is thot and co Jun ctor from 1	erage = designed id) Jul Table 1c x 95.17	(25 x N) to achieve Aug (43) 99.39	+ 36 a water us Sep 103.62	Oct 107.85 Total = Sur	Nov 112.08 m(44) ₁₁₂ =	79 5.74 Dec	1268.87	
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08	N + 1.76 x rater usage hot water reperson per Mar er day for each 107.85	ge in litre usage by s r day (all w Apr ach month	es per da 5% if the o rater use, i May Vd,m = fa 99.39	ay Vd,av dwelling is thot and co Jun ctor from 1	erage = designed id) Jul Table 1c x 95.17	(25 x N) to achieve Aug (43) 99.39	+ 36 a water us Sep 103.62	Oct 107.85 Total = Sur	Nov 112.08 m(44) ₁₁₂ =	79 5.74 Dec		(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08	N + 1.76 x rater usage hot water reperson per Mar er day for each 107.85	ge in litre usage by s r day (all w Apr ach month 103.62	es per da 5% if the d rater use, i May Vd,m = fa 99.39 onthly = 4.	ay Vd,av twelling is hot and co Jun ctor from 7 95.17	erage = designed id) Jul Table 1c x 95.17	(25 x N) to achieve Aug (43) 99.39	+ 36 a water us Sep 103.62 0 kWh/mon 120.92	Oct 107.85 Total = Suith (see Ta	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83	79 5.74 Dec 116.31 c, 1d) 167.05		(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08	N + 1.76 x rater usage hot water reperson per Mar 107.85 rused - cal	ge in litre usage by ser day (all wash month 103.62	es per da 5% if the coater use, I May Vd,m = fa 99.39 onthly = 4.	ay Vd,av dwelling is hot and co Jun ctor from 7 95.17 190 x Vd,r	erage = designed and ld) Jul Table 1c x 95.17 m x nm x E 104.13	(25 x N) to achieve Aug (43) 99.39 97m / 3600 119.49	+ 36 a water us Sep 103.62 0 kWh/mon 120.92	Oct 107.85 Total = Sun 140.92	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83	79 5.74 Dec 116.31 c, 1d) 167.05	1268.87	(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86	N + 1.76 x rater usage hot water reperson per Mar 107.85 rused - cal	ge in litre usage by ser day (all wash month 103.62	es per da 5% if the coater use, I May Vd,m = fa 99.39 onthly = 4.	ay Vd,av dwelling is hot and co Jun ctor from 7 95.17 190 x Vd,r	erage = designed and ld) Jul Table 1c x 95.17 m x nm x E 104.13	(25 x N) to achieve Aug (43) 99.39 97m / 3600 119.49	+ 36 a water us Sep 103.62 0 kWh/mon 120.92	Oct 107.85 Total = Sun 140.92	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83	79 5.74 Dec 116.31 c, 1d) 167.05	1268.87	(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63	N + 1.76 x rater usage hot water reperson per Mar 107.85 107.85 r used - cal 155.67 ting at point 23.35	ge in litre usage by a day (all was Apr ach month 103.62 culated mo 135.72 for use (no 20.36	Pes per da 5% if the content use, if the conte	ay Vd,av dwelling is hot and co Jun ctor from 7 95.17 190 x Vd,r 112.38 r storage), 16.86	erage = designed to ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92	+ 36 a water us Sep 103.62 0 kWh/more 120.92 0 to (61) 18.14	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (21.14)	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 = c, 1d) 167.05	1268.87	(43)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss:	N + 1.76 x rater usage hot water reperson per Mar 107.85 107.85 155.67 155.67 155.67 23.35	ge in litre usage by s r day (all w Apr ach month 103.62 culated mo 135.72 f of use (no	es per da 5% if the coater use,	ay Vd,av dwelling is hot and co Jun ctor from 7 190 x Vd,r 112.38 r storage), 16.86	erage = designed of ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa	+ 36 a water us Sep 103.62 0 kWh/more 120.92 0 to (61) 18.14	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth (21.14)	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb. Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss: Storage volume (litres of the storage volume) (116.31 112.08)	N + 1.76 x rater usage hot water reperson per Mar 107.85 107.85 rused - cal 155.67 ting at point 23.35 s) includir and no tal	ge in litre usage by s r day (all w Apr ach month 103.62 culated mo 135.72 f of use (no 20.36 and any so ank in dw	es per da 5% if the content use, if May Vd,m = fa 99.39 onthly = 4. 130.23 o hot water 19.53 olar or Water velling, e	ay Vd,av dwelling is hot and co Jun ctor from 1 95.17 190 x Vd,r 112.38 r storage), 16.86 WHRS	erage = designed idd) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa (47)	+ 36 a water us Sep 103.62 0 kWh/mor 120.92 0 to (61) 18.14 ame vess	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth 21.14 sel	Nov 112.08 m(44) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot we reduce the annual average not more that 125 litres per Jan Feb. Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss: Storage volume (litres of the litr	rater usage hot water reperson per Mar 107.85 107.85 155.67 123.35 1 includir and no tall hot water states at hot water states and no tall hot water states at hot water states and no tall hot water states at hot water states and no tall hot water states at hot water	ge in litre usage by strated month 103.62 culated month 20.36 gany so ank in dwer (this in	es per da 5% if the co tater use, i May Vd,m = fa 99.39 onthly = 4. 130.23 o hot water 19.53 olar or W yelling, e	ay Vd,av dwelling is hot and co Jun ctor from 1 95.17 190 x Vd,r 112.38 r storage), 16.86 WHRS enter 110 nstantar	erage = designed of ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa (47)	+ 36 a water us Sep 103.62 0 kWh/mor 120.92 0 to (61) 18.14 ame vess	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth 21.14 sel	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46) (47)
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb. Hot water usage in litres per (44)m= 116.31 112.08 Energy content of hot water (45)m= 172.49 150.86 If instantaneous water head (46)m= 25.87 22.63 Water storage loss: Storage volume (litres of the storage volume) (116.31 112.08)	N + 1.76 x rater usage hot water reperson per larger day for ear larg	ge in litre usage by s r day (all w Apr 103.62 culated mo 135.72 cof use (no 20.36 and any so ank in dw er (this in	es per da 5% if the co tater use, i May Vd,m = fa 99.39 onthly = 4. 130.23 o hot water 19.53 olar or W yelling, e	ay Vd,av dwelling is hot and co Jun ctor from 1 95.17 190 x Vd,r 112.38 r storage), 16.86 WHRS enter 110 nstantar	erage = designed of ld) Jul Table 1c x 95.17 m x nm x E 104.13 enter 0 in 15.62 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 99.39 07m / 3600 119.49 boxes (46) 17.92 within sa (47)	+ 36 a water us Sep 103.62 0 kWh/mor 120.92 0 to (61) 18.14 ame vess	Oct 107.85 Total = Sunth (see Tail 140.92) Total = Sunth 21.14 sel	Nov 112.08 m(44) ₁₁₂ = ables 1b, 1 153.83 m(45) ₁₁₂ = 23.07	79 5.74 Dec 116.31 c, 1d) 167.05 25.06	1268.87	(43) (44) (45) (46)

. 9,) x (49) =	110		(50)
b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02		(51)
If community heating see section 4.3		0.02		(31)
Volume factor from Table 2a		1.03		(52)
Temperature factor from Table 2b		0.6		(53)
Energy lost from water storage, kWh/year (47	(i) x (51) x (52) x (53) =	1.03		(54)
Enter (50) or (54) in (55)		1.03		(55)
Water storage loss calculated for each month ((56)	$6)m = (55) \times (41)m$			
(56)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 3	32.01 30.98 32.01	30.98 32.01		(56)
If cylinder contains dedicated solar storage, (57) m = (56) m x $[(50) - (H11)] \div (50)$, (50)	else (57)m = (56)m where (I	H11) is from Append	ix H	
(57)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 3	32.01 30.98 32.01	30.98 32.01		(57)
Primary circuit loss (annual) from Table 3		0		(58)
Primary circuit loss calculated for each month (59)m = $(58) \div 365$	× (41)m			
(modified by factor from Table H5 if there is solar water heating		stat)		
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 2	23.26 22.51 23.26	22.51 23.26		(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m		•		
(61)m= 0 0 0 0 0 0 0 0	0 0 0	0 0		(61)
Total heat required for water heating calculated for each month (62)	$2 \text{ m} = 0.85 \times (45) \text{ m} + 0.000 \text{ m}$	(46)m + (57)m +	(59)m + (61)m	
	74.77 174.41 196.2	207.32 222.32		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (e				
(add additional lines if FGHRS and/or WWHRS applies, see Appe		on to mater meaning,		
(63)m= 0 0 0 0 0 0	0 0 0	0 0		(63)
Output from water heater		<u> </u>		
	74.77 174.41 196.2	207.32 222.32		
	Output from water heater	(annual) ₁₁₂	2314.53	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m +	(61)m] + 0.8 x [(46)m	+ (57)m + (59)m	1	
	33.95 83 91.08	93.94 99.76		(65)
include (57)m in calculation of (65)m only if cylinder is in the dwe	elling or hot water is fr	om community h	eating	
5. Internal gains (see Table 5 and 5a):	oming or mot mater to m		- Coming	
,				
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul	Aug Sep Oct	Nov Dec		
	39.48 139.48 139.48	139.48 139.48		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also				` '
	1.49 15.42 19.58	22.85 24.36		(67)
		21.00		()
Appliances gains (calculated in Appendix L, equation L13 or L13a) (68)m= 265.89 268.65 261.7 246.89 228.21 210.65 198.92 19	96.16 203.11 217.91	236.6 254.16		(68)
		230.0 234.10		(00)
Cooking gains (calculated in Appendix L, equation L15 or L15a), a		20.05		(60)
` '	36.95 36.95 36.95	36.95 36.95		(69)
Pumps and fans gains (Table 5a)		0 0		(70)
(70)m= 0 0 0 0 0 0 0	0 0 0	0 0		(70)
Losses e.g. evaporation (negative values) (Table 5)				
	11.58 -111.58 -111.58	-111.58 -111.58		(71)

Water	heating	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	2 130.48	134.09]	(72)
Total	internal	gains =				•	(66)	m + (67)m	1 + (68	3)m + (69)m +	(70)m +	(71)m + (72))m	4	
(73)m=	490.96	488.63	472.67	446.81	420.38	3	95.01	378.57	385	.33 398.65	424.7	'5 454.77	477.46]	(73)
6. So	lar gains	S:													
Solar	gains are o	calculated u	using solai	flux from	Table 6a	and	l assoc	iated equa	tions	to convert to t	he appli	cable orientat	tion.		
Orient		ccess F	actor	Area			Flu			g_ _ a.		FF		Gains	
	_	Table 6d		m²			I al	ble 6a		Table 6b) 	Table 6c		(W)	
East	0.9x	1	X	6.2	21	X	1	9.64	X	0.4	X	0.7	=	16.6	(76)
East	0.9x	1	X	9.8	32	X	1	9.64	X	0.4	X	0.7	=	26.25	(76)
East	0.9x	1	X	6.	5	X	1	9.64	X	0.4	x	0.7	=	17.37	(76)
East	0.9x	1	X	5.6	62	X	1	9.64	X	0.4	X	0.7	=	15.02	(76)
East	0.9x	1	X	6.2	21	X	3	88.42	X	0.4	X	0.7	=	32.47	(76)
East	0.9x	1	X	9.8	32	X	3	88.42	X	0.4	X	0.7	=	51.34	(76)
East	0.9x	1	X	6.	5	X	3	88.42	x	0.4	X	0.7	=	33.98	(76)
East	0.9x	1	X	5.6	52	X	3	88.42	x	0.4	X	0.7	=	29.38	(76)
East	0.9x	1	X	6.2	21	X	6	3.27	X	0.4	X	0.7		53.47	(76)
East	0.9x	1	x	9.8	32	х	ϵ	3.27	x	0.4	X	0.7		84.55	(76)
East	0.9x	1	X	6.	5	Х	6	33.27	x	0.4	X	0.7	=	55.97	(76)
East	0.9x	1	X	5.6	52	X	6	33.27	X	0.4	X	0.7	=	48.39	(76)
East	0.9x	1	X	6.2	21	X	9	2.28	X	0.4	X	0.7	=	77.98	(76)
East	0.9x	1	X	9.8	32	x	9	2.28	Х	0.4	X	0.7	=	123.31	(76)
East	0.9x	1	X	6.	5	Х	9	2.28	X	0.4	х	0.7	=	81.62	(76)
East	0.9x	1	X	5.6	62	Х	9	2.28	X	0.4	х	0.7	=	70.57	(76)
East	0.9x	1	X	6.2	21	X	1	13.09	X	0.4	X	0.7	=	95.57	(76)
East	0.9x	1	X	9.8	32	X	1	13.09	X	0.4	X	0.7	=	151.13	(76)
East	0.9x	1	X	6.	5	X	1	13.09	X	0.4	X	0.7	=	100.03	(76)
East	0.9x	1	X	5.6	32	X	1	13.09	X	0.4	X	0.7	=	86.49	(76)
East	0.9x	1	X	6.2	21	X	1	15.77	X	0.4	X	0.7	=	97.83	(76)
East	0.9x	1	X	9.8	32	X	1	15.77	X	0.4	X	0.7	=	154.7	(76)
East	0.9x	1	X	6.	5	X	1	15.77	X	0.4	X	0.7	=	102.4	(76)
East	0.9x	1	X	5.6	62	X	1	15.77	X	0.4	X	0.7	=	88.54	(76)
East	0.9x	1	X	6.2	21	X	1	10.22	X	0.4	X	0.7	=	93.14	(76)
East	0.9x	1	X	9.8	32	X	1	10.22	X	0.4	X	0.7	=	147.29	(76)
East	0.9x	1	X	6.	5	X	1	10.22	x	0.4	X	0.7	=	97.49	(76)
East	0.9x	1	X	5.6	52	X	1	10.22	x	0.4	X	0.7	=	84.29	(76)
East	0.9x	1	X	6.2	21	X		94.68	x	0.4	x	0.7	=	80.01	(76)
East	0.9x	1	X	9.8	32	X		94.68	x	0.4	x	0.7	=	126.52	(76)
East	0.9x	1	X	6.	5	X	9	94.68	x	0.4	x	0.7	=	83.74	(76)
East	0.9x	1	x	5.6	52	x	9	94.68	x	0.4	×	0.7	=	72.41	(76)

	_												_
East	0.9x	1	X	6.21	X	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	х	5.62	x	45.59	x	0.4	X	0.7	=	34.87	(76)
East	0.9x	1	х	6.21	x	24.49	x	0.4	X	0.7	=	20.69	(76)
East	0.9x	1	х	9.82	x	24.49	x	0.4	X	0.7	=	32.72	(76)
East	0.9x	1	х	6.5	x	24.49	x	0.4	X	0.7	=	21.66	(76)
East	0.9x	1	х	5.62	х	24.49	x	0.4	X	0.7	=	18.73	(76)
East	0.9x	1	х	6.21	х	16.15	x	0.4	x	0.7	=	13.65	(76)
East	0.9x	1	х	9.82	х	16.15	x	0.4	X	0.7	=	21.58	(76)
East	0.9x	1	х	6.5	х	16.15	x	0.4	X	0.7	=	14.29	(76)
East	0.9x	1	х	5.62	x	16.15	x	0.4	x	0.7	=	12.35	(76)
South	0.9x	0.54	х	9.55	x	46.75	x	0.4	x	0.7	=	60.76	(78)
South	0.9x	0.54	х	9.55	X	46.75	Х	0.4	X	0.7	=	60.76	(78)
South	0.9x	0.54	х	5.57	х	46.75	x	0.4	x	0.7	=	35.44	(78)
South	0.9x	0.54	х	4.07	х	46.75	x	0.4	x	0.7	=	25.89	(78)
South	0.9x	0.54	х	9.55	X	76.57	x	0.4	x	0.7	=	99.5	(78)
South	0.9x	0.54	x	9.55	x	76.57	Х	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	х	4.07	х	76.57	x	0.4	x	0.7	=	42.41	(78)
South	0.9x	0.54	х	9.55	х	97.53	x	0.4	X	0.7	=	126.75	(78)
South	0.9x	0.54	х	9.55	х	97.53	x	0.4	X	0.7	=	126.75	(78)
South	0.9x	0.54	х	5.57	x	97.53	x	0.4	x	0.7	=	73.93	(78)
South	0.9x	0.54	х	4.07	х	97.53	x	0.4	X	0.7	=	54.02	(78)
South	0.9x	0.54	х	9.55	x	110.23	x	0.4	x	0.7	=	143.26	(78)
South	0.9x	0.54	х	9.55	х	110.23	x	0.4	X	0.7	=	143.26	(78)
South	0.9x	0.54	х	5.57	х	110.23	x	0.4	x	0.7	=	83.55	(78)
South	0.9x	0.54	х	4.07	x	110.23	x	0.4	x	0.7	=	61.05	(78)
South	0.9x	0.54	х	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	х	4.07	х	114.87	x	0.4	x	0.7	j =	63.62	(78)
South	0.9x	0.54	х	9.55	x	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	x	9.55	x	110.55	x	0.4	x	0.7	=	143.66	(78)
South	0.9x	0.54	х	5.57	x	110.55	x	0.4	x	0.7	j =	83.79	(78)
South	0.9x	0.54	x	4.07	x	110.55	x	0.4	x	0.7	=	61.23	(78)
South	0.9x	0.54	x	9.55	x	108.01	x	0.4	x	0.7	j =	140.37	(78)
	_		•		•		•				•		-

South	ا میر	0.54	1	0.55	1	400.04	1 .,	0.4	۱	0.7	l _	4.40.07	7(70)
South	0.9x	0.54] X	9.55	X 1	108.01	X 1	0.4	X	0.7	= 1	140.37	(78)
South	0.9x	0.54	X	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	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	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)
	0.9x	0.54	X	9.55	J X I	82.59] X]	0.4	X	0.7	= 	107.33	(78)
South South	0.9x	0.54	X	9.55	X	82.59	X 1	0.4	X	0.7	= 	107.33	[78]
	0.9x	0.54	X	5.57	X	82.59	J X I	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	X	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	Х	0.4	X	0.7	=	42] (78)
South	0.9x	0.54	X	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	X	0.4	X	0.7	=	52.5	<u> </u> (78)
South	0.9x	0.54	X	9.55	X	40.4	X	0.4	X	0.7	=	52.5	<u> </u> (78)
South	0.9x	0.54	X	5.57	X	40.4	Х	0.4	X	0.7	=	30.62	[78]
South	0.9x	0.54	X	4.07	Х	40.4	X	0.4	X	0.7	=	22.37	[78]
West	0.9x	0.54	X	5.77	Х	19.64	X	0.4	X	0.7	=	15.42	<u> </u> (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	X	5.24	X	110.22	X	0.4	X	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	x	94.68	x	0.4	X	0.7	=	67.51	(80)
West	0.9x	0.54	X	5.77	x	73.59	x	0.4	X	0.7	=	57.78	(80)
West	0.9x	0.54	X	5.24	X	73.59	X	0.4	X	0.7	=	52.47	(80)

West	0.9x	0.54	X	5.7	77	x	4	5.59	x		0.4	X	0.7	=	35.8	(80)
West	0.9x	0.54	х	5.2	24	x	45.59		x		0.4	X	0.7	=	32.51	(80)
West	0.9x	0.54	Х	5.7	77	x	24.49		x		0.4	X	0.7	=	19.23	(80)
West	0.9x	0.54	Х	5.2	24	x	24.49		x		0.4	X	0.7	=	17.46	(80)
West	0.9x	0.54	Х	5.7	77	x	16.15		X		0.4	X	0.7	=	12.68	(80)
West	0.9x	0.54	Х	5.2	24	x	1	6.15	x		0.4	X	0.7	=	11.52	(80)
Solar gains in watts, calculated for each month (83)m = Sum(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	565.93	347.23	244.06		(83)
Total ga	ains – ii	nternal a	nd sola	r (84)m =	= (73)m ·	+ (8	33)m	, watts					_		1	
(84)m=	778.47	992.82	1191.29	1369.68	1472.29	14	44.28	1388.34	130	80.0	1189.27	990.68	802	721.52		(84)
7. Mea	an inter	nal temp	erature	(heating	season)										
Tempe	erature	during h	eating p	periods ir	n the livii	ng	area t	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisa	tion fac	tor for g	ains for	living are	ea, h1,m	(s	ee Ta	ble 9a)								
ſ	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.94	0.82	0.65	(0.46	0.33	0.3	37	0.6	0.89	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollo	w ste	ps 3 to 7	7 in 1	able	e 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)
Tomp	oroturo	during h	ooting r	eriods ir	roct of	dw	olling	from To	blo (0 T					•	
(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	1	(88)
L						_	'		_		20.00		20.00	1 =0.0.		(==)
		0.97		rest of d		_	m (se _{0.4}		_	2 1	0.52	0.86	0.98	1	1	(89)
(89)m= [0.99	0.97	0.92	0.78	0.59		0.4	0.26	0.	3	0.52	0.86	0.96	1		(89)
				the rest		_	·		 	$\overline{}$			_		1	
(90)m=	18.82	19.18	19.58	19.93	20.05	2	0.09	20.09	20	.1	20.08	19.87		18.77		(90)
											Ť	LA = Liv	ving area ÷ (4) =	0.19	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling	g) = fl	LA × T1	+ (1	– fL	A) x T2				_	
(92)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.	27	20.25	20.05	19.49	19		(92)
Apply	adjustn	nent to t		n interna	temper	_		m Table	4e,	whe	re appro	priate			1	
(93)m=	19.06	19.39	19.78	20.1	20.23	2	0.26	20.27	20.	27	20.25	20.05	19.49	19		(93)
		ting requ														
				•		ned	at ste	ep 11 of	Tab	le 9t	o, so tha	t Ti,m=	=(76)m an	d re-cal	culate	
	Jan	Feb	Mar	using Ta	May	Г	Jun	Jul	Ι ,	ug	Sep	Oct	Nov	Dec	1	
L Utilisa		tor for g	!	<u> </u>	Iviay	_	Juli	Jui		ug	Sep	001	1100	l Dec	J	
(94)m=	0.99	0.97	0.91	0.78	0.6		0.41	0.28	0.3	31	0.54	0.85	0.98	0.99]	(94)
L		hmGm .	l	4)m x (8	L 4)m			<u> </u>	<u> </u>						J	
(95)m=		962.29	· `	1074.27	881.78	59	91.12	383.92	403	.79	638.2	846.37	7 782.11	716.67]	(95)
Month	ly aver	age exte	rnal ten	nperature	from Ta	abl	e 8		!					•	J	
(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 le	oss rate	e for mea	an interr	nal tempe	erature,	Lm	<u>, W</u> =	=[(39)m :	x [(9	3)m-	– (96)m]			•	
(97)m=	1599.67	1566.47	1431.35	1192.18	905.28	59	93.34	384.11	404	.14	647.8	1002.9	3 1321.96	1587.9		(97)
Space	heatin	g require	ement fo	r each n	nonth, k	Wh	/mon	th = 0.02	24 x	[(97)	m – (95)m] x (41)m		1	
(98)m=	616.55	406.01	255.16	84.89	17.48		0	0	()	0	116.49	388.69	648.19		

	Total narross (IAMIs (sees) Come (OO)	0522.47	7(00)
Space heating requirement in I/M/h/m²//cor	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	provided by a community scheme.		
Fraction of space heat from secondary/supplementary heating (Tal		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allow	•	latter	_
includes boilers, heat pumps, geothermal and waste heat from power stations. See Fraction of heat from Community CHP	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 community	y heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating	_	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	Table 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: 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		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 our	tside	267.07	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating	<u> </u>	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	Emission fact		nissions CO2/year	
Space heating from CHP)	(307a) × 100 ÷ (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) × 100 ÷ (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 us	ing two fuels repeat (363) to	(366) for the second	d fuel	96	(367b)
CO2 associated with heat source 2	2 [(307b	y)+(310b)] x 100 ÷ (367b) x	0.22	=	479.95	(368)
Electrical energy for heat distribution	on	[(313) x	0.52	=	27.68	(372)
Total CO2 associated with commun	nity systems	(363)(366) + (368)(372	2)	=	757.2	(373)
CO2 associated with space heating	g (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from im	nmersion heater or instanta	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space a	and water heating	(373) + (374) + (375) =			757.2	(376)
CO2 associated with electricity for	pumps and fans within dwe	elling (331)) x	0.52	=	138.61	(378)
CO2 associated with electricity for	lighting	(332))) x	0.52	=	217.27	(379)
Total CO2, kg/year	sum of (376)(382) =				1113.08	(383)
Dwelling CO2 Emission Ra	te (383) ÷ (4) =				10.49	(384)
El rating (section 14)					90.13	(385)

Appendix D - 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 CO_2 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.

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.

Reasons for Excluding this Technology for this Site

The proposed development does not allow sufficient roof space to implement such technology. This technology is not considered suitable for this project and is not investigated further.

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. 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.