

Sustainability & Energy Statement Kingston Bridge House, Hampton Wick. KT1 4AG

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Executive Summary

This Sustainability and Energy Statement considers the sustainability issues relating to the proposed conversion and extension of Kingston Bridge House, Hampton Wick to provide a total of 70, Studio, 1, 2 & 3-bedroom apartments.

The Statement sets out the commitments of the applicant to the site and the targets that will be applied to the development. The site is located in a sustainable location close to existing facilities and infrastructure and will provide homes to meet local need.

Throughout the design process, the applicant and design team members have given careful consideration to the sustainability issues relating to the site, and how these can be enhanced in a marketable and feasible manner. As a result, this Statement demonstrates that the development meets relevant sustainability criteria and in a number of areas exceeds them.

The fabric standards of the building exceed the requirements of the Building Regulations.

The methodology used has been based upon the policy set out in the London Plan, 2021 (and provided in 'Energy Assessment Guidance' published by the Mayor of London) and uses the carbon factors for gas and electricity proposed for SAP 10.

In order to demonstrate the energy efficiency of the building a set of SAP calculations have been prepared for the 'Be Lean' scenario based on the use of gas boilers to each apartment. This is not the proposed strategy but purely demonstrates the reduction from the 'Be Lean' condition.

The Compliance Reports, TER and DER Worksheets for this option are attached as Appendix 1 and the 'Be Lean' spreadsheet based on the SAP 10 carbon factors is attached as Appendix 2.

It is proposed to install a communal heating system using a Daikin Altherma Geo-Collective air source heat pump system. Each apartment will have its own heat pump cylinder and heating controls, which will be connected to a medium temperature heating loop within the building, which in turn will be connected to a common outdoor chiller unit (s), which will be located on the roof of the building. The 'Be Green' SAP 10 spreadsheet is attached as Appendix 4, which uses the energy demand calculations from the SAP calculations (DER Worksheets attached as Appendix 3) to calculate the total site emissions.

In order to maximise the reduction in emissions it is also proposed to install a photovoltaic array of 155 x 400W photovoltaic panels (62.0 kW). A Roof Plan showing the indicative layout of the panels is attached as Appendix 5.



The reductions in emissions can be summarised as follows:

	Total Emissions	% Reduction
	T CO ₂ per year	
Be Lean		
Baseline (Building Regulations TER) – based on gas	57.980	
Be Lean - after energy efficiency (DER) – based on gas	52.074	10.19%
Be Clean		
Be Clean	52.074	10.19%
Be Green - ASHPs		
Emissions – after communal ASHP heating system (Be Green)	18.133	68.73%
Be Green – ASHPs AND Photovoltaic Panels		
Emissions – after renewable technologies (Be Green)	4.958	91.45%

The residual emissions are 4.958 tonnes and therefore, using the carbon offset charge the payment should be **£14,130** ($4.958 \times \pounds 2,850$).

The London Borough of Richmond upon Thames Sustainable Construction Checklist is attached as Appendix 6.

It is also a requirement to calculate the unregulated emissions from the development and the spreadsheet attached as Appendix 7 provides a unit-by-unit breakdown of what these emissions will be and the total for the site. The unregulated emissions are **33,983 kg CO₂ per year**.

The Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is attached as Appendix 8.



1.0 Introduction

This report has been commissioned by the Westcombe Group and provides a Sustainability and Energy Statement for the extension and conversion of Kingston Bridge House, Hampton Wick to create 70, Studio, 1, 2 & 3-bedroom apartments.

The description of development is;

'Façade and elevational improvements, infill extension at ground floor level, and change of use of the building to provide 70 new homes with associated landscaping, access, parking/refuse provision, and external alterations.'

The report describes the methodology used in assessing the development and the initiatives proposed.

The alterations to the building have been designed and will be constructed to reduce energy demand and carbon dioxide emissions.

The objective is to reduce the energy demand to an economic minimum by making investments in the parts of the building that has the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once a cost-effective structure has been designed, low-carbon and renewable technologies have been considered for installation to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.



2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled "A better quality of life: A strategy for sustainable development in the UK". This sets out four main objectives for sustainable development in the UK".

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

National Planning Policy Framework - 2021

Paragraph 152 states;

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure."



Regional and Local Policies

The Development Plan comprises the London Plan (2021) and the London Borough of Richmond Local Plan (2018).

London Plan, published March 2021 – the following policies are relevant to the application:

Policy SI 1 Improving air quality

- A Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.
- B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:
 - 1) Development proposals should not:
 - a) lead to further deterioration of existing poor air quality
 - b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
 - c) create unacceptable risk of high levels of exposure to poor air quality.
 - 2) In order to meet the requirements in Part 1, as a minimum:
 - a) development proposals must be at least Air Quality Neutral
 - b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures
 - c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1
 - d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.
- C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:
 - 1) how proposals have considered ways to maximise benefits to local air quality, and
 - 2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.
- D In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.



E Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

Policy SI 2 Minimising greenhouse gas emissions

- A Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
 - 1) be lean: use less energy and manage demand during operation
 - be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
 - 3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
 - 4) be seen: monitor, verify and report on energy performance.
- *B* Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.
- C A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
 - 1) through a cash in lieu contribution to the borough's carbon offset fund, or
 - 2) off-site provided that an alternative proposal is identified and delivery is certain.
- D Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ringfenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.
- *E* Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
- F Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Policy SI 4 Managing heat risk

A Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.



- B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
 - reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
 - 2) minimise internal heat generation through energy efficient design
 - manage the heat within the building through exposed internal thermal mass and high ceilings
 - 4) provide passive ventilation
 - 5) provide mechanical ventilation
 - 6) provide active cooling systems.

Policy SI 5 Water infrastructure

- A In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.
- B Development Plans should promote improvements to water supply infrastructure to contribute to security of supply. This should be done in a timely, efficient and sustainable manner taking energy consumption into account.
- C Development proposals should:
 - 1) through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)
 - 2) achieve at least the BREEAM excellent standard for the 'Wat 01' water category or equivalent (commercial development)
 - incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.
- D In terms of water quality, Development Plans should:
 - promote the protection and improvement of the water environment in line with the Thames River Basin Management Plan, and should take account of Catchment Plans
 - 2) support wastewater treatment infrastructure investment to accommodate London's growth and climate change impacts. Such infrastructure should be constructed in a timely and sustainable manner taking account of new, smart technologies, intensification opportunities on existing sites, and energy implications. Boroughs should work with Thames Water in relation to local wastewater infrastructure requirements.
- E Development proposals should:
 - 1) seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided



2) take action to minimise the potential for misconnections between foul and surface water networks. F Development Plans and proposals for strategically or locally defined growth locations with particular flood risk constraints or where there is insufficient water infrastructure capacity should be informed by Integrated Water Management Strategies at an early stage.

London Borough of Richmond

The London Borough of Richmond adopted its Local Plan on the 3rd July 2018 and this supersedes the Core Strategy (2009) and the Development Management Plan (2011).

The following policy is of particular relevance to the topic area of this Statement and has been edited for clarity and relevance to the application in question.

Local Plan (2018)

Policy LP 22 - Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

- Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
- 2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
- 3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

- 1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
- 2. All other new residential buildings should achieve a 35% reduction.
- 3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.



Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

- C. This should be achieved by following the Energy Hierarchy:
- 1. Be lean: use less energy
- 2. Be clean: supply energy efficiently
- 3. Be green: use renewable energy

Decentralised Energy Networks

D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:

1. All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.



3.0 Assessment Methodology

The baseline carbon dioxide emissions from the building has been established using agreed building specifications and detailed planning drawings and SAP calculations have been prepared for a representative range of apartments, which provide an assessment of the total emissions from the site.

Emission Factors

The CO₂ emission factors, where applicable, used throughout this report have been taken from the preliminary Building Regulation Approved Document L - 2022, known colloquially as SAP 10.

	kg CO₂/kWh	
Mains gas	0.210	
Grid supplied and displaced electricity	0.233	



4.0 Proposal

The proposal is for extension and conversion of an existing building to create 70, Studio, 1, 2 and 3bedroom apartments.

The accommodation schedule in detail is;

Unit Type	Number	Area	Total Area
		m ²	m ²
Studio apartment	6	37.5	225.0
1-Bedroom apartment	21	50.0	1,050.0
1-Bedroom apartment	6	51.1	306.6
1-Bedroom apartment	1	51.2	51.2
1-Bedroom apartment	6	53.9	323.4
1-Bedroom apartment	1	55.6	55.6
1-Bedroom apartment	3	60.5	181.5
1-Bedroom apartment	6	61.0	366.0
1-Bedroom apartment	1	61.4	61.4
2-Bedroom apartment	1	62.3	62.3
2-Bedroom apartment	3	63.9	191.7
2-Bedroom apartment	3	65.2	195.6
2-Bedroom apartment	1	65.5	65.5
2-Bedroom apartment	1	67.9	67.9
2-Bedroom apartment	3	74.9	224.7
3-Bedroom apartment	3	84.3	252.9
3-Bedroom apartment	3	86.0	258.0
3-Bedroom apartment	1	86.7	86.7
Total	70		4,026



5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L - 2013) through demand reduction measures alone, which typically include a combination of passive design measures (e.g. building design and efficient building fabric) and active design measures (e.g. variable speed motors).

Passive Design Measures

The passive design measures proposed include;

Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The proposal is for the extension and conversion of an existing building and therefore the orientation of the window and door opening is largely fixed within the existing building. However, the apartments benefit from an orientation towards; (i) northeast, (ii) southwest, (iii) northwest or (iv) southeast.

All apartments will benefit from access to direct sunlight at some point throughout the day and there are no units with a solely northerly aspect.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

Building Envelope

U-values of the building envelope must meet Building Regulations Part L standards and further improvements to U-values will reduce the apartments heating requirements.



The western part of the building currently has an undercroft, which will be partially infilled to provide accommodation. The ground floors to this element to the eastern part of the building will be insulated with 150mm 'Kingspan' PIR insulation or similar.

The new walls and existing walls will be insulated to achieve the U-value set out in the table below.

All windows and external doors will be replaced and will be double glazed with Low 'e' soft coat and argon filled.

It is proposed to set maximum limits for the elemental U-values as follows:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m ² K	W/m²K	
Floor	0.25	0.13	52%
External Walls	0.30	0.18	40%
Flat Roof	0.20	0.13	35%
Windows	2.00	1.20	40%
Entrance Doors		1.60	
	•		•

'g' Value for Glazing to Ground-floor units	0.30
'g' Value for Glazing to Mid-floor units	0.63
'g' Value for Glazing to Top-floor units	0.35

Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building

The Building Regulations set a minimum standard for air permeability of 10 m³ of air per hour per m² of envelope area, at 50Pa. It is proposed to achieve a 60% improvement over Building Regulations and the building will target a permeability of 4.0 m³/hr/m².

Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy.

The building will use the Accredited Construction Details where applicable and bespoke details where ACDs do not exist.

The bridging losses have been based upon the use of the ACDs and calculated using SAP Appendix K Table 1.



Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. Additional mechanical purge ventilation will be installed to all ground-floor bedrooms.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Approved Document L1A requires three in four light fittings (75%) to be dedicated low energy fittings. The homes will exceed this and all light fittings will be of a dedicated energy efficient type.

External lighting will be fitted with time controls and light sensors to ensure illumination is restricted to required times. External lighting will be limited to a maximum fitting output of 150w.

Space Heating and Hot Water

The baseline SAP modelling has been based upon the use of a combination boiler installed to each apartment but the assessment considers other options for providing space heating and hot water.

Overheating

The GLA Energy Assessment Guidance defines the elements of the overheating hierarchy as set out below. The proposal is for the conversion and refurbishment of an existing building and therefore some elements of the hierarchy are difficult to achieve.

1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.

The orientation of the openings is largely fixed within the constraints of the existing structure. The shape and size of the floor plate only really allows for single aspect units. However, the creation of external 'add-on' balconies and inset balconies provides shading to the larger glazed openings on the apartment below. All windows and external doors will be new and the specification includes the installation of glazing with a 'g' value of 0.30 to ground-floor units, 0.63 to mid-floor units and 0.35 to top-floor units.

2. Minimise internal heat generation through energy efficient design:

It is proposed to install a medium temperature heating loop within the building. However, the outdoor units will be located on the roof and the distribution network will be largely vertical.



3. Manage the heat within the building through exposed internal thermal mass and high ceilings:

The proposal is for the conversion of an existing building and the ceiling heights are fixed by the existing structure. However, that structure is a heavy weight frame will assist in provide increased thermal mass.

4. Provide passive ventilation:

All windows will be openable to allow for passive ventilation.

5. Provide mechanical ventilation:

Mechanical extract ventilation will be provided to appropriate rooms.

6. Provide active cooling systems:

It is not proposed to provide any active cooling systems.

The Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is attached as Appendix 8.

In addition, a full Overheating Heating based on CIBSE TM59 has been prepared and now accompanies the application. This Statement has been revised to accord with the conclusions of the Over



5.2 Establishing Energy Demand and Carbon Dioxide Emissions (Be Lean)

The GLA Energy Assessment Guidance requires the energy efficient of a building (Be Lean) to be expressed using a gas heating system as a baseline.

A set of calculations have therefore been prepared on this basis, which are not necessarily the proposed final option but are used to test the 'Be Lean' reductions only.

SAP calculations have been prepared for a 1-Bedroom apartment with a southeast aspect at 51.5 m² modelled as a ground, mid and top-floor unit.

Calculations have also been prepared for a 2-Bedroom apartment with a northeast aspect at 65.2 m^2 and a 3-Bedroom apartment with a southwest aspect at 83.0 m^2 , which are both modelled as ground, mid and top-floor units.

Baseline

The Regulations Compliance Reports are attached as Appendix 1 but the energy demand for the modelled apartments can be summarised as follows;

1-Bedroom apartment – 51.5 m² Ground-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	1,621	1,934
Water heating	1,954	1,549
Electricity for pumps, fans & lighting	335	335
Total	3,910	3,818

1-Bedroom apartment – 51.5 m² Mid-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	1,041	936
Water heating	1,973	1,557
Electricity for pumps, fans & lighting	335	335
Total	3,349	2,828

1-Bedroom apartment – 51.5 m² Top-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	1,664	1,978
Water heating	1,953	1,548
Electricity for pumps, fans & lighting	335	335
Total	3,952	3,861



2-Bedroom apartment – 65.2 m² Ground-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	2,514	2,788
Water heating	2,179	1,711
Electricity for pumps, fans & lighting	386	386
Total	5,079	4,885

2-Bedroom apartment – 65.2 m² Mid-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	1,801	1,745
Water heating	2,195	1,717
Electricity for pumps, fans & lighting	386	386
Total	4,382	3,848

2-Bedroom apartment – 65.2 m² Top-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	2,339	2,486
Water heating	2,183	1,713
Electricity for pumps, fans & lighting	386	386
Total	4,908	4,585

3-Bedroom apartment – 83.0 m² Ground-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	2,622	3,309
Water heating	2,424	1,878
Electricity for pumps, fans & lighting	430	430
Total	5,476	5,617

3-Bedroom apartment – 83.0 m² Mid-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	1,831	1,606
Water heating	2,444	1,888
Electricity for pumps, fans & lighting	430	430
Total	4,705	3,924



3-Bedroom apartment – 83.0 m² Top-floor	Energy Demand TER	Energy Demand DER
	kWh/yr	kWh/yr
Space heating	2,659	3,258
Water heating	2,423	1,878
Electricity for pumps, fans & lighting	430	430
Total	5,512	5,566

The energy demand figures calculated above have been inputted into the SAP 10 spreadsheet, which is attached as Appendix 2 and provides the total site TER and DER emissions using the emerging carbon emissions factors and as required by the GLA Energy Assessment Guidance.

The maximum allowable carbon dioxide emissions from the site (TER) are assessed as **57,980 kg CO₂ per year**, with the actual carbon dioxide emissions (DER) assessed as **52,074 kg CO₂ per year**.

The reduction in emissions using from energy efficiency for the 'Be Lean' scenario and using the SAP 10 carbon factors is **5,905 kg CO₂ per year**, which equates to;

10.19%



5.3 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Church Grove to be 4.8 m/s at 10m above ground level and 5.6 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the development.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.



Consequently CHP can demonstrate significant CO₂ savings and although not necessary classed as renewable energy (depending on the fuel used) the technology is low carbon.

Historically CO_2 savings have been achieved because gas has been used to generate electricity and gas has had a lower emissions factor than electricity, However, with the de-carbonisation of the electricity grid the benefit of CHP is negated.

CHP is longer an appropriate technology.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12° C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

There is insufficient external area to install a shallow, horizontal collection system and in order to use ground source heat pumps the collection system would need to include a number of boreholes. There are limited opportunities to place these away from the building and there is insufficient ground area to accommodate the required number.

The installation of ground source heat pumps into this site is not appropriate.

Solar

(i) Solar Water Heating

Solar hot water panels use the suns energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees



In apartment buildings servicing apartments below the top-floor can be problematic for solar thermal panels. The total hot water demand of the 13 top-floor apartments is 21,426 kWh per year (based on the gas system) and assuming panels would reduce demand by 50% the reduction in CO_2 emissions would be 2,250 kg CO_2 per year. When combined with the energy efficiency measures incorporated into the scheme this equates to a total reduction of 14.07%.

Solar hot water panels could be used to reduce emissions but additional technologies would be required to achieve the policy target and the use of solar hot water heating panels would require the use of a conventional gas boiler with hot water cylinders in selected units.

Solar hot water heating panels are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels.

The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The building contains large flat roofs and photovoltaic panels could be installed without detrimentally impacting on the aesthetics of the development. The Roof Plan attached as Appendix 5 demonstrate a total of 155 panels could be installed. These would be installed on racks and gently inclined towards the southwest and southeast. Assuming the installation of 400W panels the total reduction in emissions from the array would be **13,175 kg CO₂ per year**.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

ASHP tend to have a lower coefficient of performance (CoP) than GSHP but are considerably less costly to install. They work well where there is a large low temperature demand but the efficiency can be impacted on, for example where there is a high hot water demand.

The proposal is appropriate for the installation of air source heat pumps and the SAP calculations have been based on the installation of a communal system with each apartment having an individual indoor unit, all connected to a common outdoor chiller.



5.4 Establishing Energy Demand and Carbon Dioxide Emissions (Be Clean and Be Green)

Be Clean

We understand there are no heat networks in the vicinity of the development and therefore it is proposed to install a communal heating system within the scheme, which will be fuelled by heat pumps.

Be Green

Using the methodology set out in the Mayor of London's 'Energy Assessment Guidance', the carbon emissions have been calculated using the SAP 10 carbon factors but using the SAP 2012 methodology.

The apartments modelled above under the 'Be Lean' scenario have been remodelled using a Daikin Altherma Geo-Collective communal heating system using heat pumps in lieu of a gas system.

The DER Worksheets are attached as Appendix 3 but the energy demand for the modelled apartments can be summarised as follows;

1-Bedroom apartment – 51.5 m² Ground-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	877
Heating distribution	35
Electricity for fans & lighting	260
Total	1,172

1-Bedroom apartment – 51.5 m² Mid-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	644
Heating distribution	26
Electricity for fans & lighting	260
Total	930

1-Bedroom apartment – 51.5 m² Top-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	888
Heating distribution	36
Electricity for fans & lighting	260
Total	1,184



2-Bedroom apartment – 65.2 m² Ground-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	1,122
Heating distribution	45
Electricity for fans & lighting	311
Total	1,478

2-Bedroom apartment – 65.2 m² Mid-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	872
Heating distribution	35
Electricity for fans & lighting	311
Total	1,218

2-Bedroom apartment – 65.2 m² Top-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	1,048
Heating distribution	42
Electricity for fans & lighting	311
Total	1,401

3-Bedroom apartment – 83.0 m² Ground-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	1,292
Heating distribution	52
Electricity for fans & lighting	355
Total	1,699

3-Bedroom apartment – 83.0 m² Mid-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	889
Heating distribution	36
Electricity for fans & lighting	355
Total	1,280



3-Bedroom apartment – 83.0 m² Top-floor	Energy Demand DER
	kWh/yr
Space heating and Hot water	1,281
Heating distribution	51
Electricity for fans & lighting	355
Total	1,687

The energy demand figures calculated above have been inputted into the SAP 10 spreadsheet, which is attached as Appendix 4 and provides the total site DER emissions using the SAP 10 carbon emissions factors and as required by the GLA Energy Assessment Guidance.

The actual carbon dioxide emissions (DER) assessed as 18,133 kg CO₂ per year.

The reduction in emissions from energy efficiency measures and the installation of a communal heating system using air source heat pumps (compared to the TER baseline – Be Lean) and using the SAP 10 carbon factors is **39,847 kg CO₂ per year**, which equates to;

• 68.73%



5.5 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

Be Lean

A baseline calculation has been prepared using 2013 Building Regulations and the SAP 10 carbon factors. Using the current Regulations and based upon a gas heating system for the apartments the total site CO₂ emissions are calculated as **57,980 kg CO₂ per year** (TER) and **52,074 kg CO₂ per year** (DER).

This equates to a reduction of **5,905 kg CO₂ per year** or **10.19%** of the total TER emissions and is therefore compliant with the GLA energy planning guidance. The Compliance Reports, TER and DER Worksheets are attached as Appendix 1 and the SAP 10 'Be Lean' spreadsheet is attached as Appendix 2.

Be Clean – It is proposed to provide a communal heating system on site fuelled by heat pumps.

Be Green - ASHPs

A further set of calculations has been prepared for the proposed energy strategy. This proposes the installation of a communal heating system using a Daikin Altherma Geo-Collective system. The system includes individual heat pumps and cylinders within each apartment all connected to a common outdoor chiller unit. The DER Worksheets for the modelled units and based on this system are attached as Appendix 3 and the 'Be Green' spreadsheet is attached as Appendix 4.

The actual carbon dioxide emissions (DER) are assessed as 18,133 kg CO₂ per year.

The reduction in emissions from energy efficiency measures and installing a communal air source heat pump system and using the SAP 10 carbon factors is **39,847 kg CO₂ per year**, which equates to **68.73%**.

Be Green – Photovoltaic Panels

In addition, it is proposed to install a photovoltaic array of 62 kW on the roof of the building. The array will be comprised of 155 x 400W panels, which will be installed on racks and inclined towards the southwest and southeast. The panels will reduce emissions by a further **13,175 kg CO₂ per year** (based on panels inclined at 20 degrees, orientated to due southwest and southeast at postcode KT1 and using the SAP 10 emissions factors).

A Roof Plan showing the indicative location of the panels is attached as Appendix 5.

Summary

The total reduction in emissions from energy efficiency, low-carbon and renewable technologies are calculated as; 53,022 kg CO₂ per year, which equates to a reduction of 91.45% (% of TER).

The residual emissions are **4.958 tonnes**, which requires a carbon offset payment of **£14,130** (based on the carbon offset payment of £2,850 per tonne).



6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and Flood Zone 2 and a site-specific Flood Risk Assessment has been prepared which considers the issues and sets out what measures may be incorporated.

The existing site is mostly covered with buildings and hard surfacing and the proposal does not increase the volume or rate of surface water run-off. It is understood that it will be disposed of into the combined sewer in Church Grove.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of 110 litres per person per day is achieved.

Water efficient devices will be fully evaluated, and installed, wherever possible. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the apartments:

- water efficient taps
- water efficient toilets
- low output showers
- flow restrictors to manage water pressures to achieve optimum levels and
- water meters

Water consumption calculations have been carried out using the Water Efficiency Calculator provided by the BRE. Although not perfect this calculator gives a good indication of the probable water use in a dwelling, although this is largely dependent on the way on which occupants use their homes.



Below is a typical specification, which would achieve the 105 Litres per person per year target (excluding five litres per person per day allowance for external water use).

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	6/36 litres dual flush	17.64
Basin	2.0 litres/min.	4.74
Shower	9.0 litres/min	39.33
Bath	175 litres	19.25
Sink	5.0 litres/min	12.56
Washing Machine	6.75 litres/kg	14.18
Dishwasher	1.25 litres/places	4.50
		112.20
	Normalisation Factor	0.91
		102.10



7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials to will have a zero ozone depleting potential

Construction waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.



Appendix 1 – TER & DER Worksheets for Modelled Units based on Gas

		User D	etails:								
Assessor Name: Software Name:	Assessor Name:Stroma Number:Software Name:Stroma FSAP 2012Software Version:Version										
		Property /	Address:	Kingsto	n Bridge	e 1BF 52	2 GND G	AS			
Address :											
1. Overall dwelling dime	nsions:	A	(100 2)			a h t (ma)					
Ground floor		Area	a(m²)	1a) x			(2a) =	139.05	7 (3a)		
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+,	(1n) <u> </u>	51.5	(4)			()	100.00](00)		
Dwelling volume	, , , , , , , , , , , , , , , , , , , ,			(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	139.05] (5)		
2 Ventilation rate:							l]		
	main seco	ondary	other		total			m ³ per hour			
Number of chimneys	heating hea	oting	0] = [0	× 4	40 =	0	(6a)		
Number of open flues	0 +	0 +	0) = [0	x 2	20 =	0	(6b)		
Number of intermittent fai	ns			' <u>-</u>	1	x 1	10 =	10] (7a)		
Number of passive vents				Ē	0	x 1	10 =	0	(7b)		
Number of flueless gas fi	res				0	x 4	40 =	0	(7c)		
							Air ch	anges per hou	- 1r		
Infiltration due to chimney	$(a, f _{1,2,2}, a, a, d, f, a, a, a, (6, a))$	(6b)+(7c)+(7b)+(70) -	_					יי ר		
Initiality of the second secon	7S, THES AND TANS = $(0a)$ +	$(00)^+(7a)^+(70)^+(7a)$	otherwise c	ontinue fri	om (0) to ((16)	÷ (5) =				
Number of storevs in th	ie dwelling (ns)	<i>proceed to (11),</i> e			5111 (0) 10 (10)	I	0] (9)		
Additional infiltration	J					[(9)-	-1]x0.1 =	0	(10)		
Structural infiltration: 0.	25 for steel or timber frame	me or 0.35 for	masonry	/ constr	uction			0	(11)		
if both types of wall are pr	esent, use the value correspon	nding to the greate	er wall area	(after			-		-		
If suspended wooden f	loor. enter 0.2 (unsealed) or 0.1 (seale	d). else e	enter 0			[0	7(12)		
If no draught lobby, ent	ter 0.05, else enter 0	,	-,,					0](13)		
Percentage of windows	and doors draught strip	ped						0	(14)		
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)		
Infiltration rate			(8) + (10) +	· (11) + (1	2) + (13) +	+ (15) =	İ	0	(16)		
Air permeability value,	q50, expressed in cubic	metres per ho	ur per sc	uare m	etre of e	nvelope	area	4	(17)		
If based on air permeabili	ity value, then (18) = [(17) +	÷ 20]+(8), otherwi	se (18) = (1	6)				0.27	(18)		
Air permeability value applies	s if a pressurisation test has be	een done or a deg	iree air per	meability i	is being us	sed			-		
Number of sides sheltere	d		(20) = 1 - [) 075 x (1	9)] =			2	(19)		
Infiltration rate incorporat	ing shelter factor		(21) = (18)	x(20) =	€/]		l	0.85	$\int_{(21)}^{(20)}$		
Infiltration rate modified fr	or monthly wind speed		() (10)	x (20)			l	0.23	J ⁽²¹⁾		
	Mar Apr May	Jun Jul	Αμα	Sen	Oct	Nov	Dec				
Monthly average wind so	eed from Table 7		,	000	000						
(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	$\frac{2}{123}$ 1 1 1 1 0 1		0.02	4	1.09	1 10	1 10				
	1.20 1.1 1.00	0.90 0.90	0.92	I	1.00	1.12	1.10				

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-				-		
II IIIt			ucing App	ondix N (2	(25) = (22)	x = m v (c)	oquation (nuico (23h) = (22a)			0	(23a)
If bal	ancod with	eat pump	wory: offic		.50) – (258	i) ^ i iiiv (e	actor (from	n Table 4b) –) = (238)			0	(230)
) -)]]h)ma_i (/	00k) v I	·1 (00 a)	0	(23c)
a) ir	balance							HR) (24a T	a)m = (22	20)m + (. 	230) × [(23c)) ÷ 100]]	(242)
(24a)11-			0		0		0					0	J	(244)
D) IT	balance		anical ve				covery (i	VIV) (240 T	5)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0		0	 					0	0	0	J	(240)
C) If	whole h if (22b)r	iouse ex n < 0.5 ×	tract ver (23b), f	then (24	or positiv c) = (23b); other	ventilatio wise (24	c) = (22b	outside b) m + 0.	5 × (23b))		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous)m = (221	se positiv b)m othe	ve input erwise (2	ventilati 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54]	(24d)
Effe	ctive air	change	rate - ei	nter (24a	i) or (24t	o) or (24	c) or (24	d) in boy	x (25)	-	-	-	-	
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(25)
3 He	at losse	s and he	at loss	naramet	≏r.			-				-	-	
		Gros	35	Openin		Net Ar	rea	U-valı	lie	ΑΧΠ		k-value	<u> </u>	AXk
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	2K	(W/I	K)	kJ/m²·	K I	kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Floor						51.5	x	0.13	=	6.695				(28)
Walls				6.6		24.15	5 X	0.18	=	4.35			\neg	(29)
Total a	area of e	lements	, m²			82.25	5							(31)
Party v	wall					53.34	1 X	0	= [0				(32)
Party o	ceilina					51.1] [\dashv	(32b)
* for win	dows and	l roof wind	ows, use e	effective wi	indow U-va	alue calcul	lated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given ir	n paragraph	L h 3.2	(/
Fabric	heat los	ss. W/K :	= S (A x	U)	io una pun			(26)(30)) + (32) =				18.6	(33)
Heat c	apacity	Cm = S(Άxk)	•)					((28)	(30) + (32	2) + (32a)	(32e) =	10256 59	(34)
Therm	al mass	parame	ter (TMI	P = Cm +	+ TFA) ir	ו k.l/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign asses	sments wh	ere the de	etails of the	construct	ion are not	t known pi	recisely the	e indicative	values of	TMP in 1	able 1f	230	(00)
can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) ca	lculated	using Ap	pendix I	K						7.32	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
	abric he	atioss							(33) +	(36) =	0-)	.,	25.92	(37)
ventila	ation hea			a monthly	y L na				(38)m	= 0.33 × (25)m x (5		1	
(20)	Jan	Feb		Apr	May	Jun	Jul	Aug	Sep	Uct	NOV	Dec	4	(20)
(38)m=	24.94	24.86	24.78	24.43	24.36	24.05	24.05	23.99	24.17	24.36	24.49	24.64	J	(30)
Heat tr	ansfer o		nt, W/K	I				[(39)m	= (37) + (3	38)m	1	1	
(39)m=	50.86	50.78	50.71	50.35	50.28	49.97	49.97	49.92	50.09	50.28	50.42	50.56		
										Average =	Sum(39)	112 /12=	50.35	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.99	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.98	0.98	0.98		
Numbe	er of day	s in mo	nth (Tab	le 1a)	•		•	•	/	Average =	Sum(40)1.	.12 /12=	0.98	(40)
- turnov	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ene	rav reau	irement:								kWh/ve	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 1 9, N = 1 9 N = 1	N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	1. .9)	73		(42)
Annua	l averag	e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		75	.39		(43)
Reduce not more	the annua e that 125	al average litres per	hot water person pe	usage by r day (all w	5% if the a vater use, I	lwelling is hot and co	designed Id)	to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
-		h = 1 = 1 =			and the base of the	400 ··· \/). 	-	Total = Su	m(44) ₁₁₂ =	- (-1)	904.68	(44)
Energy	content of	not water	usea - cai	culated me	Shthis = 4.	190 x Va,r	n x nm x L	JIM / 3600) kvvn/mor	nth (see Ta	adies 1d, 1	c, 1a)	I	
(45)m=	122.98	107.56	110.99	96.77	92.85	80.12	74.24	85.2	86.21	100.47	109.68	119.1	1100.10	
$Total = Sum(45)_{112} = 1186.18$ <i>If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)</i> (45)													(45)	
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:												
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel	(C		(47)
If com	nunity h	eating a	ind no ta	ink in dw	velling, e	nter 110	litres in	(47)						
Otherv	vise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/dav):					า		(48)
Tempe	erature f	actor fro	m Table	2b		,						<u>,</u>		(49)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			<u>,</u>		(50)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:					-		
Hot wa	ter stor	age loss	factor fi	om Tab	le 2 (kW	h/litre/da	ay)				(0		(51)
Volum	nunity n e factor	from Ta	ee secti ble 2a	on 4.3								1	l	(52)
Tempe	erature f	actor fro	m Table	2b))		(52)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =)		(54)
Enter	(50) or ((54) in (5	55)								()		(55)
Water	storage	loss cal	culated ⁻	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		I	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for ea	ch	month (61)m =	(60)) ÷ 36	65 × (41))m							
(61)m=	16.05	14.47	15.98	3	15.42	15.9	1	5.35	15.83	15.8	8	15.39	15.95	15.49	16.04		(61)
Total h	eat req	uired for	water	he	ating ca	alculate	d fo	r eacl	n month	(62)m	า = (0.85 × (45)m ·	+ (46)m +	(57)m	+ (59)m + (61)m	
(62)m=	139.03	122.03	126.9	7	112.19	108.75	6	95.47	90.08	101.0)7	101.6	116.42	2 125.16	135.14		(62)
Solar DH	HW input	calculated	using A	ppe	ndix G or	Appendi	хH	(negati	ve quantity	/) (ente	r '0' i	if no solar	r contrib	ution to wat	er heating	1)	
(add a	dditiona	I lines if	FGHF	RS a	and/or V	VWHR	S ap	oplies	, see Ap	pendi	x G)				_	
(63)m=	0	0	0		0	0		0	0	0		0	0	0	0		(63)
Output	from w	ater hea	ter														
(64)m=	139.03	122.03	126.9	7	112.19	108.75	9	95.47	90.08	101.0)7	101.6	116.42	2 125.16	135.14	7	
										С	outpu	ut from wa	ater hea	ter (annual)	112	1373.92	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]																	
(65)m=	44.9	39.38	40.9		36.03	34.85	3	30.48	28.65	32.3		32.51	37.39	40.34	43.61	7	(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):																	
Metabo	olic gair	ns (Table	5) W	att	\$												
motab	Jan	Feb	Ma	r	Apr	May	Γ	Jun	Jul	Au	g	Sep	Oct	Nov	Dec	7	
(66)m=	86.72	86.72	86.72	2	86.72	86.72	6	36.72	86.72	86.7	2	86.72	86.72	86.72	86.72	1	(66)
Lightin	a gains	(calcula	ted in	Api	pendix	L, equa	tion	1 L9 01	r L9a), a	lso se	e T	able 5		I		_	
(67)m=	14.74	13.09	10.65	5	8.06	6.02		5.09	5.5	7.14		9.59	12.17	14.21	15.15	7	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a). also see Table 5																	
(68)m=	151.13	152.7	148.7	4	140.33	129.71	1	19.73	113.06	111.4	.9	115.45	123.86	6 134.48	144.46	7	(68)
Cookin	l a gains	i (calcula	L Ited in	 An	pendix	l equa	tior	1 15	or I 15a)	also	see	e Table	5				
(69)m=	31.67	31.67	31.67	7.1	31.67	31.67		31.67	31.67	31.6	7	31.67	31.67	31.67	31.67	7	(69)
Pumps	and fa	I ns dains	L (Tabl	 e 5:	a)		-					I					
(70)m=	3	3			3	3	Г	3	3	3		3	3	3	3	7	(70)
		/anoratio		 iter	ve velu	es) (Tal		5)				-	-	1 -	-		
(71)m=	-69.37	-69.37		7 7	-69 37	-69.37		5) 69.37	-69.37	-69.3	7	-69.37	-69.37	-69.37	-69.37	7	(71)
\/\/ator	boating			·	00.01			00.01			<u> </u>	00.07		00.01	00.01		()
(72)m=		9ans (1	54 07)) 7 [50.04	46 84		12 33	38.5	43.4	1	45 16	50.26	56.03	58.62	7	(72)
(/2)///- Tetel :			04.01		50.04	+0.0+		(66)	$m \pm (67)m$	+.(68)	<u>'</u>	$(60)m \pm ($	70)m +	(71)m + (72))m		()
10tal 1	278 24	gains =	266.3	0	250.45	234 50		(00)	200.07	214 0		222.24	70)III +	(71)11 + (72	270.24	7	(73)
(73)III-	ar gain	270.41	200.5	°	250.45	234.39	<u> </u>	19.10	209.07	214.0	<i></i>	222.21	230.5	230.73	270.24		(10)
Solar o	ains are	s. calculated	usina s	olar	flux from	Table 6a	and	lassoci	ated equa	tions to	con	vert to the	e applic	able orienta	tion.		
Orienta	ation:	Access F	actor		Area			Flu	X			a		FF		Gains	
	-	Table 6d			m²			Tal	ole 6a		Та	able 6b		Table 6c		(W)	
Southe	ast 0.9x	0.77		x	28	8	x	3	6 79	IхГ		0.3	ר × ר	0.7	=	15 42	7(77)
Southe	ast 0.9x	0.77		x	1.8	6	x		6 79	I X [0.3		0.7	 _	19.92](77)
Southe	theast 0.9x 0.77 x 2.89		8	x		2 67	сіц Х		0.3		0.7		26.27](77)			
Southe	least 0.9x 0.77 x 1 86		x		2 67	ι ¨ L Ι _Χ Γ		0.3		0.7		33.03	_``'] ₍₇₇₎				
Southe	asto ov	0.77		x	200	8	Ŷ		5 75	ι ^ L Ι _Υ Γ		0.3	╡ Û	0.7	=	35.04](77)
		0.77		^	<u> </u>	0	^	L °	0.70	^ L		0.5	^	0.7		55.94	

Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	8	35.75	x		0.3	×	0.7	-	- [46.42	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25	x		0.3	×	0.7	-	= [44.53	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25	x		0.3	×	0.7	-	- [57.52	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	1	19.01	x		0.3	×	0.7	-	- [49.88	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01	×		0.3	×	0.7		- [64.43	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15	x		0.3	×	0.7	-	- [49.52	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15	x		0.3	×	0.7		- [63.96	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91	x		0.3	×	0.7	-	- [47.74	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91	x		0.3	×	0.7	-	= [61.67	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39	x		0.3	×	0.7		- [43.75	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39	x		0.3	×	0.7	-	- [56.51	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	9	92.85	x		0.3	×	0.7	-	- [38.92	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		92.85	Ī×		0.3	×	0.7	<u> </u>	= [50.27	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	6	69.27	x		0.3	×	0.7	-	- [29.03	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	6	69.27	x		0.3	×	0.7	-	= [37.5	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07] x		0.3	- ×	0.7	-	= Ī	18.47	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07	x		0.3	×	0.7	-	- [23.86	(77)
Southea	theast 0.9x 0.77 x		2.8	8	x	31.49		x		0.3	×	0.7	-	- [13.2	(77)		
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49] ×		0.3	×	0.7	-	- Ī	17.05	(77)
	_									-			_			_		
Solar g	ains in	watts, ca	alcula	ted	for eac	n mont	h			(83)m	n = Sur	m(74)m	.(82)m		-			
(83)m=	35.34	60.2	82.3	37	102.05	114.31	1	13.48	109.41	100	.27	89.18	66.53	42.33	30.24	1		(83)
Total g	ains – i	internal a	and so	olar	(84)m =	: (73)m	ı + (83)m	, watts						-			
(84)m=	313.58	336.6	348.	74	352.5	348.9	3	32.64	318.48	314	.33	311.39	304.84	4 299.06	300.4	8		(84)
7. Me	an intei	rnal temp	peratu	ıre (heating	seaso	n)											
Temp	erature	during h	neatin	g pe	eriods ir	the liv	/ing	area	from Tal	ble 9	, Th1	(°C)				Γ	21	(85)
Utilisa	ation fac	ctor for g	ains f	or li	ving are	ea, h1,i	m (s	ее Та	ble 9a)							L		
	Jan	Feb	Ma	ar	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov	Dec	с		
(86)m=	1	1	0.99	9	0.98	0.95		0.84	0.66	0.6	69	0.89	0.98	1	1			(86)
Mean	interna	al temper	ature	in li	iving are	ea T1 (follo	w ste	ps 3 to 7	7 in T	able	9c)		•	•			
(87)m=	19.99	20.09	20.2	27	20.5	20.74		20.92	20.98	20.	98	20.87	20.58	20.24	19.97	7		(87)
Tomp	oraturo		L		ariade ir	rest o		olling	l from Ta		<u> </u>	I			Į			
(88)m=	20.09	20.09	20	<u>9 p</u>	20.1	20.1		20 11	20 11		<u>9, 111</u> 11	20 11	20.1	20.1	20.1			(88)
				L					L	L	<u> </u>		_0.1		L			. ,
Utilisa	ation fac	ctor for g	ains f	$\frac{\text{or r}}{1}$		weiling	, n2 T	,m (se		e 9a) I_∩≞		0.84	0.07	0.00	1	_		(80)
(09)11=		0.99	0.9	9	0.97	0.92		0.70	0.94	0.8		0.04	0.97	0.99				(03)
Moon	intorno	l tompor	oturo	in t	ho roct	of dwo	llina	T2 /f	allow at	2	to 7	in Table	0.00					

wean	Interna	temper	ature in	the rest	of dwelli	ng 12 (to	ollow ste	eps 3 to	/ in Tabi	e 9c)	_		_	
(90)m=	18.74	18.89	19.15	19.49	19.82	20.05	20.1	20.1	20	19.6	19.11	18.71		(90)
fLA = Living area ÷ (4) =												0.49	(91)	
Mean	interna	l temper	ature (fo	r the wh	ole dwel	llina) = fl	LA × T1	+ (1 – fL	A) × T2					

moun													_
(92)m=	19.35	19.48	19.69	19.98	20.27	20.47	20.53	20.53	20.42	20.08	19.66	19.32	(92)
-													

Apply adjustment to the mean internal temperature from Table 4e, where appropriate
(93)m=	19.35	19.48	19.69	19.98	20.27	20.47	20.53	20.53	20.42	20.08	19.66	19.32		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	i to the i ilisation	mean int factor fo	ternal ter or gains	mperatui using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	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	ation fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.99	0.97	0.93	0.79	0.6	0.63	0.86	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	312.42	334.53	344.62	342.75	322.85	264.11	191.56	199.4	267.51	295.95	296.9	299.6		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	765.41	740.18	668.92	558.08	430.84	293.41	196.37	205.94	316.64	476.47	633.3	764.45		(97)
Space	e heatin	g require	ement fo	r each n	honth, k	Nh/mont	h = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	337.02	272.6	241.27	155.04	80.34	0	0	0	0	134.31	242.21	345.84		_
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	1808.63	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								35.12	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:										_		_
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		İ	1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ı, %					ĺ	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	u ar
Space	e heatin	g require	ement (c	alculate	d above)				-	-			
	337.02	272.6	241.27	155.04	80.34	0	0	0	0	134.31	242.21	345.84		
(211)m	n = {[(98)m x (20	04)]}x1	00 ÷ (20)6)									(211)
	360.45	291.55	258.05	165.81	85.93	0	0	0	0	143.64	259.04	369.88		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1934.36	(211)
Space	e heatin	a fuel (s	econdar	v), kWh/	month							I		4
= {[(98)m x (20)))]}x 1	00 ÷ (20)8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	a										I		1
Output	from w	, ater hea	ter (calc	ulated a	bove)	-		-	-	-	-	-		
	139.03	122.03	126.97	112.19	108.75	95.47	90.08	101.07	101.6	116.42	125.16	135.14		
Efficier	ncy of w	ater hea	iter							-	-		87.3	(216)
(217)m=	89.54	89.49	89.37	89.13	88.63	87.3	87.3	87.3	87.3	88.99	89.38	89.58		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	<u>1 = (64)</u>	<u>m x 100</u>) ÷ (217))m	r	· · · · ·		· · · · ·	· · · · ·	r	r			
(219)m=	155.27	136.37	142.08	125.87	122.7	109.36	103.18	115.78	116.38	130.83	140.03	150.86		-
								Tota	I = Sum(2	19a) ₁₁₂ =			1548.71	(219)
Annua	I totals									k	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								1934.36	

			1548.71	
		30]	(230c)
		45]	(230e)
sum of (230	0a)(230g) =		75	(231)
			260.28	(232)
(231) + (232)(237b) =			3818.36	(338)
s including micro-CHP				
Energy kWh/year	Emission fa kg CO2/kWh	ctor	Emissions kg CO2/yea	ar
(211) x	0.216	=	417.82	(261)
(215) x	0.519	=	0	(263)
(219) x	0.216	=	334.52	(264)
(261) + (262) + (263) + (264) =			752.34	(265)
(231) x	0.519	=	38.93	(267)
(232) x	0.519	=	135.09	(268)
sui	m of (265)(271) =		926.36	(272)
(27	72) ÷ (4) =		17.99	(273)
			87	(274)
	sum of (23) $(231) + (232)(237b) =$ $sincluding micro-CHP$ $Energy$ $kWh/year$ $(211) x$ $(215) x$ $(219) x$ $(261) + (262) + (263) + (264) =$ $(231) x$ $(232) x$ $sul(27)$	$sum of (230a)(230g) =$ $(231) + (232)(237b) =$ $sincluding micro-CHP$ $kWh/year$ $(211) \times 0.216$ $(215) \times 0.519$ $(219) \times 0.216$ $(261) + (262) + (263) + (264) =$ $(231) \times 0.519$ $(232) \times 0.519$ $sum of (265)(271) =$ $(272) + (4) =$	30 45 $sum of (230a)(230g) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(231) \times 0.216 =$ $(21) \times 0.216 =$ $(21) \times 0.216 =$ $(21) \times 0.216 =$ $(21) + (262) + (263) + (264) =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(22) \times 0.519 =$ $sum of (265)(271) =$ $(272) + (4) =$	1548.71 30 45 30 45 260.28 $2(231) + (232)(237b) = 75$ 260.28 3818.36 3818.36 3818.36 3818.36 3818.36 3818.36 3818.36 3818.36 3818.36 $CO2/kWh$ $(211) \times 0.216 = 417.82$ $(215) \times 0.519 = 0$ $(219) \times 0.216 = 334.52$ $(261) + (262) + (263) + (264) = 752.34$ $(231) \times 0.519 = 38.93$ $(232) \times 0.519 = 135.09$ $sum of (265)(271) = 926.36$ $(272) + (4) = 17.99$

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP	2012		Strom Softwa	a Num are Ver	ber: sion:		Versio	on: 1.0.5.59	
		Pi	roperty /	Address:	Kingsto	on Bridge	e 1BF 52	2 GND G	AS	
Address :										
1. Overall dwelling dime	ensions:		•	(0)						
Ground floor			Area 5	a(m²) 51.5	(1a) x	AV. He	Ignt(m) 2.7	(2a) =	139.05	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)·	+(1e)+(1n) 5	51.5	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	139.05	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m ³ per hou	•
Number of chimneys		0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	0] + [0] = [0	x	20 =	0	(6b)
Number of intermittent fa	ns				- 	2	x	10 =	20	(7a)
Number of passive vents					Г	0	x [,]	10 =	0	(7b)
Number of flueless gas fi	res				Г	0	x 4	40 =	0	(7c)
								Air ch	anges per ho	_ ur
Infiltration due to chimner	va fluos and fana	- (6a)+(6b)+(7	a)+(7b)+(⁻	7c) -	Г			(5)		
If a pressurisation test has h	ys, liues and lans	tended proceer	$d = (10) \cdot (10)$	otherwise (continue fr	om (9) to ((16)	÷ (5) =		
Number of storeys in the	ne dwelling (ns)						10)		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or tim	ber frame or	0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pl	resent, use the value of	orresponding to	the greate	er wall are	a (after					
If suspended wooden f	loor, enter 0.2 (un	sealed) or 0.	1 (seale	d), else	enter 0				0] (12)
If no draught lobby, en	ter 0.05, else ente	r O	,	,,					0	(13)
Percentage of windows	s and doors draug	nt stripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in	cubic metre	s per ho	our per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabil	ity value, then (18)	= [(17) ÷ 20]+(8	s), otherwi	se (18) = (16)				0.39	(18)
Air permeability value applie	s if a pressurisation tes	t has been don	e or a deg	ree air pei	rmeability	is being us	sed			
Shelter factor	iu -			(20) = 1 -	[0.075 x (1	9)] =			0.85	$-\binom{(19)}{(20)}$
Infiltration rate incorporat	ing shelter factor			(21) = (18)) x (20) =				0.33] ₍₂₁₎
Infiltration rate modified f	or monthly wind sp	beed								
Jan Feb	Mar Apr M	lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.	3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor $(22a)m = (22)$	2)m ÷ 4									
(22a)m= 1.27 1.25	, 1.23 1.1 1.0	0.95	0.95	0.92	1	1.08	1.12	1.18]	

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39		
Calcul If me	ate etteo echanica	ctive air al ventila	change	rate for t	he appli	cable ca	ISE						0	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	3b) = (23a	ı) × Fmv (e	equation (I	N5)) . othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,			0	(23c)
a) lf	balance	d mech	anical ve	entilation	with hea	at recove	erv (MVI	HR) (24a	a)m = (22	2b)m + ()	23b) × [1 – (23c)) ÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	covery (N	u VV) (24b)m = (22	2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation o	or positiv	e input v	ventilatio	on from c	outside			•	•	
	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22t	o) m + 0.	5 × (23b)		•	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	iole hous	e positiv	e input	ventilatio	on from I	Oft 2h)m² v	0.51				
(24d)m=	0 59	0.59	0.58	0.57	0.56	0.55	0.55	0.5 + [(2	0.56	0.5	0.57	0.58	I	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	or (24	c) or (24	d) in hoy	(25)	0.00	0.01	0.00	l	· · ·
(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	1	(25)
							1	1	1			1	1	
3. He		s and he	eat loss	paramete	er:	Not Ar		LLvol	10			kyolu		
ELEN	/IEN I	area	(m²)	r	ys I ²	A,r	ea n²	W/m2	:K	(W/I	<)	kJ/m ² ·	K I	алк kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.4)+	0.04] =	3.82				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.4)+	0.04] =	2.47				(27)
Floor						51.5	x	0.13	=	6.695				(28)
Walls				6.6		24.15	5 X	0.18	=	4.35				(29)
Total a	area of e	lements	, m²			82.25	5							(31)
Party v	wall					53.34	4 ×	0	=	0				(32)
Party of	ceiling					51.1								(32b)
* for win ** incluc	idows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	is given ir	n paragrapł	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				19.79	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	10256.59	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	constructi	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix I	K						4.88	(36)
if details	of therma	al bridging at loss	are not kr	10wn (36) =	= 0.05 x (3	1)			(33) +	(36) =			04.07	(27)
Ventils	ablic he	at loss c	alculater	1 monthly					(38)m	(00) =	25)m x (5	3	24.67	(37)
ventile	Jan	Feb	Mar	Apr	, Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec	1	
(38)m=	27.12	26.96	26.8	26.05	25.91	25.26	25.26	25.14	25.51	25.91	26.2	26.49		(38)
Heat t	ransfer o	coefficier	nt. W/K				1	I	(<u>39</u>)m	= (37) + (1	1	
(39)m=	51.8	51.63	51.47	50.73	50.59	49.94	49.94	49.82	50.19	50.59	50.87	51.17		
	L							I	۱ /	Average =	Sum(39)	112 / 12=	50.73	(39)

Heat lo	oss para	ımeter (l	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.01	1	1	0.98	0.98	0.97	0.97	0.97	0.97	0.98	0.99	0.99		
Numbe	or of day	re in mo	nth (Tab	le 12)				1	,	Average =	Sum(40)1.	12 /12=	0.98	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		I					ļ	1		I				
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	349 x (TI	=A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	9)	73		(42)
Annua Reduce not more	l averag the annua e that 125	je hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)		-				
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		_
Energy	content of	hot water	used - ca	lculated m	onthly — 4	100 v Vd i	m v nm v l	DTm / 360(- kW/b/mor	Total = Su	m(44) ₁₁₂ =	c 1d)	904.68	(44)
(45)m=	122.00	107 56	110.00		07.07.05	00 12	74.24	05 2	06.21	100 47				
(45)11-	122.90	107.50	110.99	90.77	92.05	00.12	74.24	05.2	00.21	Total = Su	m(45),	119.1	1186 18	(45)
lf instan	taneous v	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	rotar – Ou	III(+0) 112 -		1100.10	
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:					•				·			
Storag	e volum	ie (litres)) includir	ng any s	olar or W	WHRS	storage	within sa	ame ves	sel		0		(47)
If comi Otherw	munity r vise if no	eating a	and no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres ir Deolis co	1 (47) Smbi boil	ers) ente	r '0' in <i>(</i>	47)			
Water	storage	loss:	not wat			notantai	10000 00							
a) If m	nanufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	/ lost fro	m water	storage	e, kWh/y	ear			(48) x (49) =			0		(50)
b) If m	anufact	urer's de	eclared (cylinder com Tab	loss fact	or is not h/litre/da	known:					_		(51)
If com	munity h	neating s	ee secti	on 4.3			ау)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	om water	storage	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (8	55)									0		(55)
Water	storage	loss cal	culated ·	for each	month	i	i	((56)m = (55) × (41)	m	i			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain:	s dedicate	a solar sto	rage, (57) 1	m = (56)m 1	x [(50) – ((H11)] ÷ (5 T	ou), eise (5	7)m = (56) I	m wnere (r	H11) IS Tro	m Append	IX H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 30	65 × (41)	m	r tharm -	etet)			
(11100 (59)m=												n		(59)
(00)11-	Ŭ											U		

Combi	loss ca	alculated	for eacl	n month	(61)m =	(60) ÷ 3	365 × (41)m						
(61)m=	42.26	36.78	39.19	36.44	36.11	33.46	34.58	36.11	36.44	39.19	39.41	42.26		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for ea	ch month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		(62)
Solar Dł	-IW input	calculated	using Ap	pendix G o	r Appendix	H (nega	tive quantity	/) (enter '0)' if no sola	r contribut	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	applie	s, see Ap	pendix (G)			-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		
								Out	put from w	ater heate	r (annual)₁	12	1638.4	(64)
Heat g	ains fro	om water	heating	, kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	51.46	44.96	46.7	41.28	39.9	35.01	33.33	37.36	37.78	43.2	46.32	50.17		(65)
inclu	ide (57))m in calo	culation	of (65)m	only if c	ylinder	is in the	dwelling	or hot w	, ater is f	rom com	munity h	leating	
5. Int	ternal g	ains (see	Table	5 and 5a):									
Metab	olic gai	ns (Table	5) Wa	tts	,									
motab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)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		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L9 (or L9a), a	lso see	Table 5					
(67)m=	14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15		(67)
Applia	nces da	uns (calc	ulated i	n Append	dix L. ea	uation I	13 or L1	i 3a), also	i o see Ta	ble 5	1			
(68)m=	151.13	152.7	148.74	140.33	129.71	119.73	113.06	111.49	115.45	123.86	134.48	144.46		(68)
Cookir	L	L s (calcula	L ated in A	I	L equat	L tion I 15) also s	L ee Table	1 2.5				
(69)m=	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67		(69)
Pump	L	I Ins gains	I (Table	1 5a)		I		I						
(70)m=					3	3	3	3	3	3	3	3	l	(70)
		Vanoratio	n (neas	l ative valu	es) (Tab						-			. ,
(71)m=	-69.37	-69 37	-69 37	-69 37	-69 37	-69.37	-69 37	-69.37	-69.37	-69.37	-69.37	-69 37	l	(71)
Wator	boating			00.01	00.01	00.01	00.01	00.01	00.07		00.01	00.01		()
(72)m=			able 5)	57 34	53.63	48.62	44.8	50.21	52.47	58.07	64 33	67.43		(72)
Total			02.11	07.04	00.00	(6)	6)m + (67)m	1 + (68)m	+ (60)m +	(70)m + (7)	(1)m + (72)	m		()
(73)m=	287.04	$\frac{19200}{28471}$	274 18	257.74	241 38	225.45	215 37	220.86	220 51	246 12	265.04	270.05		(73)
6 50	lar gain	204.71	274.10	237.74	241.30	223.43	215.57	220.00	229.01	240.12	205.04	219.00		(10)
Solar c	ains are	calculated	usina sola	ar flux from	Table 6a	and asso	ciated equa	itions to co	onvert to th	ne applical	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area	1	FI	ux		a	F	FF		Gains	
		Table 6d		m²		Та	able 6a	٦	able 6b	Т	able 6c		(W)	
Southe	ast <mark>0.9x</mark>	0.77	×	2.8	38	×	36.79) x [0.63	ר × ר	0.7	=	32.38	(77)
Southe	ast <mark>0.9x</mark>	0.77	×	1.8	36	×	36.79	 [0.63	╡╷╞	0.7	=	41.83](77)
Southe	ast <mark>0.9x</mark>	0 77	×	28	38	×	62.67	i × 🗀	0.63	╡╷┝	0 7		55.16](77)
Southe	ast <mark>0.9x</mark>	0.77	×		36	x	62.67		0.63	╡╷┝	0.7		71 25] (77)
Southe	ast <mark>0.9x</mark>	0.77	×	28	38	× [85.75	× [0.63	╡╷┝	0.7		75.48](77)
	0.00	0.77	^	2.0	50	^	05.75		0.05	^ L	0.7		75.40	(''')

Southea	ast <mark>0.9x</mark> [0.77	x		1.86	6	x	8	35.75	x	0.	.63	x	0.	7] = [97.49	9	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	2.88	3	x	1	06.25	x	0.	.63	×	0.	7] = [93.52	2	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	1.86	6	x	1	06.25	x	0.	.63	×	0.	7	= [120.8	8	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	2.88	3	x	1	19.01	x	0.	.63	×	0.	7	= [104.7	'5	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	1.86	6	x	1	19.01	x	0.	.63	×	0.	7] = [135.3	3	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	2.88	3	x	1	18.15	x	0.	.63	×	0.	7] = [103.9	9	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86	6	x	1	18.15	x	0.	.63	×	0.	7] = [134.3	32	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	2.88	3	x	1	13.91	x	0.	.63	×	0.	7] = [100.2	26	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	1.86	6	x	1	13.91	x	0.	.63	×	0.	7	= = [129.	5	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	2.88	3	x	1	04.39	x	0.	.63	×	0.	7	= [91.88	8	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86	3	x	1	04.39	x	0.	.63	×	0.	7	Ī = [118.6	68	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	2.88	3	x	g	2.85	x	0.	.63	×	0.	7	ī = [81.73	3	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86	3	x	g	2.85	x	0.	.63	×	0.	7	=	105.5	6	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	2.88	3	x	6	9.27	x	0.	.63	×	0.	7	i = [60.9	7	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86	3	x	6	9.27	x	0.	.63	×	0.	7	ī = [78.7	5	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	2.88	3	x	4	4.07	x	0.	.63	×	0.	7	=	38.79	9	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86	3	x	4	4.07	x	0.	.63	×	0.	7	i = [50.1		(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	2.88	3	x	3	31.49	x	0.	.63	×	0.	7	i = 1	27.7	1	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ē	1.86	3	x	3	81.49	x	0.	.63	×	0.	7] = [35.8		(77)
Solar o	nains in	watts ca	alculate	d fo	or each	month	ı			(83)m	n = Sum((74)m	(82)m						
(83)m=	74.21	126.42	172.97		214.31	240.05		238.31	229.76	210	.56 18	87.29	139.7	2 88.8	9 6	3.51			(83)
Total g	jains – i	nternal a	nd sola	r (8	84)m =	(73)m	+ ((83)m	, watts		!	I		_!					
(84)m=	361.26	411.12	447.14	4	472.06	481.43	4	463.76	445.13	431	.42 4	16.8	385.8	3 353.9	93 34	42.56			(84)
7. Me	an inter	nal temp	erature	(h	eating	seasor	า)												
Temp	erature	during h	eating	ber	riods in	the liv	ing	area	from Tab	ole 9,	, Th1 ('	°C)]	21		(85)
																L			-

Utilisation	factor for	gains fo	r living area	, h1,m	(see	Table 9a)
-------------	------------	----------	---------------	--------	------	-----------

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.49	0.52	0.76	0.95	0.99	1		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	20.05	20.21	20.42	20.68	20.88	20.98	21	20.99	20.95	20.7	20.33	20.03		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ible 9, Tl	ח2 (°C)					
(88)m=	20.08	20.08	20.08	20.1	20.1	20.11	20.11	20.11	20.1	20.1	20.09	20.09		(88)
Utilisa	ition fac	tor for g	ains for ı	rest of d	welling, l	n2,m (se	e Table	9a)						
(89)m=	0.99	0.99	0.97	0.92	0.79	0.58	0.39	0.43	0.69	0.93	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.82	19.04	19.35	19.72	19.98	20.09	20.11	20.11	20.06	19.76	19.24	18.79		(90)
-									f	LA = Livin	g area ÷ (4	+) =	0.49	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

						• /							
(92)m=	19.42	19.61	19.87	20.19	20.42	20.52	20.54	20.54	20.49	20.22	19.77	19.39	(92)
-													

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

(93)m=	19.42	19.61	19.87	20.19	20.42	20.52	20.54	20.54	20.49	20.22	19.77	19.39		(93)
8. Spa	ace hea	iting req	uirement	t i										
Set T the ut	i to the ilisation	mean int factor fo	ternal tei or gains	mperatui using Ta	re obtain able 9a	ied at ste	ep 11 of	Table 9	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	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.97	0.92	0.81	0.62	0.44	0.47	0.72	0.93	0.98	0.99		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	358.69	405.01	432.5	434.06	390.51	287.35	195.71	204.66	301.05	358.91	348.55	340.7		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8	-	-	_		-	-		
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rat	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	-	-		
(97)m=	783.14	759.39	688.27	572.56	440.87	295.71	196.69	206.17	320.83	486.42	644.34	777.27		(97)
Space	e heatin	g requir	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	315.79	238.14	190.29	99.72	37.46	0	0	0	0	94.86	212.98	324.81		
								Tota	l per year	(kWh/yeai	⁻) = Sum(9	8)15,912 =	1514.05	(98)
Space	e heatin	g requir	ement in	kWh/m²	²/year								29.4	(99)
9a. En	ergy rea	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heati	ng:												_
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)								
	315.79	238.14	190.29	99.72	37.46	0	0	0	0	94.86	212.98	324.81		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20	06)									(211)
	338.1	254.97	203.74	106.77	40.11	0	0	0	0	101.57	228.03	347.76		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1621.04	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)]}x1	00 ÷ (20	(8)	-	-	-	-	-		-			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
					-			Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	с п .	0	(215)
Water	heating	9												-
Output	from w	ater hea	ter (calc	ulated a	bove)									
	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		_
Efficier	ncy of w	ater hea	ater						-				80.3	(216)
(217)m=	86.66	86.3	85.65	84.33	82.37	80.3	80.3	80.3	80.3	84.1	85.95	86.78		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	n = (64)	m x 100) ÷ (217))m	450	444.5=	40	4=4==	450 = 1	400	4-0.1-	40		
(219)m=	190.69	167.25	175.34	157.94	156.56	141.45	135.52	151.07	152.74	166.06	173.46	185.95		٦.
-	_							Iota	i = Sum(2	19a) ₁₁₂ =	_		1954.03	(219)
Annua	I totals	fuelue	ad main	ovotor	1					k	Wh/year	•	kWh/year	7
Space	neaung		su, main	System	I								1621.04	

Water heating fuel used				1954.03	
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 (23	0a)(230g) =		75	(231)
Electricity for lighting				260.28	(232)
Total delivered energy for all uses (211)(221) + ((231) + (232)(237b) =			3910.36	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	_				
	Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	ar
Space heating (main system 1)	Energy kWh/year (211) x	Emission fact kg CO2/kWh	or =	Emissions kg CO2/yea 350.14	ar](261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Emission fact kg CO2/kWh 0.216 0.519	or = =	Emissions kg CO2/yea 350.14	ar](261)](263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = =	Emissions kg CO2/yea 350.14 0 422.07	ar](261)](263)](264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = =	Emissions kg CO2/yea 350.14 0 422.07 772.22	ar](261)](263)](264)](265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = = =	Emissions kg CO2/yea 350.14 0 422.07 772.22 38.93	ar (261) (263) (264) (265) (267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	Emission fact kg CO2/kWh 0.216 0.519 0.216 0.519 0.519	or = = = =	Emissions kg CO2/yea 350.14 0 422.07 772.22 38.93 135.09	IF (261) (263) (264) (265) (267) (268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x su	Emission fact kg CO2/kWh 0.216 0.519 0.216 0.519 0.519 0.519 0.519 m of (265)(271) =	or = = =	Emissions kg CO2/yea 350.14 0 422.07 772.22 38.93 135.09 946.23	IC (261) (263) (264) (265) (267) (268) (272)

TER =

18.37 (273)

		Us	ser Details:						
Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Numi ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Ргор	eny Address:	Kingsto	n Briage	8 IBF 52	INID GA	19	
1 Overall dwelling dime	nsions.								
			Area(m ²)		Av. Hei	iaht(m)		Volume(m ³)	
Ground floor		Г	51.5	(1a) x	2	2.7	(2a) =	139.05](3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	∟ €)+(1n)	51.5	(4)]		_
Dwelling volume				(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	139.05] (5)
2 Ventilation rate:							l		_]
	main s	econdary	other		total			m ³ per hour	
Number of chimneys	heating h		+ 0] = [0	x 4	40 =	0	7 (6a)
Number of open flues			+ 0	」	0	x 2	20 =	0	$\int_{(6b)}^{(6d)}$
Number of intermittent fai	ns			J L T	1	x 1	10 =	10] ⁽⁰²⁾] _(7a)
Number of passive vents						x 1	10 =		$\int_{(2h)}^{(2h)}$
Number of flueless ass fi					0		10 -	0	
Number of flueless gas fil	es				0		+0 -	0	(7c)
							Air ch	anges per hou	ur
Infiltration due to chimney	$\sqrt{3}$, flues and fans = (6)	a)+(6b)+(7a)+(7b)+(7c) =	Г		<u> </u>	÷ (5) =		٦
lf a pressurisation test has be	een carried out or is intende	ed, proceed to	(17), otherwise c	ontinue fro	om (9) to ((16)	()		_
Number of storeys in the	e dwelling (ns)							0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or 0.3	35 for masonr	y constru	uction			0	(11)
deducting areas of openin	esent, use the value corres ligs); if equal user 0.35	ponaing to the	greater wall area	a (anter					
If suspended wooden f	loor, enter 0.2 (unseal	led) or 0.1 (s	sealed), else	enter 0			[0	(12)
If no draught lobby, ent	er 0.05, else enter 0							0	(13)
Percentage of windows	and doors draught st	tripped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cub	pic metres pe	er hour per so	luare me	etre of e	nvelope	area	4	(17)
If based on air permeabili	ty value, then $(18) = [(1)$	7) ÷ 20]+(8), ot	therwise (18) = (16)		(0.27	(18)
Air permeability value applies	s it a pressurisation test has d	s been aone or	a degree air per	meability i	s being us	sea	1	2	
Shelter factor	u		(20) = 1 - [0.075 x (1	9)] =			0.85	(19)
Infiltration rate incorporati	ing shelter factor		(21) = (18)	x (20) =				0.23] (21)
Infiltration rate modified for	or monthly wind speed	d					I	0.20	<u> Ц</u> , ,
Jan Feb	Mar Apr May	Jun J	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	3.8 3.7	4	4.3	4.5	4.7		
Wind Eactor (22a) $m = (22a)$	$2)m \div 4$								
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 0	.95 0.92	1	1.08	1.12	1.18		
				·		I			

Adjust	ed infiltr	ation rat	e (allow	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
~ / /	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27		
Calcul If me	ate etteo echanica	ctive air al ventila	change	rate for t	he appli	cable ca	ISE						0	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	(23a) = (23a	ı) × Fmv (e	equation (I	N5)) . othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(23c)
a) If	balance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	, a)m = (22	2b)m + (23b) × [1 – (23c)	• + 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0		0]	(24a)
b) If	balance	d mech	i anical ve	entilation	u without	heat rec	L Coverv (N	I MV) (24b)m = (22	L 2b)m + ()	1 23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	r positiv	e input v	ventilatio	n from c	outside		1	1	1	
,	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22t	o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft	-	-		-	
	if (22b)n	n = 1, th	en (24d) I)m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			1	(2.4.1)
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24)	c) or (24	d) in boy	(25)				1	(05)
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	J	(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs I ²	Net Ar A ,r	rea n²	U-valı W/m2	ue :K	A X U (W/I	K)	k-value kJ/m²·l	e / K ł	A X k <j k<="" td=""></j>
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				6.6		24.15	5 X	0.18	=	4.35				(29)
Total a	area of e	lements	, m²			30.75	5							(31)
Party v	wall					53.34	4 X	0	=	0				(32)
Party f	loor					51.5					 [\exists	(32a)
Party of	ceiling					51.1					[\neg	(32b)
* for win ** incluc	idows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	n paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				11.9	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	10514.09	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be t	ign assess used inste	ments wh ad of a de	ere the de tailed calc	etails of the ulation.	constructi	ion are noi	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix I	K						3.14	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			15.04	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y		i		(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	l	
(38)m=	24.94	24.86	24.78	24.43	24.36	24.05	24.05	23.99	24.17	24.36	24.49	24.64	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K		-				(39)m	= (37) + (3	38)m			
(39)m=	39.98	39.9	39.83	39.47	39.4	39.09	39.09	39.04	39.21	39.4	39.54	39.68		
									/	Average =	Sum(39)1	I12 / 12=	39.47	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.78	0.77	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.77	0.77	0.77		
Numbe	er of day	s in mo	nth (Tab	le 1a)					/	Average =	Sum(40)1.	.12 /12=	0.77	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	.lul	Αυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ene	rav reau	irement:								kWh/ve	ear:	
Accum		inancy	N									70		(40)
if TF	A > 13.9 A £ 13.9	9, N = 1 9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13.	.9)	73		(42)
Annua	laverag	e hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		75	.39		(43)
Reduce not more	the annua e that 125	al average litres per	hot water person pe	usage by r day (all w	5% if the a vater use, l	lwelling is hot and co	designed ld)	to achieve	a water us	se target o	t			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
_									-	Total = Su	m(44) ₁₁₂ =		904.68	(44)
Energy of	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r I	m x nm x [I	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1	
(45)m=	122.98	107.56	110.99	96.77	92.85	80.12	74.24	85.2	86.21	100.47	109.68	119.1		-
lf instan	taneous w	ater heati	ng at point	of use (no	o hot water	^r storage),	enter 0 in	boxes (46	-) to (61)	Total = Su	m(45) ₁₁₂ =		1186.18	(45)
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:												
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel	()		(47)
If com	munity h	eating a	ind no ta	ink in dw	velling, e	nter 110	litres in	(47)						
Otherv	vise if no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/dav):					า		(48)
Tempe	erature f	actor fro	m Table	2b		,						<u>,</u>		(49)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			<u>,</u>		(50)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:					-		
Hot wa	ter stor	age loss	factor fi	om Tabl	le 2 (kW	h/litre/da	iy)				(0		(51)
It comi	nunity r e factor	from Ta	ee secti ble 2a	on 4.3								2	l	(52)
Tempe	erature f	actor fro	m Table	2b)		(52)
Enera	/ lost fro	m water	storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =		<u>ີ</u>		(54)
Enter	(50) or ((54) in (5	55)	, ,						,	(2 D		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3						()		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				-	
(moo	dified by	factor f	rom Tab I	le H5 if t I	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		I	(=0)
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eacl	h month	(61)m =	(60)) ÷ 36	65 × (41))m								
(61)m=	16.05	14.47	15.98	15.42	15.9	1	5.35	15.83	15.8	88	15.39	15.95	15.49	16	6.04		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l fo	r eac	h month	(62)r	n =	0.85 × ((45)m	+ (46)m	+ (57)m +	(59)m + (61)m	
(62)m=	139.03	122.03	126.97	112.19	108.75	9	5.47	90.08	101.	07	101.6	116.4	2 125.16	5 13	5.14		(62)
Solar DH	W input	calculated	using Ap	pendix G o	r Appendix	с Н ((negati	ve quantity	/) (ente	er '0'	if no solar	r contrib	ution to wa	ater he	ating)		
(add a	dditiona	I lines if	FGHRS	and/or V	WWHRS	ap	plies	, see Ap	pend	ix G	6)						
(63)m=	0	0	0	0	0		0	0	0		0	0	0		0		(63)
Output	from w	ater hea	ter	-					-					-			
(64)m=	139.03	122.03	126.97	112.19	108.75	9	5.47	90.08	101.	07	101.6	116.4	2 125.16	5 13	5.14		
				•	•				(Dutp	ut from wa	ater hea	ter (annua)112		1373.92	(64)
Heat g	ains fro	m water	heating	ı, kWh/m	onth 0.2	5 ′	[0.85	× (45)m	+ (6	1)m] + 0.8 x	(46)r	n + (57)r	n + (!	59)m	1	
(65)m=	44.9	39.38	40.9	36.03	34.85	3	-	28.65	32.	3	32.51	37.39	40.34	43	.61	-	(65)
inclu	de (57)	n in calo	culation	of (65)m	only if c	ı vlir	nder i	s in the c	dwelli	na (or hot w	ater is	from co	nmur	nitv h	eating	
5 Int	ernal o	ains (see	Table	5 and 5a).	,									,		
Matab).												
ivietado	lan		<u>5), vva</u> Mar		May		lun	lul	<u>۸</u>		Son	Oct	Nov			l	
(66)m =	86 72	86.72	86.72	86.72	86.72		5011 86.72	86 72	86 7	19 72	86 72	86.72	86.72	86	372		(66)
liabtia	00.72									<u> </u>	Toble F	00.72	00.72		.12		(00)
	g gains				L, equat	ion	L9 0	r L9a), a I				40.47	1 4 4 9 4	1 45	- 4 -	I	(67)
(67)m=	14.74	13.09	10.65	8.06	6.02	:	5.09	5.5	7.14	4	9.59	12.17	14.21	15	0.15		(07)
Applia	nces ga	ins (calc	ulated i	n Appen	dix L, eq	uat	tion L	13 or L1	3a), a r	also	see Tal	ble 5				I	
(68)m=	151.13	152.7	148.74	140.33	129.71	1	19.73	113.06	111.	49	115.45	123.8	5 134.48	3 14	4.46		(68)
Cookin	ig gains	(calcula	ted in A	ppendix	L, equat	tior	า L15	or L15a)), also) se	e Table	5					
(69)m=	31.67	31.67	31.67	31.67	31.67	3	81.67	31.67	31.6	67	31.67	31.67	31.67	31	1.67		(69)
Pumps	and fa	ns gains	(Table	5a)	-	_		-	_								
(70)m=	3	3	3	3	3		3	3	3		3	3	3		3		(70)
Losses	s e.g. e\	aporatio	on (nega	ative valu	es) (Tab	le	5)										
(71)m=	-69.37	-69.37	-69.37	-69.37	-69.37	-6	69.37	-69.37	-69.3	37	-69.37	-69.3	7 -69.37	-69	9.37		(71)
Water	heating	gains (T	able 5)	•	•	•				•				•			
(72)m=	60.36	58.6	54.97	50.04	46.84	4	2.33	38.5	43.4	1	45.16	50.26	56.03	58	3.62		(72)
Total i	nternal	qains =					(66)	m + (67)m	n + (68)m +	· (69)m + ((70)m +	(71)m + (7	2)m			
(73)m=	278.24	276.41	266.38	250.45	234.59	2	19.16	209.07	214.	06	222.21	238.3	1 256.73	8 27	0.24		(73)
6. Sol	ar gain	s:		1	1	1							1				
Solar g	ains are	calculated	using sola	ar flux from	Table 6a	and	assoc	iated equa	tions to	о со	nvert to th	e applic	able orient	ation.			
Orienta	ation:	Access F	actor	Area			Flu	x			g_		FF			Gains	
	-	Table 6d		m²			Tal	ole 6a		Та	able 6b		Table 60	;		(W)	
Southe	ast <mark>0.9x</mark>	0.77	×	2.8	38	x	3	6.79	x		0.63	×	0.7] =	32.38	(77)
Southe	ast <mark>0.9x</mark>	0.77	×	1.8	36	x	3	6.79	×		0.63	× ٦	0.7		i =	41.83	- (77)
Southe	ast <mark>0.9x</mark> [0.77	×	2.8	38	x	6	2.67	x [0.63	× ٦	0.7		=	55.16	- (77)
Southe	ast <mark>0.9x</mark> [0.77	×		36	x	6	2.67	, r		0.63	≓ ×	0.7		=	71.25](77)
Southe	ast <mark>0.9x</mark> [0.77	×	28	38	x	8	5.75	, L X [0.63	۲×	0.7		1 =	75.48](77)
		0.11			.0		ÿ	0.10	I L		0.00		0.1			10.10	· ·

Southea	ast <mark>0.9x</mark> [0.77	x		1.86		x	85.	75	×	0.63		x	0.7	=	97.49	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[2.88		x	106	.25	x	0.63		x	0.7	=	93.52	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	ĺ	1.86		x	106	.25	x	0.63		×	0.7	=	120.8	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ì	2.88		x	119	.01	x	0.63		×	0.7	=	104.75	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	ĺ	1.86		x	119	.01	x	0.63		×	0.7	= =	135.3	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	ĺ	2.88		x	118	.15	x	0.63		×	0.7	=	103.99	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86		x	118	.15	x	0.63		×	0.7	=	134.32	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	2.88		x	113	.91	x	0.63		×	0.7	=	100.26	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ì	1.86		x	113	.91	x	0.63		×	0.7	=	129.5	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[2.88		x	104	.39	x	0.63		×	0.7	=	91.88	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	Ī	1.86		x	104	.39	x	0.63		×	0.7	=	118.68	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[2.88		x	92.8	85	x	0.63		×	0.7	=	81.73	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[1.86		x	92.8	85	x	0.63		×	0.7	=	105.56	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[2.88		x	69.3	27	x	0.63		×	0.7	=	60.97	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[1.86		x	69.2	27	x	0.63		×	0.7	=	78.75	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[2.88		x	44.0	07	x	0.63		×	0.7	=	38.79	(77)
Southea	ast <mark>0.9x</mark> [0.77	×	[1.86		x	44.0	07	x	0.63		×	0.7	=	50.1	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	[2.88		x	31.4	49	x	0.63		×	0.7	=	27.71	(77)
Southea	ast <mark>0.9x</mark> [0.77	×		1.86		x	31.4	49	x	0.63		x	0.7	=	35.8	(77)
Solar o	ains in	watts ca	alculate	d t	for each i	month				(83)m	ı = Sum(74)	m	.(82)m				
(83)m=	74.21	126.42	172.97	Ť	214.31 2	240.05	23	38.31 2	229.76	210	.56 187.2	29	139.72	88.89	63.51]	(83)
Total g	ains – i	nternal a	nd sola	r ((84)m = ((73)m -	+ (8	83)m , v	watts		I					_	
(84)m=	352.45	402.82	439.35		464.76 4	474.64	4	57.48 4	438.83	424	.62 409.4	9	378.03	345.62	333.75]	(84)
7 Me	an inter	rnal temp	erature	(heating s	eason)										

Temp	erature	during h	leating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	tion fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							-
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.96	0.89	0.74	0.54	0.39	0.42	0.65	0.91	0.99	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	20.38	20.52	20.7	20.87	20.97	21	21	21	20.99	20.87	20.59	20.35		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ible 9, Ti	n2 (°C)					
(88)m=	20.27	20.28	20.28	20.28	20.28	20.29	20.29	20.29	20.29	20.28	20.28	20.28		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, l	n2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.33	0.36	0.59	0.88	0.98	0.99		(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 19.9 19.45 19.65 20.14 20.26 20.29 20.29 20.29 20.28 (90) (90)m= 20.14 19.76 19.4 $fLA = Living area \div (4) =$ 0.49 (91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

						5/		· ·	,				_
(92)m=	19.9	20.07	20.29	20.5	20.6	20.63	20.63	20.63	20.62	20.5	20.16	19.86	(92)

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

(93)m=	19.9	20.07	20.29	20.5	20.6	20.63	20.63	20.63	20.62	20.5	20.16	19.86		(93)
8. Spa	ace hea	iting requ	uirement	t										
Set Ti the ut	i to the ilisation	mean int	ternal te or gains	mperatui using Ta	re obtain able 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	1:										
(94)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.36	0.39	0.62	0.89	0.98	0.99		(94)
Usefu	Il gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	349.54	394.64	417.09	403.79	338.89	234.75	157.63	165.16	252.33	336.04	338.55	331.76		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	nal tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	623.64	605.37	549.02	457.67	350.79	235.79	157.7	165.29	255.84	389.92	516.44	621.35		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k\ I	Nh/mont	th = 0.02	24 x [(97])m – (95)m] x (4′	1)m	·1		
(98)m=	203.93	141.61	98.15	38.8	8.85	0	0	0	0	40.09	128.08	215.45		7
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	874.97	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								16.99	(99)
9a. En	ergy rea	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatii	ng:												1
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ı, %	_					0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space	e heatin	g require	ement (o	alculate	d above)								
	203.93	141.61	98.15	38.8	8.85	0	0	0	0	40.09	128.08	215.45		
(211)m	n = {[(98)m x (20	04)] } x 1	100 ÷ (20)6)	-								(211)
	218.11	151.46	104.97	41.5	9.47	0	0	0	0	42.88	136.99	230.43		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	935.8	(211)
Space = {[(98	e heatin)m x (2(g fuel (s	econdar 00 ÷ (20	y), kWh/)8)	month									-
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15.1012}	=	0	(215)
Water	heating	r											-]. ,
Output	from w	ater hea	ter (calc	ulated a	bove)									
•	139.03	122.03	126.97	112.19	108.75	95.47	90.08	101.07	101.6	116.42	125.16	135.14		
Efficier	ncy of w	ater hea	iter										87.3	(216)
(217)m=	89.17	88.99	88.67	88.1	87.53	87.3	87.3	87.3	87.3	88.1	88.89	89.24		(217)
Fuel fo	r water	heating,	kWh/m	onth							L			
(219)m	n = (64)	<u>m x 100</u>) ÷ (217))m	r	· · · · ·	· · · · ·	· · · · ·	· · · · ·	· · · · ·	· · · · ·			
(219)m=	155.91	137.13	143.2	127.34	124.24	109.36	103.18	115.78	116.38	132.15	140.81	151.43		-
								Tota	I = Sum(2	19a) ₁₁₂ =			1556.91	(219)
Annua	l totals									k	Wh/year	I	kWh/year	1
Space	neating	tuel use	ed, main	system	1								935.8	J

Water heating fuel used				1556.91	
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 (23	80a)(230g) =		75	(231)
Electricity for lighting				260.28	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			2828	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216	=	202.13	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	336.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =	-		538.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	135.09	(268)
Total CO2, kg/year	SL	um of (265)(271) =		712.44	(272)
Dwelling CO2 Emission Rate	(2	72) ÷ (4) =		13.83	(273)
El rating (section 14)				90	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2	2012		Strom Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.5.59	
		P	roperty /	Address	: Kingsto	n Bridge	e 1BF 52	2 MID GA	AS	
Address :										
1. Overall dwelling dime	ensions:			(0)						
Ground floor			Area	a(m²) 51.5	(1a) x	AV. He	Ignt(m) 2.7	(2a) =	139.05) (3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+	-(1e)+(1n) 5	51.5	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	139.05	(5)
2. Ventilation rate:										
	main beating	secondar heating	у	other		total			m ³ per hou	•
Number of chimneys			+ [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	×2	20 =	0	(6b)
Number of intermittent fa	ns				- <u> </u>	2	x ′	10 =	20	(7a)
Number of passive vents						0	x '	10 =	0	 (7b)
Number of flueless gas fi	res				Ē	0	x 4	40 =	0	(7c)
								Air ch	anges per ho	⊐ ur
Infiltration due to chimne	in fluor and fana	-(6a)+(6b)+(7)	a)+(7b)+(70) -	F					а. П
Iniliation due to chimne	ys, liues and lans =	= (0a) + (0b) + (7)	a) + (7 D) + (rt) - otherwise (continue fr	$\frac{1}{2}$ (9) to ((16)	÷ (5) =		
Number of storeys in th	ne dwelling (ns)		<i>1</i> to (<i>11)</i> , c			5111 (0) 10 (10)		0	(9)
Additional infiltration	3 ()						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timb	per frame or	0.35 for	r masonr	y constr	uction			0	(11)
if both types of wall are p deducting areas of openir	resent, use the value co ngs); if equal user 0.35	prresponding to	the great	er wall are	a (after					-
If suspended wooden f	loor, enter 0.2 (une	sealed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter	. 0							0	(13)
Percentage of windows	s and doors draugh	nt stripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00	(1 -)		0	(15)
Infiltration rate	=0			(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in	CUDIC METRE	s per ho	our per so $(18) = ($	quare m	etre of e	nvelope	area	5	
Air permeability value applie	ity value, then (10)	- [(17) + 20]+(0	e or a dec	oree air ne	rmeahility	is heina u	sed		0.39	(18)
Number of sides sheltere	ed			groo un por	inite domity i	o boing a	500		2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	ing shelter factor			(21) = (18) x (20) =				0.33	(21)
Infiltration rate modified f	or monthly wind sp	eed								-
Jan Feb	Mar Apr M	ay 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 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4		_							
(22a)m= 1.27 1.25	1.23 1.1 1.0	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39		
Calcul	ate effec	ctive air	change	rate for t	he appli	cable ca	se							
lf evh	aust air h		using Ann	endix N (2	(2h) = (22a)	a) x Emv (e	equation (I		nwise (23h) = (23a)			0	(238)
If hal	anced with	heat reco	overv: effic	$\frac{1}{2}$	allowing f	or in-use f	actor (fron	n Table 4h) =) (200)			0	(230)
a) If		d moch			with ho	at rocov			$)^{-}$	$(h) m \pm ($	22h) v [1 (23a)	0 ± 1001	(23C)
a) II								ΠR) (248 Γ	a)iii – (24		230) × [$\frac{1 - (230)}{1 - 0}$) ÷ 100]]	(24a)
(2-4a)III-		d mooh				hoot roc			$\frac{1}{2}$) 225)	0	J	(210)
D) II								VIV) (240 1	p)m = (22	2) + m(a2	230)		1	(24b)
(240)III-			traat var							0	0	0	J	(210)
C) II	if (22b)n	1 < 0.5	(23b), t	then (24)	c) = (23b); other	wise (24	c) = (22t	butside b) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	nole hous)m = (221	se positiv o)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58]	(24d)
Effe	ctive air	change	rate - ei	nter (24a) or (24t) or (24	c) or (24	d) in boy	(25)				1	
(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58]	(25)
2 40	at loopo			noromot	or		•	•				•	.	
				Oponin		Not Ar	200		10			k volu	- /) Y k
		area	(m²)	r	95 1 ²	A,r	n²	W/m2	:K	(W/I	K)	kJ/m ² ·l	K k	J/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.4)+	0.04] =	3.82				(27)
Windo	ws Type	2				1.86	x1	/[1/(1.4)+	0.04] =	2.47				(27)
Walls				6.6		24.15	5 X	0.18	= [4.35				(29)
Total a	area of e	lements	, m²			30.75	5							(31)
Party v	wall					53.34	4 ×	0	=	0				(32)
Party f	loor					51.5							\exists	(32a)
Party of	ceiling					51.1	=				[⊣	(32b)
* for win ** incluc	idows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	h 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				13.1	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	10514.09	(34)
Therm	al mass	parame	eter (TMI	P = Cm -	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the culation.	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) ca	lculated	using Ap	pendix I	K						2.27	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			15.37	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y		1		(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	4	
(38)m=	27.12	26.96	26.8	26.05	25.91	25.26	25.26	25.14	25.51	25.91	26.2	26.49	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (38)m		-	
(39)m=	42.49	42.33	42.17	41.43	41.29	40.64	40.64	40.51	40.89	41.29	41.57	41.86		
										Average =	Sum(39)1	12 /12=	41.43	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.83	0.82	0.82	0.8	0.8	0.79	0.79	0.79	0.79	0.8	0.81	0.81		
Numbe	er of day	us in mo	nth (Tab	le 12)					,	Average =	Sum(40)1.	.12 /12=	0.8	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	.lul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
								1						
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	349 x (TI	FA -13.9	9)2)] + 0.0	0013 x (⁻	TFA -13.	.9)	73		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av lwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
Eporav	content of	hot water	used - ca	culated m	onthly — 1	100 v Vd i	m v nm v l	Tm / 360(· kW/b/mor	Total = Su	m(44) ₁₁₂ =	- 1d)	904.68	(44)
(45)		107 50			0110119 = 4.	00 10	74.04	05 0	06.04	100 47		110.1		
(45)11-	122.90	107.50	110.99	90.77	92.05	00.12	74.24	05.2	00.21	Total = Su	m(45),=	119.1	1186 18	(45)
lf instan	taneous v	ater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	rotar – Ou	III(+0) 112 -		1100.10	
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:					•				·			
Storag	e volum) includir	ng any so	olar or W	WHRS	storage	within sa	ame ves	sel	()		(47)
If comi Otherw	nunity r vise if no	eating a	and no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres in Deous co	ı (47) əmbi boil	ers) ente	r '0' in <i>(</i>	47)			
Water	storage	loss:	not wat			notantai	10000 00							
a) If m	anufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):				(C		(48)
Tempe	erature f	actor fro	m Table	2b							(C		(49)
Energy	/ lost fro	m water	r storage	e, kWh/y	ear			(48) x (49)) =		(0		(50)
b) If m	anufact	urer's de	eclared (cylinder com Tab	loss fact	or is not h/litre/da	known:							(51)
If com	nunity h	leating s	see secti	on 4.3		n/ntie/ue	ау)					J		(31)
Volum	e factor	from Ta	ble 2a								(C		(52)
Tempe	erature f	actor fro	m Table	2b							(C		(53)
Energy	/ lost fro	m water	r storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =	(C		(54)
Enter	(50) or ((54) in (8	55)								(0		(55)
Water	storage	loss cal	culated	for each	month	i	i	((56)m = (55) × (41)	m	1			
(56)m= If cylinde	0 er contain	0 s dedicate	0 d solar sto	0 rage, (57)	0 m = (56)m	$0 \times [(50) - ($	0 (H11)] ÷ (5	0 i0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
(57)m=	0	0	0	0	0	0		0	0	0	0	0		(57)
Drimer						I	I	I	I	I]		(58)
Primar	y circuit	loss cal	inuar) fro	for each	ಕು month (59)m =	(58) ÷ 36	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	alculated	for eacl	n month	(61)m =	(60) ÷ 3	365 × (41)m						
(61)m=	42.26	36.78	39.19	36.44	36.11	33.46	34.58	36.11	36.44	39.19	39.41	42.26		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for ea	ch month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		(62)
Solar Dł	-IW input	calculated	using Ap	pendix G o	r Appendix	H (nega	tive quantity	/) (enter '0)' if no sola	r contribut	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	applie	s, see Ap	pendix (G)			-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		
								Out	put from w	ater heate	r (annual)₁	12	1638.4	(64)
Heat g	ains fro	om water	heating	, kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	51.46	44.96	46.7	41.28	39.9	35.01	33.33	37.36	37.78	43.2	46.32	50.17		(65)
inclu	ide (57))m in calo	culation	of (65)m	only if c	ylinder	is in the	dwelling	or hot w	, ater is f	rom com	munity h	leating	
5. Int	ternal g	ains (see	Table	5 and 5a):									
Metab	olic gai	ns (Table	5) Wa	tts	,									
motab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)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		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L9 (or L9a), a	lso see	Table 5					
(67)m=	14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15		(67)
Applia	nces da	uns (calc	ulated i	n Append	dix L. ea	uation I	13 or L1	i 3a), also	i o see Ta	ble 5	1			
(68)m=	151.13	152.7	148.74	140.33	129.71	119.73	113.06	111.49	115.45	123.86	134.48	144.46		(68)
Cookir	L	L s (calcula	L ated in A	I	L equat	L tion I 15) also s	L ee Table	1 2.5				
(69)m=	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67		(69)
Pump	L	I Ins gains	I (Table	1 5a)		I		I	1					
(70)m=					3	3	3	3	3	3	3	3	l	(70)
		Vanoratio	n (neas	l ative valu	es) (Tab						-			. ,
(71)m=	-69.37	-69 37	-69 37	-69 37	-69 37	-69.37	-69 37	-69.37	-69.37	-69.37	-69.37	-69 37	l	(71)
Wator	boating		[00.01	00.01	00.01	00.01	00.01	00.07		00.01	00.01		()
(72)m=			able 5)	57 34	53.63	48.62	44.8	50.21	52.47	58.07	64 33	67.43		(72)
Total			02.11	07.04	00.00	(6)	6)m + (67)m	1 + (68)m	+ (60)m +	(70)m + (7)	(1)m + (72)	m		()
(73)m=	287.04	$\frac{19200}{28471}$	274 18	257.74	241 38	225.45	215 37	220.86	220 51	246 12	265.04	270.05		(73)
6 50	lar gain	204.71	274.10	237.74	241.30	223.43	215.57	220.00	229.01	240.12	205.04	219.00		(10)
Solar c	ains are	calculated	usina sola	ar flux from	Table 6a	and asso	ciated equa	itions to co	onvert to th	ne applical	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area	1	FI	ux		a	F	FF		Gains	
		Table 6d		m²		Та	able 6a	٦	able 6b	Т	able 6c		(W)	
Southe	ast <mark>0.9x</mark>	0.77	×	2.8	38	×	36.79) x [0.63	ר × ר	0.7	=	32.38	(77)
Southe	ast <mark>0.9x</mark>	0.77	×	1.8	36	×	36.79	 [0.63	╡╷╞	0.7	=	41.83](77)
Southe	ast <mark>0.9x</mark>	0 77	×	28	38	×	62.67	i × 🗀	0.63	╡╷┝	0 7		55.16](77)
Southe	ast <mark>0.9x</mark>	0.77	×		36	x	62.67		0.63	╡╷┝	0.7		71 25] (77)
Southe	ast <mark>0.9x</mark>	0.77	×	28	38	× [85.75	× [0.63	╡╷┝	0.7		75.48](77)
	0.07	0.77	^	2.0	50	^	05.75		0.05	^ L	0.7		75.40	(''')

Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	8	5.75	x	0.63	x	0.7	:	=	97.49	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	1	06.25	x	0.63	x	0.7		-	93.52	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	1	06.25	x	0.63	×	0.7		=	120.8	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	1	19.01	x	0.63	×	0.7		=	104.75	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	1	19.01	x	0.63	×	0.7		-	135.3	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	1	18.15	x	0.63	×	0.7		=	103.99	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	1	18.15	x	0.63	×	0.7		=	134.32	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	1	13.91	x	0.63	×	0.7		=	100.26	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	1	13.91	x	0.63	×	0.7		=	129.5	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	1	04.39	x	0.63	×	0.7		=	91.88	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	1	04.39	x	0.63	×	0.7		-	118.68	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	9	2.85	x	0.63	×	0.7		=	81.73	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	g	2.85	x	0.63	×	0.7		-	105.56	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	6	9.27	x	0.63	×	0.7		-	60.97	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	6	9.27	x	0.63	x	0.7		-	78.75	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	4	4.07	x	0.63	×	0.7		-	38.79	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	4	4.07	x	0.63	x	0.7		=	50.1	(77)
Southea	ast <mark>0.9x</mark>	0.77	x	2	.88	x	3	1.49	x	0.63	x	0.7		-	27.71	(77)
Southea	ast <mark>0.9x</mark>	0.77	×	1	.86	x	3	31.49	x	0.63	x	0.7		-	35.8	(77)
Solar o	ains in	watts, ca	alculated	for ea	ch mont	h			(83)m	ı = Sum(74)m	(82)m					
(83)m=	74.21	126.42	172.97	214.31	240.05	5 2	238.31	229.76	210	.56 187.29	139.7	2 88.89	63.51	1		(83)
Total g	ains – i	nternal a	nd solai	(84)m	= (73)m) + ((83)m	, watts			I	I			I	
(84)m=	361.26	411.12	447.14	472.06	481.43	3 4	463.76	445.13	431	.42 416.8	385.8	3 353.93	342.5	6		(84)
7. Me	an inter	nal temp	erature	(heatin	g seaso	n)										
Temp	erature	during h	eating p	eriods	in the liv	/ing	area	from Tab	ole 9,	, Th1 (°C)					21	(85)

Utilisation	factor for	dains	for living	area h	1 m (see Ta	able 9a)
Canoaton	100101 101	ganie	ioi niing	a. ea,	• ,• • • ,•		

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.96	0.9	0.76	0.56	0.4	0.43	0.66	0.91	0.99	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)				_	
(87)m=	20.32	20.46	20.65	20.85	20.96	21	21	21	20.99	20.85	20.55	20.3		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, Tl	n2 (°C)					
(88)m=	20.23	20.23	20.24	20.25	20.25	20.26	20.26	20.26	20.26	20.25	20.25	20.24		(88)
Utilisa	ition fac	tor for g	ains for I	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.95	0.87	0.71	0.49	0.33	0.36	0.6	0.88	0.98	0.99		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	19.33	19.54	19.8	20.08	20.22	20.26	20.26	20.26	20.25	20.09	19.68	19.3		(90)
-									f	LA = Livin	g area ÷ (4	1) =	0.49	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m= 19.81 19.99 20.21 20.45 20.58 20.62 20.62 20.62 20.61 20.46 20.1 19.78 (92)							• /							
	(92)m=	19.81	19.99	20.21	20.45	20.58	20.62	20.62	20.62	20.61	20.46	20.1	19.78	(9)

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

(93)m=	19.81	19.99	20.21	20.45	20.58	20.62	20.62	20.62	20.61	20.46	20.1	19.78		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set T the ut	i to the ilisation	mean int factor fo	ternal ter or gains	mperatui using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	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	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.37	0.4	0.63	0.89	0.98	0.99		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m			•			•	•		
(95)m=	358.16	402.95	425.86	413.96	350.84	243.08	163.27	170.85	261.44	344.72	346.6	340.37		(95)
Month	nly aver	age exte	ernal terr	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	- =[(39)m :	x [(93)m	– (96)m]				
(97)m=	659.08	638.67	578.31	478.55	366.51	244.51	163.37	171.03	266.06	407.02	540.56	652.42		(97)
Space	e heatin	g require	ement fo	r each n	honth, k	Nh/mont	th = 0.02	24 x [(97)m – (95)m] x (4 ⁻	1)m			
(98)m=	223.88	158.4	113.43	46.51	11.66	0	0	0	0	46.35	139.65	232.16		
			•	•				Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	972.04	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								18.87	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatii	ng:												
Fracti	ion of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	na from	main sve	stem 1			(204) = (2	02) × [1 –	(203)] =			1] (204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ı, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ur I
Space	e heatin	g require	ement (c	alculate	d above)	i							
	223.88	158.4	113.43	46.51	11.66	0	0	0	0	46.35	139.65	232.16		
(211)m	n = {[(98)m x (20	04)]}x1	00 ÷ (20)6)									(211)
	239.71	169.6	121.44	49.79	12.48	0	0	0	0	49.63	149.52	248.57		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1040.73	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									J
= {[(98)m x (20)]}x1	$\frac{00 \div (20)}{1}$		0	0	0	0	0	0	0	0		
(215)11-	0	0	0	0	0	0	0			$\frac{0}{1}$	215)			
								TOLA	ii (KVVII/yee	ar) –Sum(2	213) _{15,10} 12	2	0	(215)
Water	heating	9												
Output	from w	ater hea	ter (calc	ulated a	00Ve)	112 50	100.00	101 21	100.65	120.66	140.00	161.26		
Efficien	100.24	144.34	150.10	133.2	120.90	113.56	100.02	121.31	122.05	139.00	149.09	101.30		
Enicier													80.3	
(217)m=	85.82	85.29	84.36	82.69	81.05	80.3	80.3	80.3	80.3	82.6	84.89	85.97		(217)
Fuel fo (219)m	or water <u>1 = (</u> 64)	heating, m_x_100	kWh/m <u>) ÷ (2</u> 17)	onth)m										
(219)m=	192.55	169.25	178.03	161.08	159.11	141.45	135.52	151.07	152.74	169.08	175.63	187.7		
								Tota	I = Sum(2	19a) ₁₁₂ =			1973.21	(219)
Annua	I totals									k	Wh/year	•	kWh/year	-
Space	heating	fuel use	ed, main	system	1								1040.73	

Water heating fuel used				1973.21	
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 (23	0a)(230g) =		75	(231)
Electricity for lighting				260.28	(232)
Total delivered energy for all uses (211)(221) + ((231) + (232)(237b) =			3349.23	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	F			_	
	Energy kWh/year	kg CO2/kWh	or	kg CO2/yea	ar
Space heating (main system 1)	kWh/year (211) x	kg CO2/kWh	e =	kg CO2/yea	ar](261)
Space heating (main system 1) Space heating (secondary)	kWh/year (211) x (215) x	Emission fact kg CO2/kWh 0.216 0.519	or = =	Emissions kg CO2/yea 224.8	ar](261)](263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = = =	Emissions kg CO2/yea 224.8 0 426.21	ar](261)](263)](264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = =	Emissions kg CO2/yea 224.8 0 426.21 651.01	ar](261)](263)](264)](265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = = =	Emissions kg CO2/yea 224.8 0 426.21 651.01 38.93	IC (261) (263) (264) (265) (267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	Emission fact kg CO2/kWh 0.216 0.519 0.216 0.519 0.519 0.519	or = = =	Emissions kg CO2/yea 224.8 0 426.21 651.01 38.93 135.09	ar](261)](263)](264)](265)](267)](268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x su	Emission fact kg CO2/kWh 0.216 0.519 0.216 0.519 0.519 0.519 0.519 0.519	or = = =	Emissions kg CO2/yea 224.8 0 426.21 651.01 38.93 135.09 825.02	ar](261)](263)](264)](265)](267)](268)](272)

TER =

16.02 (273)

		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property /	Address:	Kingsto	n Bridge	e 1BF 52	2 TOP G	AS	
Address :									
1. Overall dwelling dime	nsions:	A	(100.2)		A. 11a	a h t (ma)			
Ground floor		Area	a(m²)	(1a) x		ignt(m)	(2a) =	139.05] (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+	(1n)	51.5	(4)			()	100.00	
	(10) (10) (10) (10)		71.5	(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	120.05	
Dweining volume				() ()	(/ (, (,		139.05	(3)
2. Ventilation rate:	main seco	ndary	other		total			m ³ per hour	
		-							
Number of chimneys	0 +	0 +	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	าร				1	x 1	10 =	10	(7a)
Number of passive vents					0	x 1	10 =	0	(7b)
Number of flueless gas fir	es				0	x 4	40 =	0	(7c)
							Air ch	anges per hou	ır
le filtre tiere due te delivere		0h);(7=);(7h);(7-) -	_				anges per not	
Inflitration due to chimney	's, flues and fans = $(6a)+(6a)$	$(73)^{+}(73)^{+}(70)$	(C) = otherwise c	ontinuo fr	$\frac{1}{2}$ (0) to ((16)	÷ (5) =		
Number of storevs in th	e dwelling (ns)	1000000 10 (11 <i>)</i> , 0		onunue no	5111 (3) 10 (10)		0	(9)
Additional infiltration	J					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber fran	ne or 0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pro	esent, use the value correspond	ding to the great	er wall area	a (after					-
If suspended wooden fl	gs); if equal user 0.35 oor enter 0.2 (unsealed)	or 0.1 (seale	d) else (enter 0				0	T (12)
If no draught lobby, ent	er 0.05. else enter 0		<i>a)</i> , elee					0	(12)
Percentage of windows	and doors draught stripp	bed						0	(14)
Window infiltration	0 11		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic n	netres per ho	our per so	uare m	etre of e	nvelope	area	4	(17)
If based on air permeabili	ty value, then (18) = [(17) ÷	20]+(8), otherwi	se (18) = (16)				0.27	(18)
Air permeability value applies	s if a pressurisation test has bee	en done or a deg	ree air per	meability i	is being us	sed			-
Number of sides sheltered	d		(20) = 1 - [0 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	ing shelter factor		(21) = (18)	x(20) =	0)]			0.85	$\int_{(21)}^{(20)}$
Infiltration rate modified for	or monthly wind speed		() (10)	x (20)				0.23	(21)
	Mar Apr May	lun .lul	Αυσ	Sen	Oct	Nov	Dec		
Monthly average wind so	eed from Table 7		,	000	000		200		
(22)m= 5.1 5	4.9 4.4 4.3 3	3.8 3.8	3.7	4	4.3	4.5	4.7		
		1				1	1		
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4	05 0.05		4	4.00	4.40	4.40		
(22a)m= 1.27 1.25 1	1.23 1.1 1.08 0.	.95 0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-		-		-		
II IIIt			ucing App	ondix N (2	(2b) = (22c)		oquation (I		nvico (23h) - (23a)			0	(23a)
If bal	ancod with	boot roce			allowing f	or in uso f	actor (fron	n Table 4b) –) - (208)			0	(230)
) - .)]]h)ma (/)	00k) v [4 (22.5)	0	(23c)
a) IT								HR) (24a 1	a)m = (22)	20)m + (. 0	23D) × [1 - (23C)) ÷ 100j]	(24a)
(24a)11-		U			0	0						0	J	(240)
D) IT	balance		anical ve			neat rec	covery (r	VIV) (240 T	o)m = (22	20)m + (2	23D)		1	(24b)
(240)m=		0			0					0	0	0	J	(240)
C) IT	if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), 1	then (24	c) = (23b); other	ventilatio wise (24	c) = (22b	p(tside) $m + 0.$	5 × (23b)	-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22l	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	k (25)	-			_	
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54]	(25)
3 He	at losse	s and he	eat loss i	paramet	er.									
		Gros	SS	Openin	as	Net Ar	ea	U-valı	Je	AXU		k-value	e /	A X k
		area	(m²)	'n	9- 1 ²	A ,r	n²	W/m2	K	(W/I	K)	kJ/m²·l	K I	kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				6.6		24.15	5 X	0.18	=	4.35				(29)
Roof				0		51.5	x	0.13	= =	6.69	7 1		$\neg \square$	(30)
Total a	area of e	lements	, m²			82.25	5							(31)
Party v	wall					53.34	4 X	0	= [0				(32)
Party f	loor					51.5	=		I				\dashv	(32a)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given ir	n paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				18.6	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	5867.59	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	⊦ TFA) ir	n kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix I	K						8.79	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			27.39	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y			<u> </u>	(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	24.94	24.86	24.78	24.43	24.36	24.05	24.05	23.99	24.17	24.36	24.49	24.64	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K		-				(39)m	= (37) + (3	38)m			
(39)m=	52.33	52.25	52.17	51.82	51.75	51.44	51.44	51.38	51.56	51.75	51.88	52.03		
										Average =	Sum(39)	112 /12=	51.82	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.02	1.01	1.01	1.01	1	1	1	1	1	1	1.01	1.01		
Numbe	er of dav	/s in mo	nth (Tab	le 1a)				-		Average =	Sum(40)1	.12 /12=	1.01	(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)
								•					1	
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13	.9)	73]	(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	75. f	.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					1	
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
Francis	oontont of	botwator	used as	laulatad m	onthly 1	100 v Vd v		DTm / 2600		Total = Su	m(44) ₁₁₂ =	a 1d)	904.68	(44)
Energy (not water			$\frac{1}{2}$							c, 1a)	1	
(45)m=	122.98	107.56	110.99	96.77	92.85	80.12	74.24	85.2	86.21	100.47	109.68	119.1	1106 10	(45)
lf instant	taneous w	ater heati	ng at point	t of use (no	o hot water	^r storage),	enter 0 in	boxes (46) to (61)	10tal = Su	III(43) ₁₁₂ =		1100.10	(43)
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:	1	I	I	1	I	1	1		I		1	
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel	()		(47)
If comr	nunity h	eating a	ind no ta	ank in dw	velling, e	nter 110) litres in	1 (47) Smbi boil	oro) ont	or '0' in ((47)			
Water	storage	loss:	not wate		iciuues i	iistailtai	ieous co		ers) erne		(47)			
a) If m	anufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):				()		(48)
Tempe	erature f	actor fro	m Table	2b							()		(49)
Energy	/ lost fro	m water	storage	e, kWh/y	ear			(48) x (49)) =		()		(50)
b) If m	anufact	urer's de	eclared (cylinder	loss fact	or is not	known:						1	(54)
If com	nunity h	age loss leating s	ee secti	on 4.3	ie z (kvv	n/iitie/ua	ay)				()		(51)
Volum	e factor	from Ta	ble 2a								()		(52)
Tempe	erature f	actor fro	m Table	2b							()		(53)
Energy	/ lost fro	m water	storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =	()		(54)
Enter	(50) or ((54) in (5	55)								()		(55)
Water	storage	loss cal	culated	for each	month	-		((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where ((H11) is from	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3						()		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		1 1			
(moo	aified by	r tactor f	rom Tab		inere is s	solar wat	ter heati	ng and a	cylinde	r thermo	ostat)	0	1	(50)
(59)m=	U	U	0	U	0	U	U		0	U	U	U		(39)

Combi	loss ca	lculated	for eac	h n	nonth (61)m =	(60)) ÷ 36	65 × (41))m								
(61)m=	16.05	14.47	15.98		15.42	15.9	1	5.35	15.83	15.8	8	15.39	15.95	15.49	16	6.04		(61)
Total h	eat req	uired for	water l	hea	ting ca	lculated	d fo	r eacl	n month	(62)r	n =	0.85 × (45)m	+ (46)m	+ (57	')m +	(59)m + (61)m	
(62)m=	139.03	122.03	126.97	' 1	112.19	108.75	g	5.47	90.08	101.	07	101.6	116.42	2 125.1	3 13	85.14		(62)
Solar DH	W input	calculated	using Ap	pen	idix G or	Appendix	(H)	negati	ve quantity	/) (ente	er '0'	if no solar	r contrib	ution to wa	ater he	eating)		
(add ad	dditiona	al lines if	FGHR	S ai	nd/or V	VWHRS	S ap	plies	, see Ap	pend	ix G	6)						
(63)m=	0	0	0		0	0		0	0	0		0	0	0		0		(63)
Output	from w	ater hea	ter							-				-	_			
(64)m=	139.03	122.03	126.97	' 1	112.19	108.75	9	5.47	90.08	101.	07	101.6	116.42	2 125.1	3 13	85.14		
I							•			. (Dutp	ut from wa	ater hea	ter (annua	l) ₁₁₂		1373.92	(64)
Heat g	ains fro	m water	heating	g, k'	Wh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (6	1)m] + 0.8 x	: [(46)r	n + (57)	m + (59)m]	
(65)m=	44.9	39.38	40.9		36.03	34.85	3	0.48	28.65	32.	3	32.51	37.39	40.34	43	3.61		(65)
inclu	de (57)	m in calo	ulation	n of	(65)m	only if c	ylir	nder i	s in the c	dwelli	ng	or hot wa	ater is	from co	mmu	nity h	eating	
5. Int	ernal a	ains (see	e Table	5 a	and 5a)):	,				Ū					,		
Motabo	olic gair	ne (Table	5) Wa	atte														
Melabl	Jan	Feb	<u>, 0), 772</u> Mar		Apr	Mav	Γ	Jun	Jul	Au	ıa	Sep	Oct	Nov	/ [Dec		
(66)m=	86.72	86.72	86.72		86.72	86.72	8	6.72	86.72	86.7	'2	86.72	86.72	86.72	86	6.72		(66)
Liahtin	n nains	(calcula	ted in 4	- Ann	endix I	equat	ion	190	(10a) a		لــــــــــــــــــــــــــــــــــــ	Table 5				-		
(67)m=	14 74	13.09	10.65		8.06	-, Cquat		5.09	55	7 1	1	9 59	12 17	14 21	11	5 1 5		(67)
Appliqu				in A	\			ionl	12 or 1	20) 6						0.10		
	10es ga				Append	120 71	uai I 1	1011 L	13 01 L I	3a), a		115 45	122 0	124.4	2 14	4 46		(68)
(00)11=		152.7	140.74		140.33	129.71	<u> </u>	19.73	113.00		49	115.45	-	134.4	5 14	4.40		(00)
Cookin	ig gains			Арр		L, equa	tior	1 L15	or L15a)), also	se 		5			4 07	I	(00)
(69)m=	31.67	31.67	31.67		31.67	31.67	3	1.67	31.67	31.6	67	31.67	31.67	31.67	3	1.67		(69)
Pumps	and fa	ns gains T	(Table	5a)		.							-i			I	
(70)m=	3	3	3		3	3		3	3	3		3	3	3		3		(70)
Losses	s e.g. e\	/aporatic	on (neg	ativ	e value	es) (Tab	ble	5)										
(71)m=	-69.37	-69.37	-69.37	-	-69.37	-69.37	-6	69.37	-69.37	-69.3	37	-69.37	-69.37	-69.3	7 -6	9.37		(71)
Water	heating	gains (T	able 5)														
(72)m=	60.36	58.6	54.97		50.04	46.84	4	2.33	38.5	43.4	1	45.16	50.26	56.03	58	8.62		(72)
Total i	nternal	gains =	•					(66)	m + (67)m	n + (68)m +	(69)m + (70)m +	(71)m + (7	′ 2)m			
(73)m=	278.24	276.41	266.38	3 2	250.45	234.59	2	19.16	209.07	214.	06	222.21	238.3	1 256.73	3 27	0.24		(73)
6. Sol	ar gain	s:																
Solar g	ains are	calculated	using so	lar fl	ux from	Table 6a	and	associ	ated equa	tions t	o co	nvert to th	e applic	able orien	tation.			
Orienta	ation: /	Access F	actor		Area			Flu	X		Ŧ	g_		FF Table C	_		Gains	
	_	i able 60		_	m-			Tai	ble 6a	_		able 6D		Table 60	5	_	(VV)	_
Southea	ast <mark>0.9x</mark> [0.77		×	2.8	8	x	3	6.79	×		0.35	×	0.7		=	17.99	(77)
Southea	ast <mark>0.9x</mark>	0.77		× [1.8	6	x	3	6.79	x		0.35	×	0.7		=	23.24	(77)
Southea	ast <mark>0.9x</mark> [0.77		×	2.8	8	x	6	2.67	×		0.35	×	0.7] =	30.65	(77)
Southea	ast <mark>0.9x</mark>	0.77	:	×	1.8	6	x	6	2.67	x		0.35	x	0.7] =	39.58	(77)
Southea	ast <mark>0.9x</mark>	0.77		×	2.8	8	x	8	5.75	×		0.35	×	0.7] =	41.93	(77)

Southea	ast <mark>0.9x</mark>	0.77		x	1.86	ô	x	8	85.75	x		0.35	x	0.7	=	54.16	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	1	06.25	x		0.35	×	0.7	=	51.96	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.86	6	x	1	06.25	x		0.35	x	0.7	=	67.11	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	1	19.01	x		0.35	×	0.7	=	58.19	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.86	ô	x	1	19.01	x		0.35	×	0.7	=	75.17	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	1	18.15	x		0.35	x	0.7	=	57.77	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.86	ô	x	1	18.15	x		0.35	×	0.7	=	74.62	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	1	13.91	x		0.35	×	0.7	=	55.7	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.86	ô	x	1	13.91	x		0.35	×	0.7	=	71.95	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	1	04.39	×		0.35	×	0.7	=	51.04	. (77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.86	6	x	1	04.39	x		0.35	×	0.7	=	65.93	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	g	92.85	×		0.35	×	0.7	=	45.4	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.80	6	x	g	92.85	x		0.35	×	0.7	=	58.65	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	6	9.27	×		0.35	×	0.7	=	33.87	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.80	6	x	6	9.27	x		0.35	×	0.7	=	43.75	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	В	x	4	4.07	×		0.35	×	0.7	=	21.55	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.86	6	x	4	4.07	x		0.35	×	0.7	=	27.83	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.88	8	x	3	31.49	x		0.35	×	0.7	=	15.4	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.80	ô	x	3	31.49	×		0.35	x	0.7	=	19.89	(77)
Colora	aina in	watta ar		. d	for ooob		h			(0.2)	- 0		(00)				
Solar g		$\frac{1}{70.23}$		ea T	119.06	133 36	n . I -	132 /	127.64	(83)m		m(74)m	.(82)m	10.38	35.28	7	(83)
		ntornal a	nd col		(94)m =	(73)m	$\frac{1}{1}$	92)m	watte	110	.30	104.00	11.02	49.00	00.20		(00)
	010 47			аі , Т		007.00			, waiis	0.04	04	200 OF T	045.00	200.44	005 50	7	(0.4)
(84)m=	319.47	346.64	362.47		369.51	367.95	2 3	51.56	336.72	331	.04	326.25	315.93	306.11	305.52		(84)
7. Mea	an inter	nal temp	eratur	е (heating	seaso	n)										

Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	tion fac	tor for ga	ains for l	iving are	ea, h1,m	(see Ta	ble 9a)							-
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.94	0.82	0.65	0.68	0.88	0.98	1	1		(86)
Mean	ean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	19.96	19.94		(87)										
Temp	erature	during h	leating p	eriods ir	n rest of	dwelling	from Ta	ible 9, Tl	ר2 (°C)				_	
(88)m=	20.07	20.07	20.07	20.08	20.08	20.08	20.08	20.09	20.08	20.08	20.08	20.07		(88)
Utilisa	tion fac	tor for ga	ains for I	rest of d	welling, l	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.97	0.91	0.74	0.53	0.56	0.82	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)				

						0 (,			_	
(90)m=	18.68	18.84	19.11	19.47	19.81	20.03	20.08	20.08	19.97	19.57	19.06	18.65		(90)
				-	-	-		-	f	LA = Livin	g area ÷ (4	4) =	0.49	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

													-
(92)m=	19.3	19.44	19.67	19.97	20.26	20.46	20.52	20.51	20.41	20.06	19.63	19.27	(92)

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

(93)m=	19.3	19.44	19.67	19.97	20.26	20.46	20.52	20.51	20.41	20.06	19.63	19.27		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set T the ut	i to the i ilisation	mean int factor fo	ernal ter or gains	mperatur using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm											
(94)m=	1	0.99	0.99	0.97	0.92	0.78	0.58	0.62	0.85	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	318.18	344.23	357.54	357.68	336.82	273.25	196.88	204.97	276.62	305.74	303.7	304.56		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	785.09	759.72	687.06	573.73	443.09	301.53	201.52	211.38	325.36	489.41	649.88	784.14		(97)
Space	e heatin	g require	ement fo	r each n	honth, k\	Nh/mont	h = 0.02	24 x [(97])m – (95)m] x (4′	1)m			
(98)m=	347.38	279.21	245.16	155.56	79.06	0	0	0	0	136.65	249.25	356.81		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1849.09	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								35.9	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												-
Fracti	on of sp	bace hea	at from s	econdary	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1							ĺ	93.5	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %					ĺ	0	(208)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space	e heatin	g require	ement (c	alculate	d above)								
	347.38	279.21	245.16	155.56	79.06	0	0	0	0	136.65	249.25	356.81		
(211)m	n = {[(98)m x (20	94)] } x 1	00 ÷ (20)6)									(211)
	371.53	298.62	262.21	166.37	84.56	0	0	0	0	146.15	266.58	381.61		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1977.63	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
(215)m=				0	0	0	0	0	0	0	0	0		
(,		-	-		-		-	Tota	l (kWh/yea	ar) =Sum(2	215), 510, 12	=	0	(215)
Wator	hosting	N								, , ,	v 10, 1012]
	from w	i ater hea	ter (calc	ulated al	hove)									
oupu	139.03	122.03	126.97	112.19	108.75	95.47	90.08	101.07	101.6	116.42	125.16	135.14		
Efficier	L Cy of w	ater hea	iter										87.3	(216)
(217)m=	89.56	89.5	89.38	89.13	88.62	87.3	87.3	87.3	87.3	89	89.4	89.6		」 (217)
Fuel fo	r water	heating	د kWh/m	onth										
(219)m	<u>1 = (64)</u>	<u>m x 100</u>) ÷ (217))m										
(219)m=	155.24	136.35	142.06	125.87	122.71	109.36	103.18	115.78	116.38	130.81	140	150.83		-
								Tota	I = Sum(2 ⁻	19a) ₁₁₂ =			1548.56	(219)
Annua	l totals									k	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								1977.63	

			1548.56]
		30]	(230c)
		45]	(230e)
sum of (23	0a)(230g) =		75	(231)
			260.28	(232)
(231) + (232)(237b) =			3861.48	(338)
s including micro-CHP				
Energy kWh/year	Emission fa kg CO2/kWh	ctor	Emissions kg CO2/yea	ır
(211) x	0.216	=	427.17	(261)
(215) x	0.519	=	0	(263)
(219) x	0.216	=	334.49	(264)
(261) + (262) + (263) + (264) =	-		761.66	(265)
(231) x	0.519	=	38.93	(267)
(232) x	0.519	=	135.09	(268)
SU	ım of (265)(271) =		935.67	(272)
(2	72) ÷ (4) =		18.17	(273)
			87	(274)
	sum of (23 (231) + (232)(237b) = s including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x st (232) x	$sum of (230a)(230g) =$ $(231) + (232)(237b) =$ Sincluding micro-CHD $kWh/year$ $(211) \times 0.216$ $(215) \times 0.519$ $(219) \times 0.216$ $(261) + (262) + (263) + (264) =$ $(231) \times 0.519$ $(232) \times 0.519$ $sum of (265)(271) =$ $(272) + (4) =$	$30 45$ $sum of (230a)(230g) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(231) \times 0.216 =$ $(21) \times 0.216 =$ $(21) \times 0.216 =$ $(21) \times 0.216 =$ $(21) + (262) + (263) + (264) =$ $(261) + (262) + (263) + (264) =$ $(261) + (262) + (263) + (264) =$ $(231) \times 0.519 =$ $(232) \times 0.519 =$ $sum of (265)(271) =$ $(272) + (4) =$	$\begin{bmatrix} 30 \\ 45 \end{bmatrix}$ $(231) + (232)(237b) = \\ \hline 75 \\ 260.28 \\ \hline 3861.48 \end{bmatrix}$ $(231) + (232)(237b) = \\ \hline 3861.48 \end{bmatrix}$ $s \text{ including micro-CHP}$ $\begin{bmatrix} \text{Emission factor} \\ kWh/year \\ (211) \times \\ 0.216 \\ 1 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 1 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 0 \\ (219) \times \\ 0.216 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 334.49 \\ (261) + (262) + (263) + (264) = \\ (231) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 2 \end{bmatrix} = \\ \hline 1 \\ 38.93 \\ (232) \times \\ 0.519 \\ 38.93 \\ (232) \times \\ 0.519 \\ 38.93 \\ (232) \times \\ 0.519 \\ 38.93 \\ (232) \times \\ 0.519 \\ 38.93 \\ (232) \times \\ 0.519 \\ 38.93 \\ (232) \times \\ 0.519 \\ 38.93 \\ (232) \times \\ 0.519 \\ 58.93 \\ (232) \times \\ 0.519 \\ ($

		U	lser Details	:					
Assessor Name: Software Name:	Stroma FSAP 201	2	Stro Soft	ma Num ware Ve	ber: rsion:		Versio	on: 1.0.5.59	
		Ριομ	Derty Addre	ss: Kingsi	on Briage		2 TOP G	AS	
1 Overall dwelling dime	nsions:								
			Area(m ²)		Av. He	iaht(m)		Volume(m ³)	
Ground floor]	51.5	(1a) x		2.7	(2a) =	139.05	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	ו)+(1n) [51.5	(4)], ,		
Dwelling volume		/ `		(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	139.05] (5)
2 Ventilation rate:									_
2. ventilation rate:	main se	econdary	othe		total			m ³ per hour	
Number of chimneys	heating h	eating	+			× 4	40 =	-	
Number of chimneys		0	0		0		+0 -	0	_(6a)
Number of open flues	0 +	0	+ 0	=	0	x 2	20 =	0	(6b)
Number of intermittent fai	ns				2	X ′	10 =	20	(7a)
Number of passive vents				Г	0	x '	10 =	0	(7b)
Number of flueless gas fi	res			Γ	0	× 4	40 =	0	(7c)
				-			Air ch	anges per ho	
			/ \	-					יוג ר
Infiltration due to chimney	/s, flues and fans = (6)	a)+(6b)+(7a)+	-(7b)+(7c) =		(0) (-	(10)	÷ (5) =		
Number of storeys in the	een carried out or is intende ne dwelling (ns)	a, proceea to	o (17), otnerw	se continue n	om (9) to ((16)		0	
Additional infiltration						[(9)	-11x0.1 =	0	(3)
Structural infiltration: 0.	25 for steel or timber	frame or 0.3	35 for mas	onrv consti	ruction			0	$= \frac{1}{1} \frac{1}{1} \frac{1}{1}$
if both types of wall are pr deducting areas of openir	resent, use the value corres ngs); if equal user 0.35	ponding to the	e greater wali	area (after					<u> </u>
If suspended wooden f	loor, enter 0.2 (unseal	ed) or 0.1 ((sealed), e	se enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else enter 0							0	(13)
Percentage of windows	s and doors draught st	ripped						0	(14)
Window infiltration			0.25 -	0.2 x (14) ÷ 1	[00] =			0	(15)
Infiltration rate			(8) + (10) + (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cub	ic metres p	per hour pe	r square m	etre of e	envelope	area	5	(17)
If based on air permeabili	ity value, then $(18) = [(1)$	7) ÷ 20]+(8), 0	otherwise (18	= (16)	:	I		0.39	(18)
Air permeability value applies	d	s been done o	or a degree al	permeability	is being u	sea		2	
Shelter factor	u		(20) =	1 - [0.075 x ([*]	19)] =			0.85	(19)
Infiltration rate incorporat	ing shelter factor		(21) =	(18) x (20) =				0.33](21)
Infiltration rate modified for	or monthly wind speed	1						0.00	
Jan Feb	Mar Apr May	Jun	Jul Au	g 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 Eactor $(22a)m = (22a)m $	2)m ÷ 4		•		-	-			
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 (0.95 0.9	2 1	1.08	1.12	1.18		
· · · · · · · · · · · · · · · · · · ·					L	I		l	

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se			-	-			
II IIIt			ucing App	ondix N (2	(25) = (22)	$) \times Emy (c$	oquation (NE)) othou	nvico (23h) - (23a)			0	(23a)
li exil				$\frac{1}{2}$.30) – (23a	i) ^ Filiv (e	equation (I	(3), (1)	1WISE (23D) – (23a)			0	(23b)
			· ·) -	N N N N N N N N N N		4 (00)	0	(23c)
a) If	balance		anical ve			at recove		HR) (24a T	a)m = (22)	2b)m + ()	23b) × [1 – (23c)	i ÷ 100] 1	(240)
(24a)m=				0	0	0	0	0	0	0	0	0]	(248)
b) If	balance	ed mecha	anical ve	entilation	without	heat rec	covery (N	VV) (24b	o)m = (22	2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) lf	whole h if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), t	ntilation o then (24)	or positiv c) = (23b	ve input v o); otherv	ventilatio wise (24	on from c c) = (22b	outside o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	iole hous m = (221	se positiv b)m othe	ve input v erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58]	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)	-			•	
(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58		(25)
2 40	at losso	e and he		naramot	or:		•	•	•			•		
		Groe	29	Openin		Net Ar	·ea	l I-valı	IA	ΔΧΠ		k-value	- <i>1</i>	ΔXk
		area	(m²)	r	193 1 ²	A,r	n²	W/m2	K.	(W/I	(ک	kJ/m²·l	K k	ςJ/Κ
Windo	ws Type	e 1				2.88	x1	/[1/(1.4)+	0.04] =	3.82				(27)
Windo	ws Type	2				1.86		/[1/(1.4)+	0.04] =	2.47	=			(27)
Walls				6.6		24.15	5 X	0.18		4.35				(29)
Roof						51.5		0.13		6 69			\dashv	
Total a	area of e	lements	. m²			82.25		0.10	[0.00	I			(31)
Party v	wall					53 34		0	= [0				(32)
Party f	loor					51.5			เ		I		\dashv	(32a)
* for win	dows and	roof wind	ows, use e	effective wi	indow U-va	alue calcul	 lated using	n formula 1	/[(1/U-valu	ie)+0.041 a	l s aiven in	paragraph	 132	(020)
** inclua	le the area	as on both	sides of i	nternal wal	ls and par	titions		,	/(<i>m</i> e Fala	<i></i>	ie giteit in	paragrapi		
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				19.79	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	5867.59	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K	,		Indica	tive Value	Medium		250	(35)
For desi can be t	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix ł	K						5.56	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			25.35	(37)
Ventila	tion hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)	•	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.12	26.96	26.8	26.05	25.91	25.26	25.26	25.14	25.51	25.91	26.2	26.49		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	52.47	52.31	52.15	51.4	51.26	50.61	50.61	50.49	50.86	51.26	51.55	51.84		
		•					•		/	Average =	Sum(39)	₁₂ /12=	51.4	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.02	1.02	1.01	1	1	0.98	0.98	0.98	0.99	1	1	1.01		
Numbe	er of day	s in mo	nth (Tab	le 1a)				1		Average =	Sum(40) ₁ .	12 /12=	1	(40)
- turnov	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13. A £ 13.	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	<u>1.</u> 9)	73		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av lwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
-						100			-	Total = Su	m(44) ₁₁₂ =	- 1 - 1)	904.68	(44)
Energy of	content of	hot water	used - cal	culated m	onthly = 4. I	190 x Vd,r I	m x nm x L I	JTm / 3600) kWh/mor I	nth (see Ta T	ables 1b, 1 I	c, 1d)		
(45)m=	122.98	107.56	110.99	96.77	92.85	80.12	74.24	85.2	86.21	100.47	109.68	119.1		
lf instan	taneous v	vater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1186.18	(45)
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:		_				_				-		
Storag	e volum	e (litres)) includir	ng any s	olar or W	WHRS	storage	within sa	ame ves	sel		0		(47)
If comin Otherw Water	munity h vise if no storage	eating a o stored loss:	and no ta hot wate	ink in dw er (this ir	velling, e ncludes i	enter 110 nstantar) litres in neous co	n (47) ombi boil	ers) ente	er '0' in (47)			(48)
Tempe	erature f	actor fro	m Table	2h			naay).					0 n		(40)
Energy	/ lost fro	m water	storage	kWh/v	ear			(48) x (49)) =			0 n		(50)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:	(10) // (10)				0		(00)
Hot wa If com	ater stor munity h	age loss leating s	factor fr	om Tab on 4.3	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	storage	, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (8	55)									0		(55)
Water	storage	loss cal	culated 1	for each	month	1	1	((56)m = (55) × (41)	m				
(56)m= If cylinde	0 er contain	0 s dedicate	0 d solar sto	0 rage, (57)	0 m = (56)m	0 x [(50) - (0 [H11)] ÷ (5	0 50), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fre	um Table	- - 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m =	(58) ÷ 36	65 × (41)	m		L			· · ·
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	alculated	for eacl	n month	(61)m =	(60) ÷ 3	365 × (41)m						
(61)m=	42.26	36.78	39.19	36.44	36.11	33.46	34.58	36.11	36.44	39.19	39.41	42.26		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for ea	ch month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		(62)
Solar Dł	-IW input	calculated	using Ap	pendix G o	r Appendix	H (nega	tive quantity	/) (enter '0)' if no sola	r contribut	tion to wate	er heating)		
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	applie	s, see Ap	pendix (G)			-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		
								Out	put from w	ater heate	r (annual)₁	12	1638.4	(64)
Heat g	ains fro	om water	heating	, kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	51.46	44.96	46.7	41.28	39.9	35.01	33.33	37.36	37.78	43.2	46.32	50.17		(65)
inclu	ide (57))m in calo	culation	of (65)m	only if c	ylinder	is in the	dwelling	or hot w	, ater is f	rom com	munity h	leating	
5. Int	ternal g	ains (see	Table	5 and 5a):									
Metab	olic gai	ns (Table	5) Wa	tts	,									
motab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)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		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L9 (or L9a), a	lso see	Table 5					
(67)m=	14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15		(67)
Applia	nces da	uns (calc	ulated i	n Append	dix L. ea	uation I	13 or L1	i 3a), also	i o see Ta	ble 5	1			
(68)m=	151.13	152.7	148.74	140.33	129.71	119.73	113.06	111.49	115.45	123.86	134.48	144.46		(68)
Cookir	L	L s (calcula	L ated in A	I	L equat	L tion I 15) also s	L ee Table	1 2.5				
(69)m=	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67		(69)
Pump	L	I Ins gains	I (Table	1 5a)		I		I						
(70)m=					3	3	3	3	3	3	3	3	l	(70)
		Vanoratio	n (neas	l ative valu	es) (Tab						-			. ,
(71)m=	-69.37	-69 37	-69 37	-69 37	-69 37	-69.37	-69 37	-69.37	-69.37	-69.37	-69.37	-69 37	l	(71)
Wator	boating		[00.01	00.01	00.01	00.01	00.07	00.07		00.01	00.01		()
(72)m=			able 5)	57 34	53.63	48.62	44.8	50.21	52.47	58.07	64 33	67.43		(72)
Total			02.11	07.04	00.00	(6)	6)m + (67)m	1 + (68)m	+ (60)m +	(70)m + (7)	(1)m + (72)	m		()
(73)m=	287.04	$\frac{1}{28471}$	274 18	257.74	241 38	225.45	215 37	220.86	220 51	246 12	265.04	270.05		(73)
6 50	lar gain	204.71	274.10	237.74	241.30	223.43	215.57	220.00	229.01	240.12	205.04	219.00		(10)
Solar c	ains are	calculated	usina sola	ar flux from	Table 6a	and asso	ciated equa	itions to co	onvert to th	ne applical	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area	1	FI	ux		a	F	FF		Gains	
		Table 6d		m²		Та	able 6a	٦	able 6b	Т	able 6c		(W)	
Southe	ast <mark>0.9x</mark>	0.77	×	2.8	38	×	36.79) x [0.63	ר × ר	0.7	=	32.38	(77)
Southe	ast <mark>0.9x</mark>	0.77	×	1.8	36	×	36.79	 [0.63	╡╷╞	0.7	=	41.83](77)
Southe	ast <mark>0.9x</mark>	0 77	×	28	38	×	62.67	i × 🗀	0.63	╡╷┝	0 7		55.16](77)
Southe	ast <mark>0.9x</mark>	0.77	×		36	x	62.67		0.63	╡╷┝	0.7		71 25] (77)
Southe	ast <mark>0.9x</mark>	0.77	×	28	38	× [85.75	× [0.63	╡╷┝	0.7		75.48](77)
	0.07	0.77	^	2.0	50	^	05.75		0.05	^ L	0.7		75.40	(''')

Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	8	35.75	x	0.63	x	0.7		=	97.49	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25	x	0.63	×	0.7		-	93.52	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25	x	0.63	x	0.7		-	120.8	(77)
Southea	st 0.9x	0.77		x	2.8	8	x	1	19.01	x	0.63	×	0.7		=	104.75	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01	x	0.63	×	0.7		-	135.3	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15	x	0.63	×	0.7		-	103.99	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15	x	0.63	×	0.7		=	134.32	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91	x	0.63	x	0.7		=	100.26	(77)
Southea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91	x	0.63	x	0.7		=	129.5	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39	x	0.63	×	0.7		=	91.88	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39	x	0.63	×	0.7		-	118.68	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	9	2.85	x	0.63	x	0.7		=	81.73	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	9	2.85	x	0.63	×	0.7		-	105.56	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27	x	0.63	x	0.7		-	60.97	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27	x	0.63	x	0.7		=	78.75	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07	x	0.63	x	0.7		=	38.79	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07	x	0.63	x	0.7		-	50.1	(77)
Southea	st <mark>0.9x</mark>	0.77		x	2.8	8	x	3	31.49	x	0.63	x	0.7		-	27.71	(77)
Southea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49	x	0.63	x	0.7		=	35.8	(77)
Colora	aina in	wette er		tod	for cool		_			(0.2)	- 0	(00)					
Solar g	ains in	$\frac{\text{watts, ca}}{126.42}$			10r eacr	1 monti 240.05	$\frac{1}{2}$	28 31	220.76	(83)m	56 187.20	(82)m	2 88.80	63.5	1		(83)
			nd co		$\frac{214.01}{(94)m}$ -	240.00		92)m	229.70	210	.50 107.29	155.7	2 00.09	00.0	1		(00)
					(04)11 =	• (73)	т (Т.	03)11	, walls							l	(0.4)
(84)m=	361.26	411.12	447.1	14	472.06	481.43	4	63.76	445.13	431	.42 416.8	385.8	3 353.93	342.5	06		(84)
7. Mea	an intei	rnal temp	peratu	ire (heating	seaso	า)										
Temp	erature	during h	neating	g pe	eriods ir	the liv	ing	area	from Tab	ole 9,	Th1 (°C)					21	(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

		U				`	,							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.5	0.53	0.77	0.95	0.99	1		(86)
Mean	interna	l tempera	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	20.03	20.19	20.4	20.67	20.87	20.97	21	20.99	20.94	20.69	20.31	20.01		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, Tl	n2 (°C)					
(88)m=	20.07	20.07	20.07	20.08	20.09	20.1	20.1	20.1	20.09	20.09	20.08	20.08		(88)
Utilisa	ation fac	tor for ga	ains for I	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	0.99	0.99	0.97	0.92	0.8	0.59	0.4	0.43	0.69	0.93	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.79	19.01	19.32	19.7	19.96	20.08	20.1	20.1	20.05	19.74	19.2	18.76		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.49	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m=19.3919.5819.8520.1720.420.5120.5320.4820.219.7419.36(92)

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

(93)m=	19.39	19.58	19.85	20.17	20.4	20.51	20.53	20.53	20.48	20.2	19.74	19.36		(93)
8. Spa	ace hea	iting requ	uirement	t										
Set Ti the ut	i to the ilisation	mean inf	ternal ter or gains	mperatui using Ta	re obtain Ible 9a	ned at ste	ep 11 of	Table 9I	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.97	0.92	0.82	0.63	0.44	0.48	0.73	0.93	0.99	0.99		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m	-	-	_						
(95)m=	358.71	405.09	432.78	434.95	392.58	290.14	197.94	206.96	303.33	359.53	348.62	340.71		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8		-			-			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	791.93	767.94	696.04	579.17	446.08	299.33	199.06	208.66	324.68	492	651.69	786.12		(97)
Space	e heatin	g requir	ement fo	or each n	honth, k\	Wh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	322.31	243.83	195.86	103.84	39.81	0	0	0	0	98.55	218.21	331.38		-
								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	1553.81	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								30.17	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac Fracti	e heatii on of sr	ng: bace hea	at from s	econdar	v/supple	mentary	svstem						0	1 (201)
Fracti	on of er		at from n	nain evet	om(s)			(202) = 1	- (201) =				1	
Fracti				iairi Syst				(204) = (2)	02) × [1	(202)] -				
Fracti	on of to		ng trom	main sys				(204) = (2	02) * [1 –	(203)] =			1	(204)
ETTICIE	ency of	main spa	ace neat	ing syste	em 1								93.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g requir	ement (c	alculate	d above)	1	1			1			
	322.31	243.83	195.86	103.84	39.81	0	0	0	0	98.55	218.21	331.38		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20	06)	-	-	_	_		_	-		(211)
	345.09	261.06	209.71	111.18	42.62	0	0	0	0	105.52	233.63	354.8		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	<u>_</u>	1663.61	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									_
= {[(98)m x (20	01)]}x 1	00 ÷ (20	8)		1	1	1			1	1		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	9												
Output	from w	ater hea	ter (calc	ulated a	bove)				(00.0-					
	165.24	144.34	150.18	133.2	128.96	113.58	108.82	121.31	122.65	139.66	149.09	161.36		
Efficier	icy of w	ater hea	ater						r				80.3	(216)
(217)m=	86.7	86.36	85.72	84.43	82.47	80.3	80.3	80.3	80.3	84.19	86.01	86.82		(217)
Fuel fo	r water $1 = (64)$	heating,	, kWh/m) ÷ (217`	onth)m										
(219)m=	190.58	167.14	175.2	157.76	156.37	141.45	135.52	151.07	152.74	165.88	173.34	185.85		
								Tota	I = Sum(2	19a) ₁₁₂ =			1952.89	(219)
Annua	I totals									k	Wh/year		kWh/year	4
Space	heating	fuel use	ed, main	system	1						-		1663.61]
Water heating fuel used				1952.89										
---	--	---	-------------------------	---	---									
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 (23	0a)(230g) =		75	(231)									
Electricity for lighting				260.28	(232)									
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			3951.78	(338)									
12a. CO2 emissions – Individual heating systems	s including micro-CHP													
	Energy kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	ar									
Space heating (main system 1)	Energy kWh/year (211) x	Emission fac kg CO2/kWh	tor =	Emissions kg CO2/yea 359.34	ar](261)									
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Emission fac kg CO2/kWh 0.216 0.519	tor = =	Emissions kg CO2/yea 359.34	ar](261)](263)									
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission fac kg CO2/kWh 0.216 0.519 0.216	tor = = =	Emissions kg CO2/yea 359.34 0 421.82	ar](261)](263)](264)									
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	Emission fac kg CO2/kWh 0.216 0.519 0.216	tor = = =	Emissions kg CO2/yea 359.34 0 421.82 781.16	$ \begin{array}{c} ar \\ (261) \\ (263) \\ (264) \\ (265) \end{array} $									
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x	Emission fac kg CO2/kWh 0.216 0.519 0.216	tor = = =	Emissions kg CO2/yea 359.34 0 421.82 781.16 38.93	$ \begin{array}{c} ar \\](261) \\](263) \\](264) \\](265) \\](267) \end{array} $									
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	Emission fac kg CO2/kWh 0.216 0.519 0.216	tor = = = =	Emissions kg CO2/yea 359.34 0 421.82 781.16 38.93 135.09	$ \begin{array}{c} ar \\ (261) \\ (263) \\ (264) \\ (265) \\ (267) \\ (268) \\ \end{array} $									
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x su	Emission fac kg CO2/kWh 0.216 0.519 0.216 0.519 0.519 0.519 m of (265)(271) =	tor = = = =	Emissions kg CO2/yea 359.34 0 421.82 781.16 38.93 135.09 955.18	$ \begin{array}{c} ar \\ [261) \\ [263) \\ [264) \\ [265) \\ [267) \\ [268) \\ [272) \\] [272)] [272)] [272)] [272)] $									

TER =

18.55 (273)

		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property A	Address:	Kingsto	n Bridge	e 2BF 65	5 GND G	AS	
Address :									
1. Overall dwelling dimer	nsions:	A	(100.2)			arla 4 (ma)		\/elume(m3)	
Ground floor		Area	a(m²)	(1a) x			(2a) =	176.04	– (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+	(1n) 6	5.2	(4)		1	(20)	170.04	
Dwelling volume			JJ.Z	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	176.04	(5)
								110.04	
2. Ventilation rate:	main seco	ndary	other		total			m ³ per hour	
Number of chimmers	heating heat	ting		ı _ r			10 -		
Number of chimneys			0	ן - ר	0	^	+0 -	0	(6a)
Number of open flues	0 +	0 +	0		0	x 2	20 =	0	(6b)
Number of intermittent fan	IS				2	x 1	10 =	20	(7a)
Number of passive vents				Г	0	x 1	10 =	0	(7b)
Number of flueless gas fir	es			Γ	0	x 4	40 =	0	(7c)
							Δir ch	anges per hoj	
Infiltration due to chimpou	(a, f)	6h)+(7a)+(7h)+(70) -	–					а. П
Initiation due to chimney	S, HUES AND IAIS = $(0a)^+(0a$	$(10)^{+}(10)$	otherwise c	ontinue fro	om (9) to ((16)	÷ (5) =		
Number of storeys in the	e dwelling (ns)	, , , , , , , , , , , , , , , , , , ,			5111 (0) 10 (10)		0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber fran	ne or 0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pre	esent, use the value correspond	ding to the greate	er wall area	a (after					_
If suspended wooden flue	<i>gs); it equal user 0.35</i> oor enter 0.2 (unsealed)	or 0.1 (seale	d) else (onter ()				0	7(12)
If no draught lobby, enter	er 0.05, else enter 0		u), cioc (0	(12)
Percentage of windows	and doors draught stripp	bed						0	(14)
Window infiltration	5 11		0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) -	- (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o	ק50, expressed in cubic n	netres per ho	ur per so	juare m	etre of e	nvelope	area	4	(17)
If based on air permeabilit	ty value, then $(18) = [(17) \div$	20]+(8), otherwi	se (18) = (16)				0.31	(18)
Air permeability value applies	; if a pressurisation test has bee	en done or a deg	ıree air per	meability i	is being us	sed			_
Number of sides sheltered	t		(20) = 1 - [0 075 v (1	9)1 =			2	(19)
Infiltration rate incorporation	ng shaltar factor		(21) = (18)	x(20) =	0)]			0.85	
Infiltration rate modified for	r monthly wind apood		(21) - (10)	x (20) -				0.27	(21)
			Δυσ	Son	Oct	Nov	Dec		
	viai Api Iviay J	Juli Jul	Aug	Sep	UCI	INUV	Dec		
$(22)m = \begin{bmatrix} 5 \\ 5 \end{bmatrix} \begin{bmatrix} 5 \\ 5 \end{bmatrix} \begin{bmatrix} 5 \\ 5 \end{bmatrix}$		28 29	37	4	13	15	47		
	^{1.0} ^{1.7} ^{4.0} ³	5.0 5.0	5.7	7	т.Ј	7.5	7./		
Wind Factor $(22a)m = (22a)m $.)m ÷ 4								
(22a)m= 1.27 1.25 1	.23 1.1 1.08 0.	.95 0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-	-		-	-		
II IIIt			ucing App	ondix N (2	(25) - (23c	$(a) \times Emy (a)$	oquation (I		nuico (23h) = (22a)			0	(23a)
lf bol	aust all fi				.50) – (258	i i i i i i i i i i	actor (fron	$n = T_{abla} 4b$) –) = (238)			0	(230)
) - .)]h)ma (/	00k) v I	·1 (00 a)	0	(23c)
a) ir	balance							HR) (24a T	i)m = (22	20)m + (. 	23D) × [(23c)) ÷ 100]]	(242)
(24a)11-			0		0		0					0		(244)
D) IT	balance		anical ve				covery (r	VIV) (240 T	o)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0			0					0	0	0		(240)
C) IT	whole r if (22b)r	iouse ex n < 0.5 ×	tract ver (23b), f	tilation (24)	c) = (23b)); otherv	ventilatio wise (24	c) = (22b)	outside b) m + 0.	5 × (23b)	-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	iole hous m = (22	se positiv b)m othe	ve input [.] erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(25)
3 He	at losse	s and he	eat loss	naramet	er.									
		Gros	s	Openin	as	Net Ar	ea	U-valı	le	AXU		k-value	e e	AXk
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K İ	kJ/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.2)+	0.04] =	6.6				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Floor						65.2	x	0.13	=	8.47599	9			(28)
Walls				9.48	3	34.64	ı x	0.18	i	6.24			\exists	(29)
Total a	area of e	elements	, m²			109.3	2							(31)
Party v	wall					44.12	2 x	0	=	0				(32)
Party of	ceilina					65.2							\dashv	(32b)
* for win	dows and	l roof wind	ows, use e	effective wi	indow U-va	alue calcul	 ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given ir	n paragraph		()
** incluc	le the area	as on both	sides of in	nternal wal	ls and par	titions				, <u>-</u>	0	, , ,		
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				25.57	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	12604.26	(34)
Therm	al mass	parame	ter (TM	- = Cm +	⊦ TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi can be u	ign asses used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						7.98	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
I otal f	abric he	atioss							(33) +	(36) =			33.55	(37)
Ventila	ation hea	at loss ca	alculated	n monthl	y I			<u> </u>	(38)m	= 0.33 × (25)m x (5	i) 	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m=	32.4	32.27	32.14	31.54	31.43	30.91	30.91	30.81	31.11	31.43	31.66	31.9		(38)
Heat ti	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		1	
(39)m=	65.95	65.82	65.69	65.09	64.98	64.45	64.45	64.36	64.66	64.98	65.2	65.44		
										Average =	Sum(39)	112 /12=	65.09	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.01	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1		
Numbe	er of day	s in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁ .	12 /12=	1	(40)
- tainio	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		<u> </u>	ļ			<u> </u>	I			<u> </u>				
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	⁻ A -13.9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . .9)	12		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	84 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
_									-	Total = Su	m(44) ₁₁₂ =		1015.8	(44)
Energy	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	m x nm x L	DTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	I	
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
lf instan	taneous w	vater heati	ng at point	t of use (no	o hot water	^r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m=	20.71	18.12	18.69	16.3	15.64	13.49	12.5	14.35	14.52	16.92	18.47	20.06		(46)
Water	storage	loss:	Į	ļ	Į	Į	Į	Į		I	I			
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comi Otherv Water	munity h vise if no storage	eating a stored loss:	nd no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres in neous co	i (47) ombi boil	ers) ente	er '0' in (47)		l	(40)
Tomne	anulaci aratura f	actor fro	m Table	25 1200			i/uay).					0		(40)
Energy	/ lost fro	m water	storage	 k\//h/\/	ar			(48) x (49)) =			0		(43)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:	(-10) X (-10)	,			U		(30)
Hot wa	ater stora	age loss leating s	factor fi	om Tabl	le 2 (kW	h/litre/da	iy)					0		(51)
Volum	e factor	from Ta	ble 2a	011 1.0								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	- storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m	n than	atat)			
(moo								ng and a				0	l	(59)
(00)11-	Ū								0			0		

Combi	loss ca	lculated	for eac	ch i	month (61)m =	(60)) ÷ 36	65 × (41))m									
(61)m=	16.16	14.57	16.08		15.5	15.97	1	5.41	15.89	15.9	94	15.46	16.03	3	15.58	16.	15		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	l fo	r eacl	n month	(62)r	n =	0.85 × ((45)m	+ (4	6)m +	(57)	m +	(59)m + (61)m	
(62)m=	154.25	135.34	140.7		124.15	120.23	1(05.37	99.25	111.	.6	112.26	128.8	5	138.73	149	.88		(62)
Solar DH	IW input	calculated	using Ap	ope	ndix G or	Appendix	(Н ((negativ	ve quantity	/) (ente	er '0'	if no sola	r contrib	outio	n to wate	er hea	ting)		
(add ad	dditiona	l lines if	FGHR	Sa	and/or V	VWHRS	s ap	plies	, see Ap	pend	ix G	G)	-						
(63)m=	0	0	0		0	0		0	0	0		0	0		0	0)		(63)
Output	from w	ater hea	ter																
(64)m=	154.25	135.34	140.7		124.15	120.23	1(05.37	99.25	111.	.6	112.26	128.8	5	138.73	149	.88		_
-			-							(Dutp	out from wa	ater hea	ater (annual)₁	12		1520.61	(64)
Heat g	ains fro	m water	heatin	g, I	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (6	1)m	i] + 0.8 x	((46)r	m +	(57)m	+ (5	9)m]	
(65)m=	49.95	43.8	45.46		40	38.66	3	3.76	31.69	35.7	'9	36.05	41.52	2	44.84	48	.5		(65)
inclu	de (57)	m in calo	culatior	1 0	f (65)m	only if c	: ylir	nder is	s in the c	dwelli	ng	or hot w	ater is	fro	m com	mun	ity h	leating	
5. Int	ernal ga	ains (see	e Table	5	and 5a)):													
Metabo	olic gair	ns (Table	25) W	atte	s														
	Jan	Feb	Mar	· T	Apr	May		Jun	Jul	Au	ıg	Sep	Oct	t	Nov	D	ес		
(66)m=	106.21	106.21	106.21		106.21	106.21	1(06.21	106.21	106.	21	106.21	106.2	1	106.21	106	.21		(66)
Lightin	g gains	(calcula	ted in A	- Apr	oendix l	L, equat	ion	L9 oi	r L9a), a	lso se	e 1	Table 5							
(67)m=	17.63	15.66	12.73	Ť	9.64	7.21	6	6.08	6.57	8.5	5	11.47	14.56	3	17	18.	12		(67)
Appliar	nces da	ins (calc	ulated	in	Append	lix L. ea	ı uat	tion L	13 or L1	3a), a	lso	see Ta	ble 5						
(68)m=	185.85	187.77	182.91	T	172.57	159.51	14	47.23	139.03	137.	11	141.97	152.3	1	165.37	177	.65		(68)
Cookin	a aains	i (calcula	L	_L An	nendix	l equat	L tior	ນ I 15	or I 15a)	l also		e Table	5			<u> </u>			
(69)m=	33.62	33.62	33.62	Ţ	33.62	33.62	3	3.62	33.62	33.6	2	33.62	33.62	2	33.62	33.	62		(69)
` I Pumns	and fa	l ns dains	I (Table	5:	a)														
(70)m=	3	3		T	3	3		3	3	3		3	3		3	3	3		(70)
		l		 ativ		es) (Tab		5)							-				. ,
(71)m=	-84 97	-84 97	-84.97	, T	-84 97	-84.97	· ی ا	34.97	-84 97	-84 9	97	-84 97	-84.97	7	-84 97	-84	97	l	(71)
\/\/ator	boating			<u> </u>	01.07				01.07	01.0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	01.07	01.01	<u> </u>	01.07		.07		、 ,
(72)m=	67 14	yanis (1		, T	55 56	51.96		16.9	12.6	/8 1	1	50.07	55.81		62.28	65	10		(72)
	07.14				55.50	51.50		(66)	+2.0	+ (68)	' \m +	$(60)m \pm ($	(70)m +	(71)	$m \pm (72)$	00.	10		()
	220 40		214.61		205.62	276 54		(00)	246.07	251		261.27	200 5	(/ I) 	202 51	210	02	l	(73)
6 Sol	ar gain	320.47	514.01	<u> </u>	295.05	270.34	2	30.00	240.07	251.	02	201.57	200.0	+	302.51	510	.02		(70)
Solar q	ains are o	s. calculated	usina so	lar	flux from	Table 6a	and	associ	ated equa	tions to	o co	nvert to th	e applic	able	orientat	tion.			
Orienta	ation:	Access F	actor		Area			Flu	X			a			FF			Gains	
	-	Table 6d			m²			Tat	ole 6a		Т	able 6b		Tab	ole 6c			(W)	
Northea	st 0.9x	0 77		x	57	6	x	1	1 28	l x [0.3	Тx		0.7		=	9 46	(75)
Northea	st _{0.9x} [0.77		x	1 8	6	x		1 28	т I х Г		0.3			0.7		=	6 11](75)
Northea	st <u>0,9x</u> [0.77		x I	57		x	' 	2.97	с Т		0.3			0.7		_	19.25](75)
Northea	ist <u>o av</u> [0.77		x I	1 9	<u> </u>	x	<u> </u>	2.97	" L _X [0.3		\vdash	0.7		_	12.43](75)
Northea	ist n av [0.77		r v	 E 7		Ŷ		1 32	^ L _¥ [0.3	⊢ Û	╞	0.7		_	34 60](75)
	0.07	0.77		^	5.7	0	^	L 4	1.50	^ L		0.5	^		0.7			34.09	

Northea	ast <mark>0.9x</mark>	0.77	>	(1.8	6	x	4	1.38	x		0.3	x	0.7		= [22.4	(75)
Northea	ast <mark>0.9x</mark>	0.77	>	(5.7	6	x	6	7.96	x		0.3	×	0.7		= [56.96	(75)
Northea	ast <mark>0.9x</mark>	0.77	>	$\langle $	1.8	6	x	6	7.96	x		0.3	×	0.7		= [36.79	(75)
Northea	ast <mark>0.9x</mark>	0.77	>	(5.7	6	x	9	1.35	x		0.3	×	0.7		= [76.57	(75)
Northea	ast <mark>0.9x</mark>	0.77)	(1.8	6	x	9	1.35	x		0.3	×	0.7		= [49.45	(75)
Northea	ast <mark>0.9x</mark>	0.77)	(5.7	6	x	9	7.38	x		0.3	×	0.7		= [81.63	(75)
Northea	ast <mark>0.9x</mark>	0.77)	(1.8	6	x	9	7.38] ×		0.3	×	0.7		= [52.72	(75)
Northea	ast <mark>0.9x</mark>	0.77		(5.7	6	x		91.1] x		0.3	×	0.7		= [76.37	(75)
Northea	ast <mark>0.9x</mark>	0.77	,	(1.8	6	x	9	91.1	X		0.3	×	0.7		= [49.32	(75)
Northea	ast <mark>0.9x</mark>	0.77	,	(5.7	6	x	7	2.63] x		0.3	×	0.7		= [60.88	(75)
Northea	ast <mark>0.9x</mark>	0.77	>	(1.8	6	x	7	2.63] x		0.3	×	0.7		= [39.32	(75)
Northea	ast <mark>0.9x</mark>	0.77	>	(5.7	6	x	5	0.42	x		0.3	×	0.7		= [42.27	(75)
Northea	ast <mark>0.9x</mark>	0.77		(1.8	6	x	5	0.42	x		0.3	×	0.7		= [27.3	(75)
Northea	ast <mark>0.9x</mark>	0.77	>	(5.7	6	x	2	8.07	x		0.3	×	0.7		= [23.53	(75)
Northea	ast <mark>0.9x</mark>	0.77	,	(1.8	6	x	2	8.07] x		0.3	×	0.7		= [15.19	(75)
Northea	ast <mark>0.9x</mark>	0.77	,	(5.7	6	x	· · ·	14.2] x		0.3	×	0.7		= [11.9	(75)
Northea	ast <mark>0.9x</mark>	0.77	,	(1.8	6	x	· ·	14.2] x		0.3	×	0.7		= [7.69	(75)
Northea	ast <mark>0.9x</mark>	0.77	,	(5.7	6	x		9.21] x		0.3	×	0.7		= [7.72	(75)
Northea	ast <u>0.9x</u>	0.77	<u> </u>	,	1.8	6	x		9.21	1 x		0.3	۲ × ۲	0.7		= [4.99	(75)
	L				L			L		4						L		
Solar o	ains in	watts, ca	alculate	d ·	for each	n mont	h			(83)m	ו = Su	ım(74)m .	(82)m	1				
(83)m=	15.57	31.69	57.09	Τ	93.75	126.02	2 1	34.35	125.69	100	0.2	69.56	38.7	2 19.59	12	.71		(83)
Total g	jains – i	nternal a	nd sola	ar ((84)m =	: (73)m	ı + (83)m	, watts					•				
(84)m=	344.05	358.16	371.7		389.38	402.56	3 3	92.43	371.75	351	.82	330.93	319.2	.7 322.1	33	1.53		(84)
7. Me	an inter	nal temp	berature	e (heating	seaso	n)											
Temp	erature	during h	eating	ре	eriods in	the liv	/ing	area	from Tal	ble 9	, Th1	(°C)				Г	21	(85)
Utilisa	ation fac	tor for g	ains for	Hiv	ving are	a, h1,	m (s	ее Та	ble 9a)							L		
	Jan	Feb	Mar	Τ	Apr	May	/	Jun	Jul	A	ug	Sep	Oc	t Nov		Dec		
(86)m=	1	1	1	T	0.99	0.96	T	0.87	0.72	0.7	77	0.95	0.99	1		1		(86)
Mean	interna	l temper	ature in		ving are	a T1 (follo	w ste	ns 3 to 7	7 in T	- able	90)						
(87)m=	19.88	19.96	20.14	T	20.4	20.68		20.89	20.97	20.	96	20.8	20.4	7 20.13	19	.86		(87)
Tomo		during h			l	root		valling	from To		L	2 (°C)			<u> </u>			
(88)m=	20.07	20.08	20.08	T	20.08	20.09		20 09	20.09	2010	9, 10 09	20.09	20.0	9 20.08	20	08		(88)
	L		L_0.00				'			<u> </u>		_0.00						()
Utilisa	ation fac	ctor for g	ains for	re T	est of d	veiling	, n2 T	,m (se		9a)	25	0.04	0.00		1	1		(20)
(09)111=				1	0.99	0.95	1	U.O	0.59	1 0.6	υo	0.91	0.99			1 I		(69)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.69	18.95	19.34	19.73	20.01	20.08	20.07	19.9	19.43	18.94	18.55		(90)
									1	fLA = Livin	g area ÷ (4	4) =	0.38	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.07	19.18	19.4	19.75	20.09	20.35	20.42	20.41	20.25	19.83	19.4	19.05	(92)
						-							

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

(93)m=	19.07	19.18	19.4	19.75	20.09	20.35	20.42	20.41	20.25	19.83	19.4	19.05		(93)
8. Spa	ace hea	ting req	uirement	t										
Set Ti the ut	i to the i ilisation	mean in factor fo	ternal ter or gains	mperatui using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9I	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	ation fac	tor for g	ains, hm	1:										
(94)m=	1	1	0.99	0.98	0.95	0.82	0.64	0.7	0.92	0.99	1	1		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	343.38	357.14	369.62	383.17	380.67	323.71	237.87	244.82	303.12	314.95	320.96	331.01		(95)
Month	ly aver	age exte	ernal terr	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]		-		
(97)m=	974.04	939.59	847.66	706.03	545.4	370.51	246.46	258.39	397.44	599.73	802.02	971.86		(97)
Space	e heatin	g requir	ement fo	r each n	nonth, k	Nh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	469.21	391.4	355.67	232.46	122.57	0	0	0	0	211.88	346.36	476.79		
			-					Tota	l per year	(kWh/year	-) = Sum(9	8)15,912 =	2606.34	(98)
Space	e heatin	g requir	ement in	kWh/m²	/year								39.97	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:												_
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	seconda	iry/suppl	ementar	y heating	g system	ı, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ur
Space	e heatin	g requir	ement (c	alculate	d above)			· · · ·				-	
	469.21	391.4	355.67	232.46	122.57	0	0	0	0	211.88	346.36	476.79		
(211)m) = {[(98)m x (20)4)]}x1	00 ÷ (20)6)			•			•	•		(211)
()	501.83	418.61	380.39	248.62	, 131.09	0	0	0	0	226.61	370.44	509.94		
			1					Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}		2787.53	(211)
Space	e heatin	a fuel (s	econdar	v) kWh/	month									J
= {[(98])m x (20)1)]}x1	00 ÷ (20)8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
			1					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}		0	(215)
Water	heating	1												J
Output	from w	, ater hea	iter (calc	ulated al	bove)									
	154.25	135.34	140.7	124.15	120.23	105.37	99.25	111.6	112.26	128.85	138.73	149.88		
Efficier	ncy of w	ater hea	ater										87.3	(216)
(217)m=	89.69	89.66	89.57	89.36	88.89	87.3	87.3	87.3	87.3	89.26	89.56	89.71		」 (217)
Fuel fo	r water	heating	kWh/m	onth	<u> </u>									
(219)m	1 = (64)	m x 100) ÷ (217))m										
(219)m=	171.99	150.95	157.09	138.93	135.26	120.7	113.69	127.84	128.59	144.35	154.9	167.06		_
								Tota	I = Sum(2	19a) ₁₁₂ =			1711.35	(219)
Annua	I totals									k	Wh/year	r	kWh/year	-
Space	heating	fuel use	ed, main	system	1								2787.53	

Water heating fuel used				1711.35]
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 (2	230a)(230g) =		75	(231)
Electricity for lighting				311.36	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			4885.23	(338)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission fa kkg CO2/kWh	ctor	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216	=	602.11	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	369.65	(264)
Space and water heating	(261) + (262) + (263) + (264)) =		971.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	161.59	(268)
Total CO2, kg/year	\$	sum of (265)(271) =		1172.28	(272)
Dwelling CO2 Emission Rate	((272) ÷ (4) =		17.98	(273)
El rating (section 14)				86	(274)

		Us	er Details:						
Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Numl ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Prope	erty Address:	Kingsto	n Briage	28F 65	GND G	AS	
1 Overall dwelling dime	nsions:								
			Area(m²)		Av. Hei	iaht(m)		Volume(m ³)	
Ground floor		Г	65.2	(1a) x	2	2.7	(2a) =	176.04	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	∟ ≥)+(1n) [65.2	(4)], , ,], ,
Dwelling volume				(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	176.04	(5)
2 Ventilation rate:									_
	main s	econdary	other		total			m ³ per hour	
Number of chimneys	heating h			1 = [0	X 4	40 =	0	7 (6a)
Number of open flues		+		」 <u>「</u> 」 = 「	0	×2	20 =	0	
Number of intermittent far		0	0		2	x ^	10 =	20	$\int_{(7a)}^{(00)}$
Number of passive vents					2		10 =	20	$\int_{(7b)}^{(7a)}$
Number of passive vents				Ļ	0		10 -	0	
Number of flueless gas fir	es				0	X 2	+0 =	0	(7c)
							Air ch	anges per hou	ur
Infiltration due to chimney	/s. flues and fans = (6)	a)+(6b)+(7a)+(7	7b)+(7c) =	Г		<u> </u>	÷ (5) =		٦
If a pressurisation test has be	een carried out or is intende	ed, proceed to ((17), otherwise c	ontinue fro	om (9) to ((16)	(0)		J
Number of storeys in th	e dwelling (ns)							0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or 0.3	5 for masonr	y constru	uction			0	(11)
if both types of wall are pro- deducting areas of openin	esent, use the value corres las): if equal user 0.35	ponding to the	greater wall area	a (after					
If suspended wooden fl	oor, enter 0.2 (unseal	led) or 0.1 (s	ealed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter 0						·	0	(13)
Percentage of windows	and doors draught st	ripped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 10	= [00			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cub	pic metres pe	er hour per so	luare me	etre of e	nvelope	area	5	(17)
If based on air permeabili	ty value, then (18) = [(1	7) ÷ 20]+(8), otl	herwise (18) = (16)				0.36	(18)
Air permeability value applies	s if a pressurisation test has d	s been done or	a degree air per	meability i	s being us	sed		•	
Shelter factor	u		(20) = 1 - [0.075 x (1	9)] =			0.85	-(19)
Infiltration rate incorporati	ing shelter factor		(21) = (18)	x (20) =				0.31	$]^{(=0)}$
Infiltration rate modified for	or monthly wind speed	ł						0.01](= ;)
Jan Feb	Mar Apr May	Jun J	ul 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		
$\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i$	<u> </u>							1	
vvind Factor (22a)m = $(22a)m = (22a)m	$\frac{1}{123}$ 11 108	0.95 0.	95 0 02	1	1 08	1 12	1 18		
	1.1		0.02	'	1.00	1.12	1.10		

Adjust	ed infiltr	ation rat	e (allow	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-		-		-		
II IIIt			ucing App	ondix N (2	(25) = (22)	$(a) \times Emv(a)$	oquation (nvico (23h) - (23a)			0	(23a)
If bal	ancod with	boot roce	wory: offic		.50) – (258	or in uso f	actor (fron	n Table 4b) –) - (208)			0	(230)
) - .)]]h)ma (/)	00k) v [4 (22.5)	0	(23c)
a) IT								HR) (24a 1	a)m = (22)	20)m + (. 0	23D) × [1 - (23C)	i ÷ 100]]	(24a)
(24a)III-					U							0	J	(244)
D) IT	balance		anical ve					VIV) (240 T	o)m = (22	20)m + (2	230)		1	(24b)
(240)m=		0			 					0	0	0	J	(240)
C) IT	if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), f	then (24	or positiv c) = (23b); other	ventilatio wise (24	c) = (22b	outside b) m + 0.	5 × (23b)		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	nole hous)m = (221	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - ei	nter (24a	i) or (24t	o) or (24	c) or (24	d) in boy	x (25)					
(25)m=	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3 He	at losse	s and he	eat loss	naramet	er.									
		Gros	s	Openin	as	Net Ar	rea	U-valı	le	AXU		k-value	<u> </u>	AXk
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K İ	kJ/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.4)+	0.04] =	7.64				(27)
Windo	ws Type	2				1.86	x1	/[1/(1.4)+	0.04] =	2.47				(27)
Floor						65.2	x	0.13	=	8.47599	9			(28)
Walls				9.48	3	34.64	4 X	0.18	= =	6.24			7 —	(29)
Total a	area of e	lements	, m²			109.3	2							(31)
Party v	wall					44.12	2 X	0	= [0			_ _	(32)
Party of	ceiling					65.2			I				\dashv	(32b)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of il	effective wi nternal wal	indow U-va Is and part	lue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	s given ir	n paragraph	 ז 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				27.28	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	12604.26	(34)
Therm	al mass	parame	ter (TMI	P = Cm ÷	⊦ TFA) ir	n kJ/m²K	,		Indica	tive Value	Medium		250	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the culation.	construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	lculated	using Ap	pendix l	K						5.52	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			32.8	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y			<u> </u>	(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	33.56	33.38	33.21	32.4	32.25	31.55	31.55	31.42	31.82	32.25	32.56	32.88	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K			-			(39)m	= (37) + (3	38)m		•	
(39)m=	66.36	66.18	66.01	65.2	65.05	64.35	64.35	64.22	64.62	65.05	65.36	65.68		
										Average =	Sum(39)	112 /12=	65.2	(39)

Heat loss paramete	r (HLP), W	//m²K					(40)m	= (39)m ÷	· (4)			
(40)m= 1.02 1.02	2 1.01	1	1	0.99	0.99	0.98	0.99	1	1	1.01		
Number of days in r	nonth (Tab	le 1a)						Average =	Sum(40) ₁ .	12 /12=	1	(40)
Jan Fe	b Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(41)m= 31 28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heating e	nergy requ	irement:								kWh/ye	ar:	
Assumed occupanc if TFA > 13.9, N = if TFA £ 13.9, N =	y, N : 1 + 1.76 > : 1	k [1 - exp	o(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	12		(42)
Annual average hot Reduce the annual avera not more that 125 litres p	water usa age hot water per person pe	ge in litre ^r usage by er day (all w	es per da 5% if the c vater use, l	ay Vd,av lwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	64 f	.65		(43)
Jan Fe	b Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres	per day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)		-				
(44)m= 93.12 89.7	3 86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
				100			-	Total = Su	m(44) ₁₁₂ =		1015.8	(44)
Energy content of hot wa	iter used - ca	Iculated m	onthly = 4.	190 x Vd,r I	m x nm x l I) 1 m / 3600) kWh/mor I	nth (see Ta T	ables 1b, 1	c, 1d)		
(45)m= 138.09 120. ⁻	77 124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
If instantaneous water h	eating at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m= 20.71 18.1	2 18.69	16.3	15.64	13.49	12.5	14.35	14.52	16.92	18.47	20.06		(46)
Water storage loss:									-			
Storage volume (litr	es) includiı	ng any s	olar or W	WHRS	storage	within sa	ame ves	sel		0		(47)
If community heatin Otherwise if no stor Water storage loss:	g and no ta ed hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres ir neous co	ı (47) ombi boil	ers) ente	er '0' in (47)			
a) If manufacturer's	declared	loss fact	or is kno	wn (kWł	n/day):					0		(48)
Temperature factor	from Table	e 2b								0		(49)
Energy lost from wa	ter storage	e, kWh/y	ear			(48) x (49)) =			0		(50)
b) If manufacturer's	declared	cylinder	loss fact	or is not	known:							(54)
If community heatin	a see secti	ion 4.3	ie z (kvv	n/iitie/ua	ay)					0		(51)
Volume factor from	Table 2a									0		(52)
Temperature factor	from Table	e 2b								0		(53)
Energy lost from wa	ter storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (54) ir	า (55)									0		(55)
Water storage loss	calculated	for each	month			((56)m = (55) × (41)	m				
(56)m= 0 0 If cylinder contains dedic	0 ated solar sto	0 prage, (57)	0 m = (56)m	0 x [(50) - (0 [H11)] ÷ (5	0 i0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Appendi	хH	(56)
(57)m= 0 0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit loss	(annual) fr	om Tabl	- 3					!		0		(58)
Primary circuit loss	calculated	for each	month (59)m = ((58) ÷ 30	65 × (41)	m					
			•									
(modified by facto	or from Tab	ole H5 if t	there is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			

Combi	loss ca	lculated	for each	month	(61)m =	(60)	÷ 365 × (41)m						
(61)m=	47.45	41.3	44	40.91	40.55	37.	57 38.82	40.55	40.91	44	44.25	47.45		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for	each month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	185.54	162.07	168.63	149.56	144.8	127	.53 122.19	136.2	137.71	156.82	167.4	181.18		(62)
Solar DH	-IW input	calculated	using App	endix G o	Appendix	: H (ne	gative quantit	y) (enter	'0' if no sola	ar contribu	tion to wate	er heating)	•	
(add a	dditiona	I lines if	FGHRS	and/or \	WWHRS	app	lies, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	C	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	185.54	162.07	168.63	149.56	144.8	127	.53 122.19	136.2	137.71	156.82	167.4	181.18		
		-		-			-	O	Itput from w	ater heate	er (annual)	112	1839.64	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [C	.85 × (45)m	ו + (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	57.78	50.48	52.44	46.35	44.8	39.	31 37.42	41.94	42.41	48.51	52.01	56.33		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylind	er is in the	dwellin	g or hot w	/ater is f	rom com	munity h	neating	
5. Int	ernal g	ains (see	e Table {	5 and 5a):									
Metabo	olic gair	ns (Table	.5) Wa	tts	/									
motab	Jan	Feb	Mar	Apr	May	Ju	ın Jul	Auc	Sep	Oct	Nov	Dec	1	
(66)m=	106.21	106.21	106.21	106.21	106.21	106	.21 106.21	106.2 ⁴	106.21	106.21	106.21	106.21		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L	9 or L9a), a	also see	e Table 5				1	
(67)m=	17.63	15.66	12.73	9.64	7.21	6.0	6.57	8.55	11.47	14.56	17	18.12	1	(67)
Applia	nces da	ins (calc	ulated ir	n Append	dix L. ea	uatio	n L13 or L1	3a), al	so see Ta	ble 5		Į	1	
(68)m=	185.85	187.77	182.91	172.57	159.51	147	.23 139.03	137.1	141.97	152.31	165.37	177.65		(68)
Cookin	na aains	i (calcula	ted in A	ppendix	L. equat	ion l	 15 or L15a), also	see Table	e 5			1	
(69)m=	33.62	33.62	33.62	33.62	33.62	33.	62 33.62	33.62	33.62	33.62	33.62	33.62	1	(69)
Pumps	and fa	ns dains	(Table)	5a)	I			1		I		I	1	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
Losses		I vaporatio	n (nega	i tive valu	i es) (Tab	le 5)				1	I		1	
(71)m=	-84.97	-84.97	-84.97	-84.97	-84.97	-84	.97 -84.97	-84.97	-84.97	-84.97	-84.97	-84.97]	(71)
Water	L heating	I dains (1	I Table 5)							I			1	
(72)m=	77.66	75.12	70.48	64.38	60.22	54.	59 50.3	56.38	58.91	65.2	72.23	75.71	1	(72)
Total i	nternal	l gains =	I				(66)m + (67)n	L n + (68)n	1 + (69)m +	(70)m + (1 71)m + (72)m	1	
(73)m=	339	336.42	323.99	304.45	284.8	265	.77 253.77	259.89	270.21	289.94	312.47	329.34	1	(73)
6. Sol	ar gain	s:						1						• •
Solar g	ains are	calculated	using sola	r flux from	Table 6a	and a	ssociated equa	ations to	convert to th	ne applica	ble orientat	tion.		
Orienta	ation:	Access F	actor	Area			Flux		g_		FF		Gains	
	-	Table 6d		m²			Table 6a		Table 6b	Т	able 6c		(W)	
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	11.28) x [0.63	x	0.7	=	19.86	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	1.8	36	×Г	11.28] × [0.63	× [0.7	= =	12.83	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	22.97] × [0.63	× [0.7	=	40.43	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	1.8	36	×Г	22.97] × [0.63		0.7	=	26.11	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	41.38] × [0.63	× [0.7	=	72.84	(75)

Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	4	1.38	x		0.63	x	0.7		= [47.04	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	6	7.96	x		0.63	×	0.7		= [119.62	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	6	7.96	x		0.63	×	0.7		= [77.26	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	g	1.35	Īx		0.63	×	0.7		= [160.8	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	1.35	x		0.63	×	0.7		= [103.85	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	7.38	x		0.63	×	0.7		= [171.43	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	g	7.38	x		0.63	×	0.7		= [110.71	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		91.1	×	-	0.63	×	0.7		= [160.37	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	91.1	x		0.63	x	0.7		= [103.57	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	7	2.63	x		0.63	×	0.7		= [127.85	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	7	2.63	x		0.63	x	0.7		= [82.57	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	5	0.42	x		0.63	×	0.7		= [88.76	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	5	0.42	x		0.63	x	0.7		= [57.32	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	2	8.07	x		0.63	x	0.7		= [49.41	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	2	8.07	x		0.63	×	0.7		= [31.91	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	'6	x		14.2	x		0.63	x	0.7		= [24.99	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		14.2	x		0.63	×	0.7		= [16.14	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	9.21	x		0.63	×	0.7		= [16.22	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		9.21] x		0.63	×	0.7		= [10.48	(75)
Solar g	gains in	watts, ca	alcula	ted	for eacl	h mont	:h			(83)m	ו = Sur	n(74)m	.(82)m					
(83)m=	32.69	66.54	119.8	38	196.88	264.6	5 2	82.14	263.94	210	.42	146.08	81.32	41.13	26.	7		(83)
Total g	jains – i	nternal a	and so	olar	(84)m =	= (73)n	า + (83)m	, watts									
(84)m=	371.69	402.96	443.8	38	501.34	549.44	4 5	47.92	517.71	470	.31	416.29	371.20	353.6	356.	03		(84)
7. Me	ean inter	rnal temp	oeratu	ire (heating	seasc	n)											
Temp	perature	during h	eatin	g pe	eriods ir	n the liv	ving	area	from Tal	ble 9	, Th1	(°C)				Γ	21	(85)
Utilisa	ation fac	ctor for g	ains f	or li	ving are	ea, h1,	m (s	ее Та	ble 9a)									
	Jan	Feb	Ma	ar	Apr	May	/	Jun	Jul	A	ug	Sep	Oct	Nov	De	ec		
(86)m=	1	1	0.99)	0.97	0.89		0.71	0.54	0.6	61	0.88	0.98	1	1			(86)
Mean	n interna	I temper	ature	in li	iving are	ea T1 (follo	ow ste	ps 3 to 7	7 in T	able	9c)						
(87)m=	19.91	20.02	20.2	4	20.55	20.83	2	20.96	20.99	20.	99	20.88	20.54	20.18	19.8	39		(87)
Temp	perature	during h	eatin	g pe	eriods ir	n rest c	of dw	velling	from Ta	able 9	9, Th2	2 (°C)						
(88)m=	20.07	20.07	20.0	7	20.08	20.09	2	20.09	20.09	20	.1	20.09	20.09	20.08	20.0)8		(88)
Utilisa	ation fac	- ctor for a	ains f	or re	est of d	welling	, h2	,m (se	e Table	9a)	<u> </u>			•				
					-				-	, 								

(89	1	1	0.98	0.82	0.5	0.43	0.63	0.85	0.96	0.99	1	1	(89)m=
-	-		le 9c)	7 in Tabl	eps 3 to 1	ollow ste	ng T2 (f	of dwelli	the rest	ature in	l temper	interna	Mean
(90	18.59	19.01	19.53	19.99	20.09	20.09	20.07	19.91	19.54	19.08	18.77	18.61	(90)m=
0.38 (91	4) =	g area ÷ (4	fLA = Livin	1									

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

													-
(92)m=	19.11	19.25	19.53	19.93	20.26	20.41	20.44	20.43	20.33	19.92	19.45	19.09	(92

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

(93)m=	19.11	19.25	19.53	19.93	20.26	20.41	20.44	20.43	20.33	19.92	19.45	19.09		(93)
8. Sp	ace hea	ting req	uirement	t										
Set T the ut	i to the i ilisation	mean int factor fo	ternal ter or gains	mperatui using Ta	re obtair able 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hrr	n:							-			
(94)m=	1	1	0.99	0.96	0.86	0.66	0.47	0.54	0.84	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	370.63	400.98	438.42	479.42	469.83	359.42	245.03	255.14	347.84	361.84	351.67	355.24		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m : I	x [(93)m I	– (96)m]			1	
(97)m=	982.62	949.55	859.88	719.22	556.95	374.09	246.95	259.11	402.64	606.21	807.46	977.87		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Nh/moni	th = 0.02	24 x [(97])m – (95)m] x (4	1)m			
(98)m=	455.32	368.64	313.57	172.66	64.81	0	0	0	0	181.81	328.17	463.23		1
								Tota	l per year	(kWh/year	⁻) = Sum(9	8)15,912 =	2348.22	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								36.02	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												-
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	iry/suppl	ementar	y heatin	g system	n, %			-			0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g requir	ement (c	alculate	d above)								
	455.32	368.64	313.57	172.66	64.81	0	0	0	0	181.81	328.17	463.23		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	487.5	394.69	335.73	184.86	69.39	0	0	0	0	194.66	351.36	495.97		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2514.15	(211)
Space = {[(98	e heatin)m x (20	g fuel (s)1)] } x 1	econdar 00 ÷ (20	y), kWh/)8)	month									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
			<u>!</u>					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	_	0	(215)
Water	heating	1												J
Output	from w	ater hea	ter (calc	ulated a	bove)		-			-				
	185.54	162.07	168.63	149.56	144.8	127.53	122.19	136.21	137.71	156.82	167.4	181.18		_
Efficier	ncy of w	ater hea	ater	-					-				80.3	(216)
(217)m=	87.22	87.06	86.59	85.41	83.17	80.3	80.3	80.3	80.3	85.42	86.72	87.31		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100	$) \div (217)$)m	1744	150.00	150.40	160.00	174 5	100 57	102.04	207 54		
(219)m=	212.71	100.17	194./4	1/5.1	1/4.1	100.82	152.10	Toto	1 = Sum(2)	19a) -	193.04	207.51	0470.05	
	4-4-1-							iola	Oum(2	- July ₁₁₂ –	A/6 4		21/9.05](219)
Space	heating	fuelue	ed main	system	1					K	wn/yeai		2514 15	1
Space	nearing	1001 030	sa, main	System									2014.10	1

Water heating fuel used				2179.05]
Electricity for pumps, fans and electric keep-hot					
central heating pump:		Γ	30		(230c)
boiler with a fan-assisted flue		Γ	45		(230e)
Total electricity for the above, kWh/year	sum of ((230a)(230g) =		75	(231)
Electricity for lighting				311.36	(232)
Total delivered energy for all uses (211)(221) + ((231) + (232)(237b) =			5079.56	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				_
	-		_		
	Energy kWh/year	kg CO2/kWh	or E k	E <mark>missions</mark> (g CO2/yea	ır
Space heating (main system 1)	kWh/year (211) x	kg CO2/kWh	or E k =	Emissions (g CO2/yea 543.06	ır](261)
Space heating (main system 1) Space heating (secondary)	kWh/year (211) x (215) x	kg CO2/kWh	or E 	Emissions (g CO2/yea 543.06 0	ır](261)](263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.216 0.519 0.216	>r E 	a CO2/yea	ır](261)](263)](264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264)	Emission facto kg CO2/kWh 0.216 0.519 0.216	•r E = =	Emissions (g CO2/yea 543.06 0 470.68 1013.73	nr](261)](263)](264)](265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x	Emission facto kg CO2/kWh 0.216 0.519 0.216		Emissions (g CO2/yea 543.06 0 470.68 1013.73 38.93	ar](261)](263)](264)](265)](267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Emission facto kg CO2/kWh 0.216 0.519 0.216 +) = 0.519 0.519		Emissions (g CO2/yea 543.06 0 470.68 1013.73 38.93 161.59	ar](261)](263)](264)](265)](267)](268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Emission facto kg CO2/kWh 0.216 0.519 0.216 }) = 0.519 0.519 0.519 0.519 sum of (265)(271) =		Emissions (g CO2/yea 543.06 0 470.68 1013.73 38.93 161.59 1214.25	ar](261)](263)](264)](265)](267)](268)](272)

TER =

18.62 (273)

		User Details:				
Assessor Name: Software Name:	Stroma FSAP 2012	Stror Softv	na Number: vare Version:	Versic	on: 1.0.5.59	
		Property Addres	s: Kingston Bridg	e 2BF 65 MID G	AS	
Address :						
1. Overall dwelling dime	nsions:	• ())				
Ground floor		Area(m²) 65.2	Av. He	2.7 (2a) =	176.04) (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+	(1n) 65.2	(4)			_
Dwelling volume			(3a)+(3b)+(3c)+(3c)	d)+(3e)+(3n) =	176.04	(5)
2. Ventilation rate:						
	main second	ary other	total		m ³ per hou	r
Number of chimneys		+ 0	= 0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0	= 0	x 20 =	0	(6b)
Number of intermittent far	าร		2	x 10 =	20	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fir	res		0	x 40 =	0	(7c)
				 Air ch	nanges per ho	our
Infiltration due to chimney	$r_{\rm c}$ flues and fans = (6a)+(6b)	+(7a)+(7b)+(7c) =		÷ (5) =	J	7
If a pressurisation test has be	een carried out or is intended. proc	eed to (17). otherwise	continue from (9) to	(16)		
Number of storeys in th	e dwelling (ns)	(<i>m</i>	(1)	· -/	0	(9)
Additional infiltration				[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber frame	or 0.35 for maso	nry construction		0	(11)
if both types of wall are pro	esent, use the value corresponding	g to the greater wall a	rea (after			
If suspended wooden fl	oor, enter 0.2 (unsealed) or	0.1 (sealed), els	e enter 0		0	(12)
If no draught lobby, ent	er 0.05, else enter 0				0	(13)
Percentage of windows	and doors draught stripped	I			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,	q50, expressed in cubic me	tres per hour per	square metre of e	envelope area	4	(17)
If based on air permeabili	ty value, then (18) = [(17) ÷ 20	+(8), otherwise (18) =	(16)		0.31	(18)
Air permeability value applies	s if a pressurisation test has been (lone or a degree air p	ermeability is being u	ised		_
Number of sides sheltered	a	(20) = 1	- [0 075 x (19)] =		2	(19)
Infiltration rate incorporati	ng shelter factor	(21) = (1	8) x (20) =		0.00	$\Box_{(21)}^{(20)}$
Infiltration rate modified for	or monthly wind speed		0)/((=0)		0.27	
Jan Feb	Mar Apr May Jur	n Jul Aug	Sep Oct	Nov Dec]	
Monthly average wind spe	ed from Table 7		- · -	1 1	1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8 3.7	4 4.3	4.5 4.7]	
		_11	<u> </u>	<u>ı I</u>	1	
VVIND Factor (22a)m = $(22a)m = 1.27 + 1.25 + 4$	2)m÷4	0.95 0.92	1 1.08	1 12 1 18	1	
					1	

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calcul	ate effe	ctive air	change	rate for t	the appli	cable ca	se	-				-		
II IIIt			ucing App	ondix N (2	(22h) = (22c)		oquation (I		nuico (23h) = (23a)			0	(23a)
If bol		eat pump			(200) = (200)	i) ~ i iiv (e	Squation (i	n = Table 4b) –) = (238)			0	(230)
) -	2 a)	006)	4 (00 -)	0	(23c)
a) ir	balance							HR) (24a T	a)m = (22	20)m + (230) × [1 - (23C)) ÷ 100]]	(245)
(24a)11-			0		0							0		(244)
D) IT	balance		anical ve			neat rec	covery (r	VIV) (240 T	5)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0			 					0	0	0		(240)
C) If	whole h if (22b)r	iouse ex n < 0.5 ×	tract ver (23b), f	then (24	or positiv c) = (23b); other	ventilatio wise (24	c) = (22b)	outside b) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a	i) or (24t	o) or (24	c) or (24	d) in boy	x (25)	-	-	-		
(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(25)
3 He	at losse	s and he	at loss	naramet	er.								-	
		Gros	35	Openin		Net Ar	rea	U-valı	lie	ΑΧΠ		k-value	ر د	4 X k
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	2K	(W/I	K)	kJ/m²·l	K I	kJ/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.2)+	0.04] =	6.6				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				9.48	3	34.64	1 X	0.18	=	6.24				(29)
Total a	area of e	elements	, m²			44.12	2							(31)
Party v	wall					44.12	2 X	0	=	0				(32)
Party f	loor					65.2	=				i		\exists	(32a)
Party of	ceiling					65.2					[\dashv	(32b)
* for win ** includ	dows and le the area	l roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Ils and pari	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	n paragraph	1 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)) + (32) =				17.09	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	12930.26	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm +	+ TFA) ir	ו kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign asses: Jsed inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	e construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	K						3.89	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	:1)								
Total fa	abric he	at loss							(33) +	(36) =			20.98	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y			,	(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.4	32.27	32.14	31.54	31.43	30.91	30.91	30.81	31.11	31.43	31.66	31.9		(38)
Heat tr	ansfer o	coefficie	nt, W/K				_		(39)m	= (37) + (3	38)m		_	
(39)m=	53.39	53.26	53.13	52.53	52.42	51.89	51.89	51.8	52.09	52.42	52.64	52.88		
										Average =	Sum(39)	112 /12=	52.53	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	0.82	0.82	0.81	0.81	0.8	0.8	0.8	0.79	0.8	0.8	0.81	0.81		
Numbe	er of day	s in mo	nth (Tab	le 1a)				•	,	Average =	Sum(40)1.	.12 /12=	0.81	(40)
- turnov	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	949 x (TF	⁻ A -13.9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . 9)	12		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person per	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	y Vd,av welling is not and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	f 84	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres pei	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	· · · · ·					
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
_									-	Total = Su	m(44) ₁₁₂ =		1015.8	(44)
Energy	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	m x nm x [DTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1	
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		-
lf instan	taneous w	ater heati	ng at point	of use (no	o hot water	storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m =	20.71	18 12	18.69	16.3	15.64	13.49	12.5	14.35	14 52	16.92	18.47	20.06		(46)
Water	storage	loss:	10.00	10.0	10.04	10.40	12.0	14.00	14.02	10.52	10.47	20.00		(10)
Storag	e volum	e (litres)	includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel	(0		(47)
If comi Otherv Water	munity h vise if no	eating a stored	nd no ta	ink in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres in neous co	ı (47) ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):)		(48)
Tempe	erature f	actor fro	m Table	2b		,	,)		(49)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =)		(50)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:							
Hot wa	ter stor	age loss	factor fr	rom Tabl	le 2 (kW	h/litre/da	ay)				(0		(51)
Volum	nunity n e factor	from Ta	ble 2a	011 4.3								า		(52)
Tempe	erature f	actor fro	m Table	2b))		(52)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =)		(54)
Enter	(50) or ((54) in (5	55)	, ,								с С		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	60), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3						())		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		·			
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	ch	month (61)m =	(60)) ÷ 36	65 × (41))m									
(61)m=	16.16	14.57	16.08		15.5	15.97	1	5.41	15.89	15.9	4	15.46	16.03	3	15.58	16.	.15		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	l fo	r eac	h month	(62)m	า =	0.85 × ((45)m	+ (4	6)m +	(57)	m +	(59)m + (61)m	
(62)m=	154.25	135.34	140.7		124.15	120.23	1	05.37	99.25	111.	6	112.26	128.8	5	138.73	149	9.88		(62)
Solar DH	IW input	calculated	using A	ope	ndix G or	Appendix	(H)	(negati	ve quantity) (ente	r '0'	if no sola	r contrib	oution	n to wate	er hea	ating)		
(add a	dditiona	al lines if	FGHR	Sa	and/or V	VWHRS	s ap	plies	, see Ap	pendi	x G	i)							
(63)m=	0	0	0		0	0		0	0	0		0	0		0	(D		(63)
Output	from w	ater hea	ter				_												
(64)m=	154.25	135.34	140.7		124.15	120.23	1	05.37	99.25	111.	6	112.26	128.8	5	138.73	149	9.88		_
										C)utpi	ut from wa	ater hea	ater (annual)₁	12		1520.61	(64)
Heat g	ains fro	m water	heatin	g, I	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (61)m] + 0.8 x	(46)	m +	(57)m	+ (5	i9)m]	
(65)m=	49.95	43.8	45.46		40	38.66	3	3.76	31.69	35.7	9	36.05	41.52	2	44.84	48	8.5		(65)
inclu	de (57)	m in calo	culation	1 0	f (65)m	only if c	ylir	nder i	s in the c	dwellir	ng d	or hot w	ater is	fro	m com	mun	ity h	eating	
5. Int	ernal g	ains (see	e Table	5	and 5a)):													
Metabo	olic gair	ns (Table	e 5), W	atts	S														
	Jan	Feb	Mai	·	Apr	May		Jun	Jul	Au	g	Sep	Oct	t	Nov	D	ec		
(66)m=	106.21	106.21	106.2 ⁴	1	106.21	106.21	1	06.21	106.21	106.2	21	106.21	106.2	1	106.21	106	6.21		(66)
Lightin	g gains	(calcula	ted in <i>i</i>	Ap	pendix I	_, equat	ion	L9 o	r L9a), a	lso se	e T	able 5				•			
(67)m=	17.63	15.66	12.73	Τ	9.64	7.21	(6.08	6.57	8.55	;	11.47	14.56	3	17	18.	.12		(67)
Appliar	nces ga	ins (calc	ulated	in	Append	lix L, eq	uat	tion L	13 or L1	3a), a	lso	see Tal	ble 5	•					
(68)m=	185.85	187.77	182.9	1	172.57	159.51	1	47.23	139.03	137.1	1	141.97	152.3	1	165.37	177	' .65		(68)
Cookin	g gains	, (calcula	ted in	_г Ар	pendix	L, equa	tior	n L15	or L15a)	, also	se	e Table	5						
(69)m=	33.62	33.62	33.62	Ť	33.62	33.62	3	3.62	33.62	33.6	2	33.62	33.62	2	33.62	33.	.62		(69)
Pumps	and fa	ns gains	(Table	2 5	a)		-												
(70)m=	3	3	3	Т	3	3		3	3	3		3	3		3	3	3		(70)
Losses	s e.q. e	/aporatic	n (neg	ati	ve valu	es) (Tab	le	5)			_			-					
(71)m=	-84.97	-84.97	-84.97	7	-84.97	-84.97	-8	, 34.97	-84.97	-84.9	7	-84.97	-84.9	7	-84.97	-84	.97		(71)
Water	heating	u aains (1	i Table 5)			I												
(72)m=	67.14	65.18	61.1	Ť	55.56	51.96		46.9	42.6	48.1	1	50.07	55.81	1	62.28	65.	.19		(72)
Total i	nternal	u gains =	! :				I	(66)	m + (67)m	+ (68)	m +	(69)m + ((70)m +	(71)	m + (72))m			
(73)m=	328.48	326.47	314.6 ²	1	295.63	276.54	2	58.08	246.07	251.6	52	261.37	280.5	4	302.51	318	3.82		(73)
6. Sol	ar gain	s:	<u> </u>	-			I									1			
Solar g	ains are	calculated	using sc	lar	flux from	Table 6a	and	assoc	iated equa	tions to	o cor	nvert to th	e applic	cable	orientat	ion.			
Orienta	ation:	Access F	actor		Area			Flu	х			g_			FF			Gains	
	-	Table 6d			m²			Tal	ole 6a		Та	able 6b		Tab	ole 6c			(W)	
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	1	1.28	×		0.63	x		0.7		=	19.86	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	1.28	×		0.63	×		0.7		=	12.83	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	2	2.97	x		0.63	×		0.7		=	40.43	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	2	2.97	×		0.63	×		0.7		=	26.11	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	4	1.38	×		0.63	×	F	0.7		=	72.84	(75)

Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	4	1.38	x		0.63	×	0.7		=	47.04	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	6	7.96	X		0.63	×	0.7		= [119.62	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	6	7.96	x		0.63	x	0.7		=	77.26	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	g	1.35	x		0.63	x	0.7		=	160.8	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	g	1.35	x		0.63	×	0.7		=	103.85	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	g	7.38	x		0.63	×	0.7		=	171.43	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	g	7.38	x		0.63	×	0.7		=	110.71	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		91.1	x		0.63	×	0.7		=	160.37	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		91.1	x		0.63	×	0.7		=	103.57	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	7	2.63	x		0.63	×	0.7		=	127.85	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	7	2.63	x		0.63	×	0.7		=	82.57	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	5	0.42	x		0.63	x	0.7		=	88.76	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	5	0.42	x		0.63	×	0.7		=	57.32	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	2	8.07	x		0.63	×	0.7		=	49.41	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	2	8.07	x		0.63	×	0.7		=	31.91	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	· ·	14.2	x		0.63	×	0.7		=	24.99	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	· ·	14.2	x		0.63	x	0.7		=	16.14	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		9.21	x		0.63	x	0.7		=	16.22	(75)
Northea	ast _{0.9x}	0.77		x	1.8	6	x		9.21] x		0.63	×	0.7		=	10.48	(75)
Solar g	gains in	watts, ca	alcula	ted	for eac	n montl	1 			(83)m	1 = SL	um(74)m	(82)m					(02)
(83)m=	32.69	66.54	119.8		196.88	264.65	$\frac{1}{2}$	82.14	263.94	210	.42	146.08	81.32	41.13	26.7	((83)
					(04)111 -	- (73)III 541 10	+ (+	03)III 40.22	, waits	462	04	407.45	261.9	2 242 64	245 1	52		(84)
(04)111-	301.17	393.01	434.4	9	492.51	541.19	5	40.22	510.01	402	.04	407.45	301.0	5 343.04	345.0	52		(04)
7. Me	an inter	nal temp	beratu	re (heating	seaso	n)											
lemp	erature	during h	eating	g pe	eriods ir	the liv	ing	area	from I al	ole 9	, Th	1 (°C)					21	(85)
Utilisa	ation fac	tor for g	ains fo	or li	ving are	ea, h1,r	n (s	ee Ta	ble 9a)	<u> </u>								
(00)	Jan	Feb	Ma	ır	Apr	May	-	Jun	Jul	A	ug	Sep	Oct	Nov	De	ec ((96)
(86)m=	1	1	0.99	'	0.95	0.82		0.61	0.45	0.5	51	0.81	0.98	1	1			(80)
Mean	interna	l temper	ature	in li	iving are	ea T1 (†	follo	w ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	20.19	20.29	20.4	8	20.74	20.93	2	20.99	21	2	1	20.96	20.71	20.4	20.1	7		(87)
Temp	erature	during h	eating	g pe	eriods ir	n rest o	f dw	/elling	from Ta	able 9	9, Th	n2 (°C)						

20.24 20.25 (88) (88)m= 20.24 20.24 20.25 20.25 20.26 20.26 20.26 20.25 20.25 20.24 Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)

(89)m= 0.54 0.37 0.43 0.75 0.97 1 1 1 0.99 0.94 0.78 1 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 19.95 19.14 19.28 19.56 20.19 20.25 20.26 (90) (90)m= 20.26 20.22 19.9 19.46 19.11 $fLA = Living area \div (4) =$ 0.38 (91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

									,				
(92)m=	19.54	19.67	19.91	20.25	20.47	20.54	20.54	20.54	20.5	20.21	19.82	19.52	(

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

(93)m=	19.54	19.67	19.91	20.25	20.47	20.54	20.54	20.54	20.5	20.21	19.82	19.52		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	i to the i ilisation	mean int factor fo	ternal ter or gains	mperatur using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	ייייי ו:										
(94)m=	1	1	0.99	0.94	0.79	0.56	0.4	0.46	0.77	0.97	0.99	1		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	360.27	391.08	428.14	461.98	427.81	305.13	204.29	213.9	313.82	350.05	341.76	344.86		(95)
Month	nly aver	age exte	ernal terr	nperature	e from Ta	able 8		_			_			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	813.53	786.46	712.68	596.32	459.86	308.04	204.53	214.51	333.46	503.66	669.66	809.91		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	337.23	265.7	211.7	96.73	23.84	0	0	0	0	114.28	236.09	346		_
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	1631.57	(98)
Space	e heatin	g require	ement in	ı kWh/m²	/year								25.02	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:												_
Fracti	on of sp	ace hea	at from s	econdary	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		ĺ	1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ı, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)		-						
	337.23	265.7	211.7	96.73	23.84	0	0	0	0	114.28	236.09	346		
(211)m	n = {[(98)m x (20	04)]}x1	100 ÷ (20)6)									(211)
	360.67	284.17	226.42	103.45	25.5	0	0	0	0	122.23	252.5	370.05		
			•					Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1745	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							I		4
= {[(98)m x (20)1)]}x1	00 ÷ (20)8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	1												-
Output	from w	ater hea	ter (calc	ulated al	bove)						-			
	154.25	135.34	140.7	124.15	120.23	105.37	99.25	111.6	112.26	128.85	138.73	149.88		
Efficier	ncy of w	ater hea	ater										87.3	(216)
(217)m=	89.47	89.39	89.19	88.67	87.81	87.3	87.3	87.3	87.3	88.78	89.29	89.51		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100) ÷ (217))m	126.04	100 7	112.00	107.04	100 50	115 44	155 07	167 44		
(∠19)m=	172.4	151.39	157.75	140.01	136.91	120.7	113.69	127.84	128.59	145.14	155.37	107.44	4-1-6-	٦
								rota	i – Suili(2	σα) ₁₁₂ =	•		1/1/.24	(219)
Annua	I totals	fuelues	od main	ovotor	1					k	Wh/year		kWh/year	1
Space	neating		eu, maiñ	system	I							l	1745	

Water heating fuel used				1717.24	
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 (2	230a)(230g) =		75	(231)
Electricity for lighting				311.36	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			3848.59	(338)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission fa kg CO2/kWh	ctor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216	=	376.92	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	370.92	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		747.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	161.59	(268)
Total CO2, kg/year	s	sum of (265)(271) =		948.36	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		14.55	(273)
El rating (section 14)				88	(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	12		Stroma Softwa	a Num Ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Pro	operty A	Address:	Kingsto	n Bridge	e 2BF 65	5 MID GA	AS	
Address :										
1. Overall dwelling dime	nsions:		-	()						
Ground floor			Area 6	a(m²) 65.2	(1a) x	Av. He	ight(m) 2.7	(2a) =	Volume(m³) 176.04	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	6	5.2	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	176.04	(5)
2. Ventilation rate:										
	main s	econdary		other		total			m ³ per hour	
Number of chimneys		0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	× 2	20 =	0	(6b)
Number of intermittent far	าร				- <u> </u>	2	x ′	10 =	20	(7a)
Number of passive vents					Ē	0	x ^	10 =	0	_ (7b)
Number of flueless gas fir	res				Г	0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	e flues and fans - (f	a)+(6b)+(7a	u)+(7b)+(7	7c) =	Г			· (E) -	J	7
If a pressurisation test has be	een carried out or is intende	ed. proceed	to (17). c	otherwise c	ontinue fro	om (9) to ((16)	- (5) -		
Number of storeys in th	e dwelling (ns)						-/		0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or (0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pro	esent, use the value corres	sponding to t	the greate	er wall area	a (after					
If suspended wooden fl	oor, enter 0.2 (unsea	led) or 0.1	l (seale	d), else	enter 0				0	J (12)
If no draught lobby, ent	er 0.05, else enter 0	,	(-,,					0	(13)
Percentage of windows	and doors draught s	tripped							0	 (14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10) ·	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cut	oic metres	per ho	ur per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabili	ty value, then (18) = [(1	(7) ÷ 20]+(8)	, otherwi	se (18) = (16)				0.36	(18)
Air permeability value applies	s if a pressurisation test ha	s been done	e or a deg	iree air pei	meability i	is being u	sed			-
Number of sides sheltered	d			(20) = 1 - [0 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	ng shelter factor			(21) = (18)	x (20) =	- /1			0.00	$\int_{(21)}^{(20)}$
Infiltration rate modified for	or monthly wind speed	4		() ()					0.31	
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		
\downarrow \downarrow \downarrow	1 1	1 1					1		I	
$\frac{1}{(22a)m} = \frac{1}{1} \frac{27}{1} \frac{1}{1} \frac{25}{1} \frac{1}{1} \frac{25}{1} \frac{1}{1} $	1 23 1 1 1 08	0 95	0.95	0.92	1	1 08	1 1 2	1 18		
(220)III 1.21 1.23	1.20 1.1 1.00	0.00	0.00	0.92	I	1.00	1.12	1.10		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-		-		-		
II IIIt			using Ann	ondix N (2	(25) - (22c	x = m v (c)	oquation (I		nvico (23h) = (23a)			0	(23a)
li exi				$\frac{1}{2}$.50) – (256	i) ^ FIIIV (6	equation (i		1WISE (23D) – (238)			0	(23b)
						or in-use i) =		00L \ F	4 (00)	0	(23c)
a) If	balance					at recove		HR) (24a T	a)m = (22)	2b)m + (23b) × [1 – (23C) T) ÷ 100]]	(245)
(24a)m=				0	0	0	0	0		0	0	0	J	(24a)
b) If	balance	ed mecha	anical ve	entilation	without	heat rec	covery (l	MV) (24b	o)m = (22	2b)m + (2	23b)		1	(0.41-)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) lf	whole h if (22b)n	ouse ex n < 0.5 ×	tract ver < (23b), †	ntilation of the the the the the the the the the the	or positiv c) = (23b	ve input v o); otherv	ventilatio wise (24	on from c c) = (22t	outside o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	ole hous)m = (221	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]			-	
(24d)m=	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - ei	nter (24a) or (24t	o) or (24	c) or (24	d) in box	(25)	-	-	-	-	
(25)m=	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3 Ho	at lossa	s and he	at loss	naramet	or.	•	•	•	•		•	•	-	
		Groe		Openin		Net Ar	·ea	LL-valı	10	ΔΧΠ		k-value	<u>α</u> Δ	Xk
		area	(m²)	r	93 1 ²	A,r	n²	W/m2	K	(W/I	K)	kJ/m ² ·	K k	J/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.4)+	0.04] =	7.64				(27)
Windo	ws Type	2				1.86		/[1/(1.4)+	0.04] =	2.47	=			(27)
Walls				9.48	3	34.64	1 X	0.18		6.24	= 			(29)
Total a	area of e	lements	, m²			44.12	2		I		J L			(31)
Party v	wall					44.12	2 X	0	= [0				(32)
Party f	loor					65.2			I				\dashv	(32a)
Party of	ceiling					65.2					Ĩ		\exists \vdash	(32b)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	n 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				18.8	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	12930.26	(34)
Therm	al mass	parame	eter (TMI	P = Cm +	+ TFA) ir	n kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the rulation.	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) ca	culated	using Ap	pendix ł	K						2.74	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			21.54	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y			,	(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ļ	
(38)m=	33.56	33.38	33.21	32.4	32.25	31.55	31.55	31.42	31.82	32.25	32.56	32.88	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	55.1	54.93	54.76	53.95	53.8	53.1	53.1	52.97	53.37	53.8	54.1	54.42		
									/	Average =	Sum(39)1	12 /12=	53.95	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	0.85	0.84	0.84	0.83	0.83	0.81	0.81	0.81	0.82	0.83	0.83	0.83		
Numbe	ar of day	us in mo	nth (Tab	le 12)			1	1		Average =	Sum(40)1.	.12 /12=	0.83	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	.lul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
· ·														
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	349 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . 9)	12		(42)
Annual Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	84 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
_										Total = Su	m(44) ₁₁₂ =		1015.8	(44)
Energy o	content of	hot water	used - cal	culated me	onthly = 4. I	190 x Vd,r 1	n x nm x L I	DTm / 3600) kWh/mor I	nth (see Ta I	ables 1b, 1	c, 1d)		
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
lf instant	aneous w	ater heati	ng at point	of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m=	20.71	18.12	18.69	16.3	15.64	13.49	12.5	14.35	14.52	16.92	18.47	20.06		(46)
Water	storage	loss:												
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel	()		(47)
If comr	nunity h	eating a	and no ta	ink in dw	/elling, e	nter 110	litres in	ı (47)		(0)				
Water -	/ISE IT NO	o stored	hot wate	er (this ir	ICLUDES I	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):)		(48)
Tempe	rature f	actor fro	m Table	2b		,)		(49)
Energy	lost fro	m water	r storage	, kWh/ye	ear			(48) x (49)) =))		(50)
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:							
Hot wa	iter stor	age loss	factor fi	om Tabl	le 2 (kW	h/litre/da	iy)				(0		(51)
Volume	e factor	from Ta	ble 2a	011 4.5								n		(52)
Tempe	rature f	actor fro	m Table	2b							(у Э		(53)
Energy	lost fro	m water	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		 C		(54)
Enter	(50) or ((54) in (8	55)	-							(C		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Appendi	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3						(2		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 30	65 × (41)	m					
(moc	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	month	(61)m =	(60)	÷ 365 × (41)m						
(61)m=	47.45	41.3	44	40.91	40.55	37.	57 38.82	40.55	40.91	44	44.25	47.45		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for (each month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	185.54	162.07	168.63	149.56	144.8	127	.53 122.19	136.2	137.71	156.82	167.4	181.18		(62)
Solar DH	-IW input	calculated	using App	endix G o	Appendix	: H (ne	gative quantit	y) (enter	'0' if no sola	ar contribu	tion to wate	er heating)	•	
(add a	dditiona	I lines if	FGHRS	and/or \	WWHRS	app	lies, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	C	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	185.54	162.07	168.63	149.56	144.8	127	.53 122.19	136.2	137.71	156.82	167.4	181.18		
		-		-			-	O	Itput from w	ater heate	er (annual)	112	1839.64	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [C	.85 × (45)m	ו + (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	57.78	50.48	52.44	46.35	44.8	39.	31 37.42	41.94	42.41	48.51	52.01	56.33		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylind	er is in the	dwellin	g or hot w	/ater is f	rom com	munity h	neating	
5. Int	ernal g	ains (see	e Table {	5 and 5a):									
Metabo	olic gair	ns (Table	.5) Wa	tts	/									
motab	Jan	Feb	Mar	Apr	May	Ju	ın Jul	Auc	Sep	Oct	Nov	Dec	1	
(66)m=	106.21	106.21	106.21	106.21	106.21	106	.21 106.21	106.2 ⁴	106.21	106.21	106.21	106.21		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L	9 or L9a), a	also see	e Table 5				1	
(67)m=	17.63	15.66	12.73	9.64	7.21	6.0	6.57	8.55	11.47	14.56	17	18.12	1	(67)
Applia	nces da	ins (calc	ulated ir	n Append	dix L. ea	uatio	n L13 or L1	3a), al	so see Ta	ble 5		Į	1	
(68)m=	185.85	187.77	182.91	172.57	159.51	147	.23 139.03	137.1	141.97	152.31	165.37	177.65		(68)
Cookin	na aains	i (calcula	ted in A	ppendix	L. equat	ion l	 15 or L15a), also	see Table	e 5			1	
(69)m=	33.62	33.62	33.62	33.62	33.62	33.	62 33.62	33.62	33.62	33.62	33.62	33.62	1	(69)
Pumps	and fa	ns dains	(Table)	5a)	I			1		I		I	1	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
Losses		I vaporatio	n (nega	i tive valu	i es) (Tab	le 5)				1	I		1	
(71)m=	-84.97	-84.97	-84.97	-84.97	-84.97	-84	.97 -84.97	-84.97	-84.97	-84.97	-84.97	-84.97]	(71)
Water	L heating	I dains (1	I Table 5)							I			1	
(72)m=	77.66	75.12	70.48	64.38	60.22	54.	59 50.3	56.38	58.91	65.2	72.23	75.71	1	(72)
Total i	nternal	l gains =	I				(66)m + (67)n	L n + (68)n	1 + (69)m +	(70)m + (1 71)m + (72)m	1	
(73)m=	339	336.42	323.99	304.45	284.8	265	.77 253.77	259.89	270.21	289.94	312.47	329.34	1	(73)
6. Sol	ar gain	s:						1						• •
Solar g	ains are	calculated	using sola	r flux from	Table 6a	and a	ssociated equa	ations to	convert to th	ne applica	ble orientat	tion.		
Orienta	ation:	Access F	actor	Area			Flux		g_		FF		Gains	
	-	Table 6d		m²			Table 6a		Table 6b	Т	able 6c		(W)	
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	11.28) x [0.63	x	0.7	=	19.86	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	1.8	36	×Г	11.28] × [0.63	× [0.7	= =	12.83	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	5.7	76	×Г	22.97] × [0.63	× [0.7	=	40.43	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	1.8	36	×Г	22.97] × [0.63		0.7	=	26.11	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	41.38] × [0.63	× [0.7	=	72.84	(75)

Northeast 0.9x 0.77 × 1.86 × 41.38 × 0.63 × 0.7 = 47.04 (7 Northeast 0.9x 0.77 × 5.76 × 67.96 × 0.63 × 0.7 = 119.62 (7 Northeast 0.9x 0.77 × 1.86 × 67.96 × 0.63 × 0.7 = 119.62 (7 Northeast 0.9x 0.77 × 1.86 × 91.35 × 0.63 × 0.7 = 110.86 (7 Northeast 0.9x 0.77 × 1.86 × 91.35 × 0.63 × 0.7 = 110.86 (7 Northeast 0.9x 0.77 × 5.76 × 91.35 × 0.63 × 0.7 = 110.37 (7 Northeast 0.9x 0.77 × 5.76 × 91.1 × 0.63 × 0.7 = 110.71 (7 Northeast 0.9x 0.77 × 5.76 × 91.1 × 0.63 × 0.7 = 110.37 (7 Northeast 0.9x 0.77 × 1.86 × 91.1 × 0.63 × 0.7 = 110.37 (7 Northeast 0.9x 0.77 × 1.86 × 91.1 × 0.63 × 0.7 = 110.37 (7 Northeast 0.9x 0.77 × 1.86 × 91.1 × 0.63 × 0.7 = 103.57 (7 Northeast 0.9x 0.77 × 1.86 × 91.1 × 0.63 × 0.7 = 103.57 (7 Northeast 0.9x 0.77 × 1.86 × 72.63 × 0.63 × 0.7 = 102.57 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 102.57 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 49.41 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 49.41 (7 Northeast 0.9x 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 57.32 (7 Northeast 0.9x 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 116.22 (7 Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7 Solar gains in watts, calculated for each mont (8)m= 3.209 6.54 119.88 196.82 24.45 12.82 (14 26.94 120.42 140.08 18.1.32 41.13 26.7 (8 (8)m= 3.209 6.54 119.88 196.82 0.44 54.792 517.71 470.31 416.29 371.26 35.6 356.03 (6 2 b Mar Apr May Jun Jul Aug Sep Oct Nov Dec (8)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 Mean internal temperature in																			
Northeast 0.9x 0.77 × 5.76 × 67.36 × 0.63 × 0.7 = 119.62 (7 Northeast 0.9x 0.77 × 5.76 × 0.138 × 0.63 × 0.7 = 77.26 (7 Northeast 0.9x 0.77 × 5.76 × 0.138 × 0.63 × 0.7 = 100.86 (7 Northeast 0.9x 0.77 × 1.86 × 0.738 × 0.63 × 0.7 = 103.85 (7 Northeast 0.9x 0.77 × 1.86 × 0.738 × 0.63 × 0.7 = 101.7143 (7 Northeast 0.9x 0.77 × 1.86 × 0.738 × 0.63 × 0.7 = 100.37 (7 Northeast 0.9x 0.77 × 1.86 × 0.738 × 0.63 × 0.7 = 100.37 (7 Northeast 0.9x 0.77 × 1.86 × 0.71 × 0.63 × 0.7 = 100.37 (7 Northeast 0.9x 0.77 × 1.86 × 0.71 × 0.63 × 0.7 = 100.37 (7 Northeast 0.9x 0.77 × 1.86 × 0.72 × 0.63 × 0.7 = 103.57 (7 Northeast 0.9x 0.77 × 1.86 × 0.72 × 0.63 × 0.7 = 127.85 (7 Northeast 0.9x 0.77 × 1.86 × 72.63 × 0.63 × 0.7 = 127.85 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 62.57 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 62.57 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 62.57 (7 Northeast 0.9x 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 64.41 (7 Northeast 0.9x 0.77 × 1.86 × 0.42 × 0.63 × 0.7 = 64.27 (7 Northeast 0.9x 0.77 × 1.86 × 0.42 × 0.63 × 0.7 = 64.27 (7 Northeast 0.9x 0.77 × 1.86 × 0.42 × 0.63 × 0.7 = 14.41 (7 Northeast 0.9x 0.77 × 1.86 × 0.42 × 0.63 × 0.7 = 14.41 (7 Northeast 0.9x 0.77 × 1.86 × 0.42 × 0.63 × 0.7 = 14.41 (7 Northeast 0.9x 0.77 × 1.86 × 0.42 × 0.63 × 0.7 = 16.14 (7 Northeast 0.9x 0.77 × 1.86 × 0.21 × 0.63 × 0.7 = 10.48 (7 Solar gains in watts, calculated for each mont (8)m = Sum(74)m(82)m (8)m = 371.69 40.29 443.88 613.4 649.44 647.92 617.71 470.31 416.29 371.26 353.6 356.03 (6 7 Mean internal emperature (healing seasion) Temperature during heating periods in the living area from Table 9. (8)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 Mean internal temperature in living area 11. (follow steps 3 to 7 in Table 9C) (8)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 Mean internal temperature in living area 11. (follow steps 3 to 7 in Table 9C) (8)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 Mean internal temperature in living area 11. (foll	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	×	4	1.38	x	(0.63	x	0.7		= [47.04	(75)	
Northeast 0.9x 0.77 x 1.86 x 67.96 x 0.63 x 0.7 = 77.26 (7 Northeast 0.9x 0.77 x 5.76 x 91.35 x 0.63 x 0.7 = 160.8 (7 Northeast 0.9x 0.77 x 1.86 x 91.35 x 0.63 x 0.7 = 1103.85 (7 Northeast 0.9x 0.77 x 5.76 x 91.38 x 0.63 x 0.7 = 110.71 (7 Northeast 0.9x 0.77 x 1.86 x 97.38 x 0.63 x 0.7 = 110.71 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 160.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 160.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 160.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 160.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 160.37 (7 Northeast 0.9x 0.77 x 1.86 x 0.72 x 0.63 x 0.7 = 127.85 (7 Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 127.85 (7 Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 82.57 (7 Northeast 0.9x 0.77 x 1.86 x 20.42 x 0.63 x 0.7 = 67.32 (7 Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 63.191 (7 Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 49.41 (7 Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 31.91 (7 Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 31.91 (7 Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.22 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.22 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.22 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.22 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7 Solar gains in watts, calculated for each month (8)m 92 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7 Solar gains in watts, calculated for each month (8)m 12 2.69 6.654 119.8 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8 7. Mean internal emperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8 (8)m 11 0.99 0.95 0.32 (0.61 0.45 0.51 0.81 0.98 11 1 Mean internal temperature in living area 11 (follow steps 3 to	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	j ×	6	67.96	x		0.63	×	0.7		= [119.62	(75)	
Northeast 0.9x 0.77 x 5.76 x 91.35 x 0.63 x 0.7 = 160.8 (7 Northeast 0.9x 0.77 x 1.86 x 91.35 x 0.63 x 0.7 = 1107.1 (7 Northeast 0.9x 0.77 x 1.86 x 91.35 x 0.63 x 0.7 = 1107.1 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 100.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 100.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 100.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 100.37 (7 Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 103.57 (7 Northeast 0.9x 0.77 x 1.86 x 0.72 x 0.63 x 0.7 = 103.57 (7 Northeast 0.9x 0.77 x 1.86 x 0.72 x 0.63 x 0.7 = 102.57 (7 Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 127.85 (7 Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 82.57 (7 Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 82.57 (7 Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 31.91 (7 Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 31.91 (7 Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 31.91 (7 Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 31.91 (7 Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.14 (7 Northeast 0.9x 0.77 x 0.	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86] ×	6	67.96	x		0.63	×	0.7		= [77.26	(75)	
Northeast 0.9x 0.77 × 1.86 × 91.35 × 0.63 × 0.7 = 103.85 (7) Northeast 0.9x 0.77 × 5.76 × 97.38 × 0.63 × 0.7 = 110.71 (7) Northeast 0.9x 0.77 × 5.76 × 91.1 × 0.63 × 0.7 = 110.71 (7) Northeast 0.9x 0.77 × 5.76 × 91.1 × 0.63 × 0.7 = 103.57 (7) Northeast 0.9x 0.77 × 5.76 × 91.1 × 0.63 × 0.7 = 103.57 (7) Northeast 0.9x 0.77 × 1.86 × 97.263 × 0.63 × 0.7 = 127.85 (7) Northeast 0.9x 0.77 × 1.86 × 97.263 × 0.63 × 0.7 = 22.57 (7) Northeast 0.9x 0.77 × 5.76 × 22.80 × 0.63 × 0.7 = 22.57 (7) Northeast 0.9x 0.77 × 5.76 × 22.807 × 0.63 × 0.7 = 57.32 (7) Northeast 0.9x 0.77 × 5.76 × 28.07 × 0.63 × 0.7 = 57.32 (7) Northeast 0.9x 0.77 × 5.76 × 28.07 × 0.63 × 0.7 = 49.41 (7) Northeast 0.9x 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 49.41 (7) Northeast 0.9x 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast 0.9x 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast 0.9x 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.22 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast 0.9x 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Solar gains in watts, calculated for each mont (8)m = 371.69 402.96 443.88 501.34 547.32 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (neating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area 11 (follow steps 3 to 7 in Table 9c) (8)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 1 Mean internal temperature in living area 11 (follow steps 3 to 7 in Table 9c) (8)m = 20.16 20.26 20.46 20.73 20.83 20.99 21 21 20.25 20.7 20.39 20.15 (8) Temperature during heating periods in the living from Table 9, Th2 (°C) (8)m = 20.41 20.22 20.22 20.22 20.22 20.24 20.24 20.24 20.24 20.24 20.24 20	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	j ×	g	1.35	x		0.63	×	0.7		= [160.8	(75)	
Northeast 0.9x 0.77 × (5.76) × (97.38) × (0.63) × (0.7) = (171.43) (7 Northeast 0.9x 0.77 × (1.86) × (97.38) × (0.63) × (0.7) = (100.37) (7 Northeast 0.9x 0.77 × (5.76) × (91.1) × (0.63) × (0.7) = (100.37) (7 Northeast 0.9x 0.77 × (5.76) × (91.1) × (0.63) × (0.7) = (100.37) (7 Northeast 0.9x 0.77 × (5.76) × (72.63) × (0.63) × (0.7) = (127.85) (7 Northeast 0.9x 0.77 × (5.76) × (72.63) × (0.63) × (0.7) = (22.57) (7 Northeast 0.9x 0.77 × (5.76) × (50.42) × (0.63) × (0.7) = (82.57) (7 Northeast 0.9x 0.77 × (5.76) × (50.42) × (0.63) × (0.7) = (82.57) (7 Northeast 0.9x 0.77 × (5.76) × (22.63) × (0.63) × (0.7) = (49.41) (7 Northeast 0.9x 0.77 × (5.76) × (22.07) × (0.63) × (0.7) = (49.41) (7 Northeast 0.9x 0.77 × (5.76) × (14.2) × (0.63) × (0.7) = (49.41) (7 Northeast 0.9x 0.77 × (5.76) × (14.2) × (0.63) × (0.7) = (49.41) (7 Northeast 0.9x 0.77 × (5.76) × (14.2) × (0.63) × (0.7) = (49.41) (7 Northeast 0.9x 0.77 × (5.76) × (14.2) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (14.2) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (9.21) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (9.21) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (9.21) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (9.21) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (9.21) × (0.63) × (0.7) = (16.14) (7 Northeast 0.9x 0.77 × (1.86) × (9.21) × (16.10)	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	g	91.35	x		0.63	x	0.7		= [103.85	(75)	
Northeast 0.9x 0.77 x 1.86 x 97.38 x 0.63 x 0.7 = 110.71 (7) Northeast 0.9x 0.77 x 5.76 x 91.1 x 0.63 x 0.7 = 160.37 (7) Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 127.85 (7) Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 127.85 (7) Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 82.57 (7) Northeast 0.9x 0.77 x 1.86 x 50.42 x 0.63 x 0.7 = 82.57 (7) Northeast 0.9x 0.77 x 1.86 x 50.42 x 0.63 x 0.7 = 88.76 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 49.11 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 49.11 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 101.17 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 101.17 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 101.17 (7) Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 101.17 (7) Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 101.14 (7) Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 101.14 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.44 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.44 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 101.48 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 100.48 (8) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.83 x 0.7 = 100.48 (8) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.83 x 0.7 = 100.48 (8) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.83 x 0.7 = 100.48 (8) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.83 x 0.7 = 100.48 (8) Northeast 0.9x 0.77 x 1.86	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	x	g	97.38	x		0.63	×	0.7		= [171.43	(75)	
Northeast 0.9x 0.77 x 5.76 x 91.1 x 0.63 x 0.7 = 160.37 (7) Northeast 0.9x 0.77 x 1.86 x 91.1 x 0.63 x 0.7 = 103.57 (7) Northeast 0.9x 0.77 x 5.76 x 72.63 x 0.63 x 0.7 = 127.85 (7) Northeast 0.9x 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 82.57 (7) Northeast 0.9x 0.77 x 5.76 x 50.42 x 0.63 x 0.7 = 82.57 (7) Northeast 0.9x 0.77 x 1.86 x 50.42 x 0.63 x 0.7 = 88.76 (7) Northeast 0.9x 0.77 x 1.86 x 50.42 x 0.63 x 0.7 = 67.32 (7) Northeast 0.9x 0.77 x 1.86 x 50.42 x 0.63 x 0.7 = 64.41 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 44.41 (7) Northeast 0.9x 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 31.91 (7) Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 24.99 (7) Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 161.41 (7) Northeast 0.9x 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 161.41 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.42 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 161.22 (7) Northeast 0.9x 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (8)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) Mean internal temperature (heating seesion) Temperature during heating periods in the living area for Table 9, Th1 (°C) 21 (8) Mean internal temperature in living area for table 9, Th1 (°C) (8)m = 20.16 20.26 20.46 20.73 20.93 20.94 21.21 20.25 20.7 20.39 20.15 (8) Temperature during h	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	g	97.38	x		0.63	×	0.7		= [110.71	(75)	
Northeast $0.9x$ 0.77 × 1.86 × 91.1 × 0.63 × 0.7 = 103.57 (7) Northeast $0.9x$ 0.77 × 5.76 × 72.63 × 0.63 × 0.7 = 127.85 (7) Northeast $0.9x$ 0.77 × 1.86 × 72.63 × 0.63 × 0.7 = 82.57 (7) Northeast $0.9x$ 0.77 × 5.76 × 50.42 × 0.63 × 0.7 = 88.76 (7) Northeast $0.9x$ 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.42 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.42 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 19.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 0.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 0.92.1 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 0.92.1 × 0.63 × 0.7 = 10.48 (7) Mortheast $0.9x$ 0.77 × 1.86 × 0.92.1 × 0.63 × 0.7 = 10.48 (7) Mortheast $0.9x$ 0.77 × 1.86 × 0.92.1 × 0.63 × 0.7 = 10.48 (7) Mortheast $0.9x$ 0.77 × 0.	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	x		91.1	x		0.63	x	0.7		= [160.37	(75)	
Northeast $0.9x$ 0.77 × 5.76 × 72.63 × 0.63 × 0.7 = 127.85 (7) Northeast $0.9x$ 0.77 × 1.86 × 72.63 × 0.63 × 0.7 = 82.57 (7) Northeast $0.9x$ 0.77 × 5.76 × 50.42 × 0.63 × 0.7 = 88.76 (7) Northeast $0.9x$ 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 88.76 (7) Northeast $0.9x$ 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 × 5.76 × 28.07 × 0.63 × 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 5.76 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.83 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.83 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 0.92 (1.7 × 0.93 20.90 × 0.17 (1.40 × 0.98 1) 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9, Th1 (°C) 21 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9. (C) (8)m ^m 20.16 20.26 20.46 20.73 20.93 20.99 21 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in the stor dwelling from Table 9, Th2 (°C) (8)	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x		91.1	x	(0.63	x	0.7		= [103.57	(75)	
Northeast $0.9x$ 0.77 x 1.86 x 72.63 x 0.63 x 0.7 = 82.57 (7) Northeast $0.9x$ 0.77 x 5.76 x 50.42 x 0.63 x 0.7 = 88.76 (7) Northeast $0.9x$ 0.77 x 1.86 x 50.42 x 0.63 x 0.7 = 57.32 (7) Northeast $0.9x$ 0.77 x 5.76 x 28.07 x 0.63 x 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 x 1.86 x 28.07 x 0.63 x 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 x 5.76 x 14.2 x 0.63 x 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 x 5.76 x 14.2 x 0.63 x 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 x 5.76 x 9.21 x 0.63 x 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 x 5.76 x 9.21 x 0.63 x 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (8)m = (73)m + (83)m, watts (84)m 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 31.32 61.7 (8) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) Main Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (80)m 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area 11 (follow steps 3 to 7 in Table 9c) (97)m 20.16 20.26 20.48 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (8)m 20.21 20.22 20.	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	x	7	2.63	x		0.63	×	0.7		= [127.85	(75)	
Northeast $0.9x$ 0.77 × 5.76 × 50.42 × 0.63 × 0.7 = 88.76 (7) Northeast $0.9x$ 0.77 × 1.86 × 50.42 × 0.63 × 0.7 = 57.32 (7) Northeast $0.9x$ 0.77 × 5.76 × 28.07 × 0.63 × 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.83 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.83 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.83 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 0.78 ×	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	7	2.63	x	(0.63	x	0.7		= [82.57	(75)	
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Northeast $0.9x$ 0.77 × 5.76 × 28.07 × 0.63 × 0.7 = 49.41 (7) Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 5.76 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (8)m= 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains – internal and solar (84)m = (73)m + (83)m, watts (8)m= 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area T1 (follow steps 3 to 7 in Table 9c) (8)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (8)m= 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (8)m= 20.21 20.22 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.24 20.24 20.23 20.23 20.2	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	5	50.42	x		0.63	x	0.7		= [57.32	(75)	
Northeast $0.9x$ 0.77 × 1.86 × 28.07 × 0.63 × 0.7 = 31.91 (7) Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 5.76 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains - internal and solar (84)m = (73)m + (83)m , watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 20.21 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	x	2	28.07	x		0.63	x	0.7		= [49.41	(75)	
Northeast $0.9x$ 0.77 × 5.76 × 14.2 × 0.63 × 0.7 = 24.99 (7) Northeast $0.9x$ 0.77 × 1.86 × 14.2 × 0.63 × 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 × 5.76 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 × 1.86 × 9.21 × 0.63 × 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 20.21 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x	2	28.07	x		0.63	x	0.7		= [31.91	(75)	
Northeast $0.9x$ 0.77 x 1.86 x 14.2 x 0.63 x 0.7 = 16.14 (7) Northeast $0.9x$ 0.77 x 5.76 x 9.21 x 0.63 x 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 20.21 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	x		14.2	x		0.63	x	0.7		= [24.99	(75)	
Northeast $0.9x$ 0.77 x 5.76 x 9.21 x 0.63 x 0.7 = 16.22 (7) Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (6) Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 20.21 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.24 20.23 20.23 20.23 (8)	Northea	ast <mark>0.9x</mark>	0.77	x	1	.86	x		14.2	x		0.63	x	0.7		= [16.14	(75)	
Northeast $0.9x$ 0.77 x 1.86 x 9.21 x 0.63 x 0.7 = 10.48 (7) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) <u>Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec</u> (86)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m = 20.21 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Northea	ast <mark>0.9x</mark>	0.77	x	5	.76	×	9	9.21	x	(0.63	x	0.7		= [16.22	(75)	
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 32.69 66.54 119.88 196.88 264.65 282.14 263.94 210.42 146.08 81.32 41.13 26.7 (8) Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 $(86)m$ 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 $(88)m$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.98 1 1 $(80)m$ 1 1 $(80)m$ 1 1 $(80)m$ 1 1 $(80)m$ 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 $(80$	Northea	ast _{0.9x}	0.77	x	1	.86	x		9.21	×	(0.63	x	0.7		= [10.48	(75)	
(83)m = Sun(74)m(82)m (83)m = Sun(74)m(82)m (83)m = Sun(74)m(82)m (83)m = Sun(74)m(82)m (83)m = Sun(74)m(82)m Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.71 470.31 416.29 371.26 353.6 356.03 (8 Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m = 371.69 402.96 443.88 501.34 549.44 547.71 470.31 416.29 371.26 353.6 356.03 (8 Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 21 21 21 21 21 21 21 21 (8) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 0.82 0.61 <th colsp<="" td=""><td>Solar</td><td>noine in</td><td>watta a</td><td>alaulata</td><td>tor oo</td><td>h mon</td><td>th</td><td></td><td></td><td>(02)~</td><td></td><td>n(74)m</td><td>(02)m</td><td></td><td></td><td></td><td></td><td></td></th>	<td>Solar</td> <td>noine in</td> <td>watta a</td> <td>alaulata</td> <td>tor oo</td> <td>h mon</td> <td>th</td> <td></td> <td></td> <td>(02)~</td> <td></td> <td>n(74)m</td> <td>(02)m</td> <td></td> <td></td> <td></td> <td></td> <td></td>	Solar	noine in	watta a	alaulata	tor oo	h mon	th			(02)~		n(74)m	(02)m					
Total gains – internal and solar (84)m = (73)m + (83)m , watts Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts (84)m = $(73)m + (83)m$, watts Total gains – internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m = 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m = 20.16 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 (8 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) <td cols<="" td=""><td>(83)m=</td><td>32.69</td><td>66.54</td><td>119.88</td><td>196.88</td><td>264.6</td><td>5 2</td><td>282.14</td><td>263.94</td><td>210</td><td>).42</td><td>146.08</td><td>81.32</td><td>41.13</td><td>26</td><td>.7</td><td></td><td>(83)</td></td>	<td>(83)m=</td> <td>32.69</td> <td>66.54</td> <td>119.88</td> <td>196.88</td> <td>264.6</td> <td>5 2</td> <td>282.14</td> <td>263.94</td> <td>210</td> <td>).42</td> <td>146.08</td> <td>81.32</td> <td>41.13</td> <td>26</td> <td>.7</td> <td></td> <td>(83)</td>	(83)m=	32.69	66.54	119.88	196.88	264.6	5 2	282.14	263.94	210).42	146.08	81.32	41.13	26	.7		(83)
(84)m= 371.69 402.96 443.88 501.34 549.44 547.92 517.71 470.31 416.29 371.26 353.6 356.03 (8) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) Mar Apr May Jun Jul Aug Sep Oct Nov Dec (8) (86)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 20.16 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (8) (80.21 20.22 20.22 20.23 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Total g	L jains – i	I nternal a	and sola	I r (84)m	 = (73)n	n + ((83)m	, watts	1									
7. Mean internal temperature (heating season)Temperature during heating periods in the living area from Table 9, Th1 (°C)21Utilisation factor for gains for living area, h1,m (see Table 9a)JanFebMarAprMayJunJulAugSepOctNovDec(86)m=110.990.950.820.610.450.510.810.9811(8)Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)(87)m=20.1620.2620.4620.7320.99212120.9520.720.3920.15(8)Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)(88)m=20.2120.2220.2320.2320.2420.2420.2420.2420.2320.2320.22(8)	(84)m=	371.69	402.96	443.88	501.34	549.4	4 5	547.92	517.71	470	.31 4	416.29	371.26	353.6	356	.03		(84)	
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (8) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 20.16 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.21 20.22 20.23 20.24 20.24 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23 20.23	7 Me	an inte	nal tem	perature	(heatin	a seaso	on)		1	•					1				
Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 20.16 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.21 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Temp	erature	during h	neating p	periods	in the li	ving	area	from Ta	ble 9	, Th1	(°C)				Г	21	(85)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 20.16 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.21 20.22 20.23 20.23 20.24 20.24 20.24 20.23 20.23 20.22 (8)	Utilisa	ation fac	ctor for a	ains for	living a	ea, h1,	m (s	see Та	ible 9a)							L			
(86)m= 1 1 0.99 0.95 0.82 0.61 0.45 0.51 0.81 0.98 1 1 (8) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.21 20.22 20.23 20.23 20.24 20.24 20.24 20.23 20.23 20.22 (8)		Jan	Feb	Mar	Apr	Ma	уÌ	Jun	Jul	A	ug	Sep	Oct	Nov	D	ec			
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 20.16 20.26 20.46 20.73 20.99 21 21 20.95 20.7 20.39 20.15 (8 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) 88/m= 20.21 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.23 20.23 20.22 (8	(86)m=	1	1	0.99	0.95	0.82		0.61	0.45	0.5	51	0.81	0.98	1	1			(86)	
(87)m= 20.16 20.26 20.46 20.73 20.93 20.99 21 21 20.95 20.7 20.39 20.15 (8 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.21 20.22 20.23 20.23 20.24 20.24 20.24 20.23 20.23 20.22 (8	Mean	interna	l temper	ature in	livina a	rea T1	(follo	ow ste	ns 3 to '	7 in T	[able]	9c)			•				
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.21 20.22 20.23 20.23 20.24 20.24 20.24 20.23 20.23 20.23 (8)	(87)m=	20.16	20.26	20.46	20.73	20.93	3	20.99	21	2	1	20.95	20.7	20.39	20.	15		(87)	
(88)m= 20.21 20.22 20.22 20.23 20.23 20.24 20.24 20.24 20.24 20.24 20.23 20.23 20.23 (8)	Temp	erature	durina t	neating r		in rest o	of dv	velling	from T:	- able (9 Th2	ـــــــــــــــــــــــــــــــــــــ		-!	Į				
	(88)m=	20.21	20.22	20.22	20.23	20.23		20.24	20.24	20.	.24	20.24	20.23	20.23	20.	22		(88)	

(89) 0.54 0.37 0.43 0.75 0.97 1 (89)m= 1 1 0.99 0.94 0.78 0.99 Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 20.24 19.08 19.23 19.52 20.16 (90) (90)m= 19.91 20.24 20.24 20.2 19.87 19.42 19.07 $fLA = Living area \div (4) =$ 0.38 (91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

									, ,				_
(92)m=	19.5	19.63	19.88	20.23	20.46	20.53	20.53	20.53	20.49	20.19	19.79	19.48	(92)

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

(93)m=	19.5	19.63	19.88	20.23	20.46	20.53	20.53	20.53	20.49	20.19	19.79	19.48		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set T the ut	i to the i ilisation	mean int factor fo	ternal tei or gains	mperatui using Ta	re obtair able 9a	ied at ste	ep 11 of	Table 9	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	ation fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.98	0.94	0.79	0.57	0.4	0.46	0.77	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	370.61	400.76	437.02	469.96	435.85	311.28	208.45	218.14	320.07	358.38	351.41	355.24		(95)
Month	nly aver	age exte	ernal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m : I	x [(93)m	– (96)m]				
(97)m=	837.41	808.97	732.57	611.09	471.05	314.61	208.74	218.83	340.92	515.93	686.79	831.62		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Nh/moni	th = 0.02	24 x [(97)m – (95 L)m] x (4	1)m			
(98)m=	347.3	274.32	219.88	101.61	26.19	0	0	0	0	117.21	241.48	354.42		1
								Tota	ll per year	(kWh/year	⁻) = Sum(9	8)15,912 =	1682.42	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								25.8	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												-
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g require	ement (c	alculate	d above)		1						
	347.3	274.32	219.88	101.61	26.19	0	0	0	0	117.21	241.48	354.42		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	371.84	293.7	235.42	108.79	28.04	0	0	0	0	125.49	258.54	379.47		_
								Tota	ll (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1801.3	(211)
Space = {[(98	e heatin)m x (20	g fuel (s)1)] } x 1	econdar 00 ÷ (20	y), kWh/)8)	month									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	1												1
Output	from w	ater hea	ter (calc	ulated a	bove)									
	185.54	162.07	168.63	149.56	144.8	127.53	122.19	136.21	137.71	156.82	167.4	181.18		_
Efficier	ncy of w	ater hea	ater	-				-					80.3	(216)
(217)m=	86.61	86.37	85.72	84.1	81.7	80.3	80.3	80.3	80.3	84.33	85.97	86.71		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100	$) \div (217)$)m	177.04	150.00	150.46	160.62	171 5	10E 0E	104 74	200 05		
(219)11=	214.23	107.00	190.72	1//.84	177.24	130.82	152.10		= Sum(2)	192) -	194.71	200.95	0405.4	
	4-4-1-							TULA	– Ourri(Z	- Jul ₁₁₂ –	A/b /		2195.4	J ⁽²¹⁹⁾
Space	heating	fueluse	ed main	system	1					K	wn/yeai		1801 3	1
Space	nearing	1001 030	sa, main	System									1001.3	1

Water heating fuel used				2195.4]
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 (2	30a)(230g) =		75	(231)
Electricity for lighting				311.36	(232)
Total delivered energy for all uses (211)(221) + ((231) + (232)(237b) =			4383.06	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				-
	Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	ır
Space heating (main system 1)	Energy kWh/year (211) x	Emission fact kg CO2/kWh	or =	Emissions kg CO2/yea 389.08	ar](261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Emission fact kg CO2/kWh 0.216 0.519	or = =	Emissions kg CO2/yea 389.08	ar](261)](263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = =	Emissions kg CO2/yea 389.08 0 474.21	ar](261)](263)](264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264)	Emission fact kg CO2/kWh 0.216 0.519 0.216	or = =	Emissions kg CO2/yea 389.08 0 474.21 863.29	ar](261)](263)](264)](265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x	Emission fact kg CO2/kWh 0.216 0.519 0.216 =	or = = =	Emissions kg CO2/yea 389.08 0 474.21 863.29 38.93	ar](261)](263)](264)](265)](267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Emission fact kg CO2/kWh 0.216 0.519 0.216 = 0.519 0.519	or = = =	Emissions kg CO2/yea 389.08 0 474.21 863.29 38.93 161.59	ar](261)](263)](264)](265)](267)](268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x S	Emission fact kg CO2/kWh 0.216 0.519 0.216 = 0.519 0.519 0.519 0.519	or = = =	Emissions kg CO2/yea 389.08 0 474.21 863.29 38.93 161.59 1063.81	ar](261)](263)](264)](265)](267)](268)](272)

TER =

16.32 (273)

		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	Num re Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property A	Address:	Kingsto	n Bridge	e 2BF 65	5 TOP G	AS	
Address :									
1. Overall dwelling dimer	nsions:	٨	(100 2)			arla 4 (ma)			
Ground floor		Area	a(m²)	1a) x			(2a) =	176.04	1 (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 6	5.2	4)		1	()	170.04	
Dwelling volume	, (, (, (, (,		JJ.2	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	176.04] (5)
								110.04	
2. Ventilation rate:	main seco	ondary	other		total			m ³ per hour	
Number of chimneye	heating hea	ting		ı			10 - I		٦
Number of chimneys			0		0		- 0	0	(6a)
Number of open flues	0 +	0 +	0	=	0	x 2	20 =	0	(6b)
Number of intermittent far	IS				2	x 1	0 =	20	(7a)
Number of passive vents				Г	0	x 1	0 =	0	(7b)
Number of flueless gas fir	es				0	x 4	40 =	0	(7c)
							Air ch	anges per hoj	ır
Infiltration due to chimmon	$(a, f _{a,a,a}) = (a, b)$	(6b)+(7c)+(7b)+(⁻	70) -	_					יי ר
Initiation due to chimney	S, HUES and rans = $(0a)$ +	$(00)^+(7a)^+(70)^+(7a)^+(7b)$	otherwise c	ontinue fro	om (9) to ((16)	+ (5) =		
Number of storeys in th	e dwelling (ns)	proceed to (11), e			, (0) 10 (10)	[0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber fram	me or 0.35 for	masonry	constru	uction			0	(11)
if both types of wall are pre	esent, use the value correspon	nding to the greate	er wall area	(after					_
If suspended wooden fl	gs); if equal user 0.35) or 0 1 (seale	d) else é	enter 0			1	0	7(12)
If no draught lobby, ent	er 0.05. else enter 0		u), cióc (0	(12)
Percentage of windows	and doors draught strip	ped						0	(14)
Window infiltration	0 11	•	0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) +	(11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o	q50, expressed in cubic	metres per ho	ur per sq	uare me	etre of e	nvelope	area	4	(17)
If based on air permeabilit	ty value, then (18) = [(17) ÷	+ 20]+(8), otherwi	se (18) = (1	6)				0.31	(18)
Air permeability value applies	; if a pressurisation test has be	een done or a deg	iree air peri	neability i	is being us	sed			-
Number of sides sheltered	1		(20) = 1 - [() 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	na shelter factor		(20) = (18)	x (20) =	0)]		l	0.85	(20)
Infiltration rate modified for	or monthly wind spood		(21) (10)	x (20)			l	0.27	(21)
	Mar Apr May		Διια	Sen	Oct	Nov	Dec		
Monthly average wind and	and from Table 7		Aug	OCP	001	NOV	Dee		
$(22)m = \begin{bmatrix} 51 \\ 5 \end{bmatrix} \begin{bmatrix} 5 \\ 5 \end{bmatrix}$		38 38	37	4	43	45	47		
		0.0	5.7	т	-1.0	- 1 .5	-7.1		
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		

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m		-			
<u> </u>	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calcul If me	ate etter echanica	ctive air al ventila	change	rate for t	he appli	cable ca	ISE						0	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	(23a) = (23a	ı) × Fmv (e	equation (I	N5)) . othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(23c)
a) If	balance	d mech	anical ve	ntilation	with he	at recove	erv (MVI	HR) (24a	, a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0		0		(24a)
b) If	balance	d mech	i anical ve	ntilation	u without	heat rec	L Coverv (N	I MV) (24b))m = (22	L 2b)m + ()	1 23b)		I	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	tract ver	ntilation of	r positiv	e input v	ventilatio	n from c	outside			Į	1	
,	if (22b)n	n < 0.5 ×	(23b), t	hen (24)	c) = (23b); other	wise (24	c) = (22t	o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft	-	-			
	if (22b)n	n = 1, th	en (24d) I	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]		1	1	
(24d)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24)	c) or (24	d) in boy	(25)			1	1	(05)
(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs 1²	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	K)	k-value kJ/m²·l	e A K k	λXk ⊲J/Κ
Windo	ws Type	e 1				5.76	x1	/[1/(1.2)+	0.04] =	6.6				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				9.48	3	34.64	1 X	0.18] = [6.24				(29)
Roof				0		65.2	×	0.13		8.48	= i		⊣ ⊢	(30)
Total a	area of e	lements	, m²			109.3	2		'		١			(31)
Party v	wall					44.12	<u>2</u> X	0	= [0				(32)
Party f	loor					65.2	=		I				\dashv	(32a)
* for win	dows and le the area	roof wind	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] á	as given in	n paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				25.57	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	6997.06	(34)
Therm	al mass	parame	ter (TMI		⊦ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign assess	sments wh	ere the de	tails of the	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
can be ι Thorm	used inste	ad of a de	tailed calc	ulation.	ucina An	nondivil	/							
if dotails	al bridge	es : S (L	x Y) Cal		using Ap		n in the second						3.89	(36)
Total f	abric he	at loss	are not ki	10WI1 (30) =	= 0.05 X (3	1)			(33) +	(36) =			29 46	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	v				(38)m	= 0.33 × (25)m x (5)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.4	32.27	32.14	31.54	31.43	30.91	30.91	30.81	31.11	31.43	31.66	31.9		(38)
Heat tr	ansfer o	coefficie	nt, W/K				•		(39)m	= (37) + (3	• 38)m	•		
(39)m=	61.86	61.73	61.6	61	60.89	60.37	60.37	60.27	60.57	60.89	61.12	61.36		
	L					<u> </u>		<u>.</u>	,	Average =	Sum(39)	₁₂ /12=	61	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.92	0.93	0.93	0.94	0.94		
Numbe	er of day	us in mo	nth (Tab	le 1a)			•			Average =	Sum(40) ₁ .	12 /12=	0.94	(40)
Numbe	Jan	Feb	Mar	Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	-													
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	:[1 - exp	(-0.0003	349 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	12		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	84 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
-						100			-	Total = Su	m(44) ₁₁₂ =		1015.8	(44)
Energy	content of	hot water	used - cai	culated me I	onthly = 4. I	190 x Vd,r I	m x nm x L I	JTM / 3600) kWh/mor I	nth (see Ta	ables 1b, 1 I	c, 1d)	I	
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
lf instan	taneous v	vater heati	ng at point	of use (no	o hot water	^r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	-	1331.88	(45)
(46)m=	20.71	18.12	18.69	16.3	15.64	13.49	12.5	14.35	14.52	16.92	18.47	20.06		(46)
Water	storage	loss:		I	I									
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com Otherw Water a) If m	munity h vise if no storage nanufact	eating a stored loss: urer's de	nd no ta hot wate eclared l	ink in dw er (this ir oss facto	velling, e ncludes i or is kno	nter 110 nstantar wn (kWł) litres in neous co n/day):	ı (47) ombi boil	ers) ente	er '0' in (47)	0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy b) If m	/ lost fro anufact	m water urer's de	storage	, kWh/ye cylinder ∣	ear loss fact	or is not	known:	(48) x (49)) =			0		(50)
Hot wa If com	ater stor munity h	age loss leating s	factor fi ee secti	om Tabl on 4.3	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
lempe	erature f	actor fro	m lable	20								0		(53)
Energy	/ lost fro (50) or (m water (54) in (5	storage	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m		0		()
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	l ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		I	/==:
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	ch	month (61)m =	(60	0) ÷ 36	65 × (41))m									
(61)m=	16.16	14.57	16.08		15.5	15.97	1	5.41	15.89	15.	94	15.46	16.0	3	15.58	16.	.15		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	d fo	r eacl	h month	(62)	m =	0.85 × ((45)m	+ ((46)m +	(57)	m +	(59)m + (61)m	
(62)m=	154.25	135.34	140.7		124.15	120.23	1	05.37	99.25	111	.6	112.26	128.8	35	138.73	149	9.88		(62)
Solar DH	IW input	calculated	using A	ppe	ndix G or	Appendi	(H)	(negati	ve quantity	/) (ent	er '0'	' if no sola	r contri	buti	on to wate	er hea	ating)		
(add a	dditiona	al lines if	FGHR	Sa	and/or V	VWHRS	S ap	plies	, see Ap	penc	lix C	G)				-			
(63)m=	0	0	0		0	0		0	0	0)	0	0		0	()		(63)
Output	from w	ater hea	iter																
(64)m=	154.25	135.34	140.7		124.15	120.23	1	05.37	99.25	111	.6	112.26	128.8	35	138.73	149	9.88		
			-								Outp	out from wa	ater he	ater	. (annual)₁	12		1520.61	(64)
Heat g	ains fro	m water	heatin	g, I	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (6	1)m	n] + 0.8 x	(46) (m	+ (57)m	+ (5	i9)m]	
(65)m=	49.95	43.8	45.46		40	38.66	3	33.76	31.69	35.	79	36.05	41.5	2	44.84	48	8.5		(65)
inclu	de (57)	m in cal	culation	<u>ר ח</u>	f (65)m	only if c	ylir	nder i	s in the o	dwell	ing	or hot w	ater is	s fr	om com	mun	ity h	leating	
5. Int	ernal g	ains (see	e Table	5	and 5a)):													
Metabo	olic gair	ns (Table	e 5). W	atts	s														
	Jan	Feb	Mai	r T	Apr	May		Jun	Jul	A	ug	Sep	Oc	t	Nov	D	ec		
(66)m=	106.21	106.21	106.2 [,]	1	106.21	106.21	1	06.21	106.21	106	.21	106.21	106.2	21	106.21	106	6.21		(66)
Lightin	g gains	(calcula	ted in <i>i</i>	Ap	pendix l	L, equat	ion	L9 oi	r L9a), a	lso s	ee ⁻	Table 5							
(67)m=	17.63	15.66	12.73	Ť	9.64	7.21	(6.08	6.57	8.5	55	11.47	14.5	6	17	18.	.12		(67)
Appliar	nces ga	ins (calc	ulated	in	Append	dix L, eq	uat	tion L	13 or L1	3a), i	also	see Ta	ble 5						
(68)m=	185.85	187.77	182.9	1	172.57	159.51	1	47.23	139.03	137	.11	141.97	152.3	31	165.37	177	7.65		(68)
Cookin	a aains	s (calcula	ated in	 Ap	pendix	L. equa	tior	ו L15	or L15a`), als	o se	e Table	5						
(69)m=	33.62	33.62	33.62		33.62	33.62	3	33.62	33.62	33.	62	33.62	33.6	2	33.62	33.	.62		(69)
Pumps	and fa	ns gains	(Table	- 1 2 5a	a)		1						I						
(70)m=	3	3	3		3	3	Γ	3	3	3		3	3		3		3		(70)
Losses		u vaporatio	n (neo	 ati	ve valu	es) (Tab	ble	5)		I									
(71)m=	-84.97	-84.97	-84.97	7	-84.97	-84.97	-8	84.97	-84.97	-84	.97	-84.97	-84.9	97	-84.97	-84	.97		(71)
Water	heating	L aains (1	I Cable 5	<u>т</u>			I												
(72)m=	67.14	65.18	61.1	T	55.56	51.96		46.9	42.6	48.	11	50.07	55.8	1	62.28	65.	.19		(72)
Total i	nterna	l aains =					L	(66)	L m + (67)m	l 1 + (68	3)m +	- (69)m + ((70)m +	+ (7 ⁻	1)m + (72))m			
(73)m=	328.48	326.47	- 314.6 [,]	1	295.63	276.54	2	58.08	246.07	251	, .62	261.37	280.5	54	302.51	318	3.82		(73)
6. Sol	ar gain	s:	<u> </u>	-			I						<u> </u>			1			
Solar g	ains are	calculated	using sc	olar	flux from	Table 6a	and	assoc	iated equa	tions	to co	nvert to th	e appli	cab	le orientat	ion.			
Orienta	ation:	Access F	actor		Area			Flu	х			g_			FF			Gains	
	-	Table 6d			m²			Tal	ole 6a		Т	able 6b		Τa	able 6c			(W)	
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	1	1.28	x		0.35	x	Γ	0.7		=	11.03	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	1	1.28	×		0.35	x		0.7		=	7.13	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	2	2.97	×		0.35	x	Γ	0.7		=	22.46	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	2	2.97	×		0.35	×	Γ	0.7		=	14.51	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	4	1.38	×		0.35	×	Ē	0.7		=	40.47	(75)

Northea	st <mark>0.9x</mark>	0.77		x	1.8	6	x	4	1.38	×		0.35	x	0.7		=	26.13	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x	6	67.96	×		0.35	x	0.7		=	66.46	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x	6	67.96	x		0.35	x	0.7		=	42.92	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x	g	91.35	x		0.35	×	0.7		=	89.33	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x	g	91.35	x		0.35	x	0.7		=	57.69	(75)
Northea	st <mark>0.9x</mark>	0.77		x	5.7	6	x	g	97.38	x		0.35	x	0.7		=	95.24	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x	g	97.38	x		0.35	x	0.7		=	61.51	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x		91.1	x		0.35	x	0.7		=	89.09	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x		91.1	x		0.35	x	0.7		=	57.54	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x	7	2.63	x		0.35	×	0.7		=	71.03	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x	7	2.63	x		0.35	x	0.7		=	45.87	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x	5	50.42	x		0.35	x	0.7		=	49.31	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x	5	50.42	x		0.35	x	0.7		=	31.85	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x	2	28.07	x		0.35	x	0.7		=	27.45	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x	2	28.07	x		0.35	×	0.7		=	17.73	(75)
Northea	st <u>0.9</u> x	0.77		x	5.7	6	x		14.2	x		0.35	x	0.7		=	13.88	(75)
Northea	st <u>0.9</u> x	0.77		x	1.8	6	x		14.2	x		0.35	x	0.7		=	8.97	(75)
Northea	st <mark>0.9x</mark>	0.77		x	5.7	6	x		9.21	x		0.35	×	0.7		=	9.01	(75)
Northea	st <mark>0.9x</mark>	0.77		x	1.8	6	x		9.21	x		0.35	×	0.7		=	5.82	(75)
Solar g	ains in	watts, ca	alcula	ted	for each	n mont	h			(83)m	ו = Su	m(74)m	<mark>(82)</mark> m		-			
(83)m=	18.16	36.97	66.0	6	109.38	147.03	1	56.75	146.63	116	6.9	81.16	45.18	22.85	14	.83		(83)
Total ga	ains – i	nternal a	and so	olar	(84)m =	: (73)m	1 + (83)m	, watts		-						-	
(84)m=	346.64	363.44	381.	21	405.01	423.56	4	14.82	392.7	368	5.52	342.53	325.72	2 325.36	333	3.65		(84)
7. Mea	an inter	nal temp	beratu	ıre (heating	seaso	n)											
Tempe	erature	during h	eatin	g pe	eriods ir	the liv	ving	area	from Tal	ble 9	, Th1	(°C)					21	(85)
Utilisa	tion fac	tor for g	ains f	or li	ving are	ea, h1,i	n (s	ее Та	ıble 9a)									
Г	Law	F ak			A	N.4	Ì	1	, ,	_		0	0.1	N				

				-		•								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	0.99	0.95	0.82	0.65	0.71	0.93	0.99	1	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	19.97	20.06	20.23	20.49	20.75	20.93	20.99	20.98	20.85	20.53	20.21	19.96		(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)														
(88)m=	20.13	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13		(88)
Utilisa	ition fac	tor for g	ains for I	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.98	0.92	0.75	0.54	0.6	0.88	0.99	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	ps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.74	18.86	19.12	19.51	19.87	20.1	20.14	20.14	20	19.57	19.1	18.72		(90)
fLA = Living area ÷ (4) =												0.38	(91)	

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

9.94 19.53 19.19	19.94	20.33	20.46	20.46	20.42	20.21	19.88	19.55	19.32	19.21	(92)m=
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.21	19.32	19.55	19.88	20.21	20.42	20.46	20.46	20.33	19.94	19.53	19.19		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set T the ut	i to the i tilisation	mean int factor fo	ernal tei or gains	mperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	1	1	0.99	0.98	0.93	0.78	0.58	0.64	0.89	0.98	1	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	345.96	362.34	378.74	396.74	392.69	322.34	229.03	237.22	306.45	320.58	324.15	333.13		(95)
Montl	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	922.54	890.19	803.72	670.06	518.13	351.14	233.3	244.66	377.22	568.65	759.49	919.95		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	4 x [(97])m – (95)m] x (4	1)m			
(98)m=	428.98	354.72	316.18	196.79	93.32	0	0	0	0	184.56	313.44	436.6		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	2324.59	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								35.65	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatii	ng:										-		_
Fract	ion of sp	bace hea	at from s	econdar	y/supple	mentary	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														(206)
Efficiency of secondary/supplementary heating system, %														(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above))								
	428.98	354.72	316.18	196.79	93.32	0	0	0	0	184.56	313.44	436.6		
(211)m	n = {[(98)m x (20	94)] } x 1	00 ÷ (20)6)									(211)
	458.8	379.38	338.16	210.47	99.81	0	0	0	0	197.39	335.24	466.95		
		-	-					Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	-	2486.19	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							•		-
= {[(98)m x (20	01)] } x 1	00 ÷ (20	8)						-				
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
		-	-					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	-	0	(215)
Water	heating	3										•		-
Output	from w	ater hea	ter (calc	ulated a	bove)									
	154.25	135.34	140.7	124.15	120.23	105.37	99.25	111.6	112.26	128.85	138.73	149.88		_
Efficie	ncy of w	ater hea	iter										87.3	(216)
(217)m=	89.63	89.59	89.49	89.23	88.67	87.3	87.3	87.3	87.3	89.16	89.49	89.66		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	<u>1 = (64)</u>	<u>m x 100</u>) ÷ (217)	m										
(219)m=	172.09	151.06	157.23	139.13	135.59	120.7	113.69	127.84	128.59	144.52	155.02	167.16		-
								Tota	I = Sum(2	19a) ₁₁₂ =			1712.61	(219)
Annua	al totals									k	Wh/year		kWh/year	7
Space heating fuel used, main system 1												2486.19		

			1712.61							
		30]	(230c)						
		45]	(230e)						
sum of (23	30a)(230g) =		75	(231)						
			311.36	(232)						
(231) + (232)(237b) =			4585.16	(338)						
s including micro-CHP										
Energy kWh/year	Emissions kg CO2/yea	ar								
(211) x	0.216	=	537.02	(261)						
(215) x	0.519	=	0	(263)						
(219) x	0.216	=	369.92	(264)						
(261) + (262) + (263) + (264)	=		906.94	(265)						
(231) x	0.519	=	38.93	(267)						
(232) x	0.519	=	161.59	(268)						
S	um of (265)(271) =		1107.46	(272)						
(2	272) ÷ (4) =		16.99	(273)						
			87	(274)						
	sum of (2) (231) + (232)(237b) = sincluding micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x s (2	$sum of (230a)(230g) =$ $(231) + (232)(237b) =$ $sincluding micro-CHP$ $kWh/year$ $(211) \times 0.216$ $(215) \times 0.519$ $(219) \times 0.216$ $(261) + (262) + (263) + (264) =$ $(231) \times 0.519$ $(232) \times 0.519$ $sum of (265)(271) =$ $(272) + (4) =$	$\begin{bmatrix} 30 \\ 45 \end{bmatrix}$ $sum of (230a)(230g) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(21) \times 0.216 =$ $(21) \times 0.216 =$ $(21) \times 0.216 =$ $(21) + (262) + (263) + (264) =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(21) \times 0.519 =$ $(22) \times 0.519 =$ $sum of (265)(271) =$ $(272) + (4) =$	1712.61 30 45 311.36 $(231) + (232)(237b) = 75$ 311.36 $(231) + (232)(237b) = 4585.16$ $5 including micro-CHP$ $Energy KWh/year Kg CO2/kWh Kg CO2/year (211) \times 0.216 = 537.02 (215) \times 0.519 = 0 (219) \times 0.216 = 369.92 (261) + (262) + (263) + (264) = 906.94 (231) \times 0.519 = 38.93 (232) \times 0.519 = 161.59 sum of (265)(271) = 1107.46 (272) + (4) = 16.99$						
			User D	etails:						
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Assessor Name: Software Name:	Stroma FSAP 20 ²	12		Stroma Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.5.59	
		Pro	operty A	Address:	Kingsto	on Bridge	e 2BF 65	5 TOP G	AS	
Address :										
1. Overall dwelling dime	ensions:		A	(A 11a)/ a la una a (una 2)	
Ground floor			Area 6	a(m²) 65.2	(1a) x	Av. не	ignt(m) 2.7	(2a) =	176.04	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)) 6	65.2	(4)					
Dwelling volume			L		(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	176.04	(5)
2. Ventilation rate:										
	main s beating l	econdary	/	other		total			m ³ per hour	,
Number of chimneys		0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x	20 =	0	(6b)
Number of intermittent fa	ins		_			2	x ′	10 =	20	(7a)
Number of passive vents	3				Γ	0	x ·	10 =	0	(7b)
Number of flueless gas f	ires				Г	0	× 4	40 =	0	(7c)
								Air ch	anges per ho	_ ur
Infiltration due to chimne	ve flues and fans - (6	Sa)+(6b)+(7a)+(7b)+(⁻	7c) -	Г				langee per ne	
If a pressurisation test has h	een carried out or is intend	ed proceed	$t_{\rm r}$ (17) c	otherwise c	continue fr	om (9) to ((16)	÷ (5) =		
Number of storevs in t	he dwelling (ns)	ou, proceeu	<i>io</i> (<i>11)</i> , c			0111 (0) 10 (10)		0	7 (9)
Additional infiltration	3(1)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber	frame or (0.35 for	masonr	y constr	uction			0	 (11)
if both types of wall are p deducting areas of openi	resent, use the value corres ngs); if equal user 0.35	sponding to a	the greate	er wall area	a (after					_
If suspended wooden	floor, enter 0.2 (unsea	led) or 0.1	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0								0	(13)
Percentage of window	s and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cul	Dic metres	s per ho	our per so	quare m	etre of e	nvelope	area	5	(17)
Air permeability value applie	$\begin{array}{l} \text{IIIty value, then (10) - I(10)} \end{array}$	s boon dong	, otherwis	se(10) - (rmoobility	is hoing u	ood		0.36	(18)
Number of sides sheltere	ed	s been done	e or a deg	nee an per	Πεαριπτγ	is being us	360		2	T (19)
Shelter factor				(20) = 1 - [[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	ting shelter factor			(21) = (18)) x (20) =				0.31	_ (21)
Infiltration rate modified f	for monthly wind spee	d								-
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	beed 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 = (2	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ng for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-			-	-	-	
II III				ondiv NL (2	(2b) = (22c)	\rightarrow Emu (austion (I		nuine (22h) = (22a)			0	(23a)
li exi				ionovin 0/	.50) = (258	a) × FIIIV (6		no)), otre) = (238)			0	(23b)
IT Data	anced with	i neat reco	very: enic	iency in %		or in-use t	actor (from) =				0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a T	a)m = (22	2b)m + () I	23b) × [1 – (23c)) ÷ 100] 1	(24a)
(24a)m=		0	0	0	0	0	0	0	0	0	0	0	J	(248)
b) lf	balance	ed mecha	anical ve	entilation	without	heat rec	covery (I	MV) (24b 1	o)m = (22	2b)m + (2 1	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), 1	itilation o hen (24)	or positiv c) = (23b	ve input v o); otherv	ventilatio wise (24	on from c c) = (22b	outside o) m + 0.	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	ole hous m = (221	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	x (25)					
(25)m=	0.58	0.57	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3 He	at losse	s and he	at loss i	naramet	≏r.								-	
		Gros	s	Openin	as	Net Ar	ea	U-valı	le	AXU		k-value	<u>.</u> Δ	Xk
		area	(m²)	m	90 1 ²	A ,r	n²	W/m2	K	(W/I	K)	kJ/m²·	K k	J/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.4)+	0.04] =	7.64				(27)
Windo	ws Type	e 2				1.86		/[1/(1.4)+	0.04] =	2.47				(27)
Walls				9.48	3	34.64	1 X	0.18	=	6.24				(29)
Roof				0		65.2	×	0.13	= [8.48			\exists	(30)
Total a	area of e	lements	, m²			109.3	2		I					(31)
Party v	wall					44 12	> x	0	= [0				(32)
Party f	floor					65.2			I				\dashv	(32a)
* for win	ndows and	roof wind	ows. use e	effective wi	ndow U-va	alue calcul	lated using	n formula 1	/[(1/U-valu	ıe)+0.041 a	as aiven ir	n paragraph	 1 3.2	(020)
** incluc	le the area	as on both	sides of ir	nternal wal	ls and par	titions		,		,		·		
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)) + (32) =				27.28	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	6997.06	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	ו kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For des can be l	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	K						2.74	(36)
if details	s of therma	al bridging	are not kr	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			30.02	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5	5)	•	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ļ	
(38)m=	33.56	33.38	33.21	32.4	32.25	31.55	31.55	31.42	31.82	32.25	32.56	32.88	J	(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	63.58	63.4	63.23	62.42	62.27	61.57	61.57	61.44	61.84	62.27	62.58	62.9		
										Average =	Sum(39)	112 /12=	62.42	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.98	0.97	0.97	0.96	0.96	0.94	0.94	0.94	0.95	0.96	0.96	0.96		
Numbe	er of day	s in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁ .	12 /12=	0.96	(40)
- turnot	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9	9)2)] + 0.0	0013 x (⁻	TFA -13.	2. .9)	12		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person per	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	64 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
_									-	Total = Su	m(44) ₁₁₂ =		1015.8	(44)
Energy of	content of	hot water	used - cai	culated m	onthly = 4. I	190 x Vd,r I	n x nm x L I	JTM / 3600) kWh/mor I	nth (see Ta	ables 1b, 1	c, 1d)	I	
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
lf instant	taneous w	vater heati	ng at point	t of use (no	o hot water	^r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m=	20.71	18.12	18.69	16.3	15.64	13.49	12.5	14.35	14.52	16.92	18.47	20.06		(46)
Water	storage	loss:									-			
Storag	e volum	e (litres)) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr Otherw Water a) If m	munity h vise if no storage anufact	eating a stored loss: urer's de	and no ta hot wate eclared l	ank in dw er (this ir oss facte	velling, e ncludes i or is kno	nter 110 nstantar wn (kWł) litres in neous co n/day):	ı (47) ombi boil	ers) ente	er '0' in ((47)	0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy b) If m	/ lost fro anufact	om water urer's de	⁻ storage eclared (e, kWh/ye cylinder	ear loss fact	or is not	known:	(48) x (49)) =			0		(50)
Hot wa If comr	iter stora nunity h	age loss leating s	factor fi ee secti	rom Tab on 4.3	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy Enter	/ lost fro (50) or (m wateı (54) in (٤	⁻ storage 55)	e, kWh/yo	ear			(47) x (51)) x (52) x (53) =		0 0		(54) (55)
Water	storage	loss cal	culated ⁻	for each	month			((56)m = (55) × (41)ı	m				
(<mark>56)m=</mark> If cylinde	0 er contains	0 s dedicate	0 d solar sto	0 rage, (57)	0 m = (56)m	0 x [(50) – (0 H11)] ÷ (5	0 50), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Drimor								1				n		(58)
Primar	y circuit	loss (al	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		'	~	I	(00)
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		l	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for each	month	(61)m =	(60)	÷ 365 × (41)m						
(61)m=	47.45	41.3	44	40.91	40.55	37.	57 38.82	40.55	40.91	44	44.25	47.45		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for (each month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	185.54	162.07	168.63	149.56	144.8	127	.53 122.19	136.2	137.71	156.82	167.4	181.18		(62)
Solar DH	-IW input	calculated	using App	endix G o	Appendix	: H (ne	gative quantit	y) (enter	'0' if no sola	ar contribu	tion to wate	er heating)	•	
(add a	dditiona	I lines if	FGHRS	and/or \	WWHRS	app	lies, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	C	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	185.54	162.07	168.63	149.56	144.8	127	.53 122.19	136.2	137.71	156.82	167.4	181.18		
		-		-			-	O	Itput from w	ater heate	er (annual)	112	1839.64	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [C	.85 × (45)m	ו + (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	57.78	50.48	52.44	46.35	44.8	39.	31 37.42	41.94	42.41	48.51	52.01	56.33		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylind	er is in the	dwellin	g or hot w	/ater is f	rom com	munity h	neating	
5. Int	ernal g	ains (see	e Table {	5 and 5a):									
Metabo	olic gair	ns (Table	.5) Wa	tts	/									
motab	Jan	Feb	Mar	Apr	May	Ju	ın Jul	Auc	Sep	Oct	Nov	Dec	1	
(66)m=	106.21	106.21	106.21	106.21	106.21	106	.21 106.21	106.2 ⁴	106.21	106.21	106.21	106.21		(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion L	9 or L9a), a	also see	e Table 5				1	
(67)m=	17.63	15.66	12.73	9.64	7.21	6.0	6.57	8.55	11.47	14.56	17	18.12	1	(67)
Applia	nces da	ins (calc	ulated ir	n Append	dix L. ea	uatio	n L13 or L1	3a), al	so see Ta	ble 5		Į	1	
(68)m=	185.85	187.77	182.91	172.57	159.51	147	.23 139.03	137.1	141.97	152.31	165.37	177.65		(68)
Cookin	na aains	i (calcula	ted in A	ppendix	L. equat	ion l	 15 or L15a), also	see Table	e 5			1	
(69)m=	33.62	33.62	33.62	33.62	33.62	33.	62 33.62	33.62	33.62	33.62	33.62	33.62	1	(69)
Pumps	and fa	ns dains	(Table)	5a)	I			1		I		I	1	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
Losses		I vaporatio	n (nega	i tive valu	i es) (Tab	le 5)				1	I		1	
(71)m=	-84.97	-84.97	-84.97	-84.97	-84.97	-84	.97 -84.97	-84.97	-84.97	-84.97	-84.97	-84.97]	(71)
Water	L heating	I dains (1	I Table 5)							I			1	
(72)m=	77.66	75.12	70.48	64.38	60.22	54.	59 50.3	56.38	58.91	65.2	72.23	75.71	1	(72)
Total i	nternal	l gains =	I				(66)m + (67)n	L n + (68)n	1 + (69)m +	(70)m + (1 71)m + (72)m	1	
(73)m=	339	336.42	323.99	304.45	284.8	265	.77 253.77	259.89	270.21	289.94	312.47	329.34	1	(73)
6. Sol	ar gain	s:						1						• •
Solar g	ains are	calculated	using sola	r flux from	Table 6a	and a	ssociated equa	ations to	convert to th	ne applica	ble orientat	tion.		
Orienta	ation:	Access F	actor	Area			Flux		g_		FF		Gains	
	-	Table 6d		m²			Table 6a		Table 6b	Т	able 6c		(W)	
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	11.28) x [0.63	x	0.7	=	19.86	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	1.8	36	×Г	11.28] × [0.63	× [0.7	= =	12.83	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	5.7	76	×Г	22.97] × [0.63	× [0.7	=	40.43	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	1.8	36	×Г	22.97] × [0.63		0.7	=	26.11	(75)
Northea	ast <mark>0.9x</mark>	0.77	x	5.7	76	×Г	41.38] × [0.63	× [0.7	=	72.84	(75)

Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	6	x	4	1.38	x		0.63	x	0.7		- [47.04	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	5.7	'6	x	6	67.96	x		0.63	×	0.7		- [119.62	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	86	x	6	67.96	x		0.63	x	0.7		= [77.26	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	5.7	'6	x	g	1.35	x		0.63	x	0.7		- [160.8	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	6	x	9	1.35	x		0.63	×	0.7		= [103.85	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	5.7	'6	x	g	97.38	x		0.63	×	0.7		- [171.43	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	86	x	9	97.38	x		0.63	×	0.7		= [110.71	(75)
Northea	ast <mark>0.9x</mark>	0.77)	<	5.7	'6	x		91.1	x		0.63	x	0.7		= [160.37	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	86	x		91.1	x		0.63	x	0.7		- [103.57	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	5.7	'6	x	7	2.63	x		0.63	×	0.7		= [127.85	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	6	x	7	2.63	x		0.63	×	0.7		- [82.57	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	5.7	'6	x	5	0.42	x		0.63	×	0.7		- [88.76	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	6	x	5	0.42	x		0.63	×	0.7		= [57.32	(75)
Northea	ast <mark>0.9x</mark>	0.77)	(5.7	'6	x	2	28.07	x		0.63	x	0.7		- [49.41	(75)
Northea	ast <mark>0.9x</mark>	0.77)	(1.8	86	x	2	28.07	x		0.63	×	0.7		- [31.91	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	5.7	'6	x		14.2	x		0.63	×	0.7		= [24.99	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	86	x		14.2	x		0.63	×	0.7		- [16.14	(75)
Northea	ast <mark>0.9x</mark>	0.77)	(5.7	'6	x		9.21	x		0.63	×	0.7		- [16.22	(75)
Northea	ast <mark>0.9x</mark>	0.77)	•	1.8	86	x		9.21	x		0.63	×	0.7		- [10.48	(75)
	-									-						-		
Solar g	pains in	watts, ca	alculate	d	for eac	h mont	h		-	(83)m	า = S เ	um(74)m .	(82)m					
(83)m=	32.69	66.54	119.88		196.88	264.65	5 2	282.14	263.94	210	.42	146.08	81.32	41.13	26.7			(83)
Total g	jains – i	internal a	and sola	ar T	(84)m =	= (73)m) + ((83)m	, watts									
(84)m=	371.69	402.96	443.88		501.34	549.44	1 5	547.92	517.71	470).31	416.29	371.20	353.6	356.0	3		(84)
7. Me	an inte	rnal temp	perature	e (heating	seaso	n)											
Temp	erature	during h	neating	pe	eriods ir	n the liv	/ing	area	from Tal	ble 9	, Th′	1 (°C)				[21	(85)
Utilisa	ation fac	ctor for g	ains for	· li	ving are	ea, h1,i	m (s	see Ta	ble 9a)									_
	Jan	Feb	Mar		Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov	De	с		
(86)m=	1	1	0.99		0.97	0.88		0.69	0.52	0.5	59	0.87	0.98	1	1			(86)
Mean	interna	al temper	ature in	n li	iving are	ea T1 (follo	ow ste	ps 3 to 7	7 in T	Table	e 9c)						
(87)m=	19.97	20.08	20.29		20.6	20.85		20.97	21	20.	.99	20.9	20.58	20.23	19.95	5		(87)
Temp	erature	during h	neatina	pe	eriods ir	n rest o	of dv	vellina	from Ta	able	9, Tł	ם. 12 (°C)						
(88)m=	20.1	20.11	20.11	T	20.12	20.12		20.13	20.13	20.	13	20.13	20.12	20.12	20.11	1		(88)
	L			_			_											

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

0.96

19.63

20

0.83

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.98

20.31

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

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

0.61

20.11

20.44

0.42

20.13

20.46

0.48

20.13

20.46

0.8

20.04

20.37

0.97

19.62

19.98

1

19.11

19.54

 $fLA = Living area \div (4) =$

1

18.7

19.18

(89)m=

(90)m=

(92)m=

1

18.72

19.2

1

18.88

19.34

0.99

19.19

19.61

(89)

(90)

(91)

(92)

0.38

(93)m=	19.2	19.34	19.61	20	20.31	20.44	20.46	20.46	20.37	19.98	19.54	19.18		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	mperatui using Ta	re obtair able 9a	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	n:										
(94)m=	1	1	0.99	0.95	0.84	0.64	0.46	0.52	0.82	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (84	4)m	_	-	-						
(95)m=	370.64	400.95	438.2	477.82	463.41	348.83	236.42	246.61	342.51	361.27	351.64	355.25		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	nal tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	947.44	915.49	829.06	693.12	536.31	359.73	237.72	249.39	387.85	584.41	778.25	942.43		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k ^v	Wh/moni	th = 0.02	24 x [(97)m – (95 I)m] x (4	1)m	i		
(98)m=	429.14	345.77	290.8	155.02	54.23	0	0	0	0	166.02	307.16	436.86		-
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	2185	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								33.51	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:												-
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	ו, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g require	ement (c	alculate	d above)					-			
	429.14	345.77	290.8	155.02	54.23	0	0	0	0	166.02	307.16	436.86		
(211)m	n = {[(98)m x (20	94)]}x1	100 ÷ (20)6)									(211)
	459.46	370.2	311.35	165.98	58.06	0	0	0	0	177.75	328.87	467.73		
								Tota	ll (kWh/yea	ar) =Sum(2	211) _{15,1012}	2=	2339.4	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20)1)]}x1	00 ÷ (20)8)	-									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,10} 12	2=	0	(215)
Water	heating	I												
Output	from w	ater hea	ter (calc	ulated a	bove)									
- <i>c</i>	185.54	162.07	168.63	149.56	144.8	127.53	122.19	136.21	137.71	156.82	167.4	181.18		
Efficier	icy of w	ater nea	iter										80.3	(216)
(217)m=	87.09	86.91	86.41	85.14	82.82	80.3	80.3	80.3	80.3	85.19	86.56	87.19		(217)
Fuel fo	r water $a = (64)$	heating,	kWh/m `ב (217` ∸ (onth										
(219)m=	213.03	186.48	195.14	175.66	174.84	158.82	152.16	169.63	171.5	184.07	193.39	207.81		
		-	ļ		-			Tota	l = Sum(2	19a) _{1 12} =			2182.53	(219)
Annua	l totals									k	Wh/veau	•	kWh/vear],,
Space	heating	fuel use	ed, main	system	1					i v	, jour		2339.4	1
-	5			-										L

Water heating fuel used			2182.53	
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 (2	230a)(230g) =	75 ((231)
Electricity for lighting			311.36	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		4908.29	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP			
	_			
	Energy kWh/year	Emission factor kg CO2/kWh	r Emissions kg CO2/year	
Space heating (main system 1)	Energy kWh/year (211) x	Emission factor kg CO2/kWh	kg CO2/year	(261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Emission factor kg CO2/kWh 0.216 = 0.519 =	kg CO2/year	(261) (263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	Emission factor kg CO2/kWh 0.216 = 0.519 = 0.216 =	Emissions kg CO2/year 505.31 0 471.43	(261) (263) (264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264)	Emission factor kg CO2/kWh 0.216 = 0.519 = 0.216 =	Emissions kg CO2/year 505.31 0 471.43 976.74	(261) (263) (264) (265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x	Emission factor kg CO2/kWh 0.216 = 0.519 = 0.216 = 0.519 =	Emissions kg CO2/year 505.31 0 471.43 976.74 38.93	(261) (263) (264) (265) (267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Emission factor kg CO2/kWh 0.216 = 0.519 = 0.216 = 0.519 = 0.519 =	Emissions kg CO2/year 505.31 (471.43 (976.74 (38.93 (161.59 ((261) (263) (264) (265) (267) (268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Emission factor kg CO2/kWh 0.216 = 0.519 = 0.216 = 0.519 = 0.519 = 0.519 = 0.519 = 0.519 =	Emissions kg CO2/year 505.31 0 471.43 976.74 38.93 161.59 1177.26	(261) (263) (264) (265) (267) (268) (272)

TER =

18.06 (273)

Assessor Name: Stroma FSAP 2012 Software Version: Version: 1.0.5.59 Property Address: Kingston Bridge 3BF 83 GND GAS Address : 1. Overall dwelling dimensions: Ground floor $Area(m^2)$ Av . Height(m) Volume(m ²) 224.1 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) B_3 (4) Dwelling volume (3a)+(3b)+(3c)+(3c)+(3c)+(3c)) = 224.1 (5) 2. Ventilation rate: Number of chimneys 0 + 0 + 0 = 0 $\times 40$ = 0 (6a) Number of open flues 0 + 0 + 0 = 0 $\times 20$ = 0 (6b) Number of open flues 0 + 0 + 0 = 0 $\times 40$ = 0 (7a) Number of passive vents 0 $\times 10$ = 0 (7b) Number of passive vents 0 $\times 40$ = 0 (7c) Number of storeys in the dwelling (ns) Additional infiltration $(e_1 + (1e) $
Property Address: Kingston Bridge 3Br 83 GND GAS Address: Kingston Bridge 3Br 83 GND GAS Action 1000000000000000000000000000000000000
Address :1. Overall dwelling dimensions:Area(m?)Av. Height(m)Volume(m ⁹)Ground floor(a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)B3(a)Outline (1a)+(1b)+(1c)+(1d)+(1e)+(1n)B3(a)Volume(m ⁹)Outline (1a)+(1b)+(1c)+(1d)+(1e)+(1n)B3(a)Volume(m ⁹)Outline (1a)+(1b)+(1c)+(1d)+(1e)+(1n)B3(a)Volume(m ⁹)Outline (1a)+(1b)+(1c)+(1d)+(1e)+(1n)B3(a)Volume(m ⁹)Outline (1a)+(1b)+(1c)+(1d)+(1c)+(1c)+(1c)+(1c)+(1c)+(1c)+(1c)+(1c
Area(m²)Av. Height(m)Volume(m²)Ground floor83(1a) x2.7(2a) =224.1(3a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)83(4)(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =224.1(5)Dwelling volume(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =224.1(5)(5)(5)2. Ventilation rate:main heatingsecondary heatingothertotalm³ per hourNumber of chimneys0+0=0x40 =0(6a)Number of pan flues0+0=0x10 =(6b)Number of passive vents0x10 =0(7b)Number of flueless gas fires0x40 =0(7c)Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) =+(5) =(6)Infiltration(9)x40 =0(7c)Number of storeys in the dwelling (ns)Additional infiltration(9)+1]x0.1 =0Additional infiltration(19)(10)(11)0if 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(10)(11)if suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00(12)If no draught lobby, enter 0.05, else enter 00(14)Percentage of windows and doors draught stripped(0)+(11)+(12)+(13)+(15) =(14)Window infiltration0.25-(0.2 x (14)+100) =(14) <t< td=""></t<>
FrequinityColume(m)Ground floor $\boxed{83}$ (1a) x $\boxed{2.7}$ (2a) = $\boxed{224.1}$ (3a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) $\boxed{83}$ (1a) x $\boxed{2.7}$ (2a) = $\boxed{224.1}$ (3)Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n)$ = $\boxed{224.1}$ (5) 2. Ventilation rate: main heating heating heating heating heatingother heating heating heating heatingtotalm³ per hourNumber of chimneys $\boxed{0}$ + $\boxed{0}$ + $\boxed{0}$ = $\boxed{0}$ x40 = $\boxed{0}$ (6e)Number of passive vents $\boxed{0}$ + $\boxed{0}$ = $\boxed{0}$ x10 = $\boxed{0}$ (7c)Number of flueless gas fires $\boxed{0}$ x10 = $\boxed{0}$ (7c)Infiltration due to chimneys, flues and fans =(6a)+(7a)+(7b)+(7c) =+ (5) = $\boxed{0}$ (7c)Infiltration $\underbrace{0}$ structural infiltration: $\underbrace{0}$ structural or is intended, proceed to (17), otherwise continue from (9) to (16) $\underbrace{0}$ (10)Structural infiltration: $\underbrace{0.25 \text{ for steel or timber frame or 0.35 for masonry construction}$ $\underbrace{0}$ (11) $\underbrace{0}$ (12)if buspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 $\underbrace{0}$ (12) $\underbrace{0}$ (12)If or araught lobby, enter 0.05, else enter 0 $\underbrace{0}$ (13) $\underbrace{0}$ (14)Percentage of windows and doors draught stripped $\underbrace{0}$ (14) $\underbrace{0}$ (15) $\underbrace{0}$ (15)Infiltration rate($\underbrace{0}$ + (10) + (11) + (12) + (13) + (15) = $\underbrace{0}$ (15)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Bas (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 224.1 (6) 2. Ventilation rate: main secondary other total m ³ per hour heating + 0 + 0 = 0 x40 = 0 (6a) Number of chimneys 0 + 0 + 0 = 0 x20 = 0 (6b) Number of intermittent fans 2 x 10 = 20 (7a) Number of flueless gas fires 0 x40 = 0 (7c) Number of flueless gas fires 0 x40 = 0 (7c) H a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration 0 (9) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masony construction 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 For construction 0 (11) Infiltration 1 (0) Percentage of windows and doors draught stripped Window infiltration 1 (0) Percentage of windows and doors draught stripped Window infiltration 1 (0) Percentage of windows and doors draught stripped Window infiltration 1 (0) + (10) + (11) + (12) + (15) = 0 (16) Number of toreys in the (0) + (10) + (11) + (12) + (15) = 0 (16) Percentage of windows and doors draught stripped Window infiltration 1 (0) (10) = 0 (15) Infiltration rate (0) + (10) + (11) + (12) + (15) + (15) = 0 (16)
Number of chimneysmain heating 0secondary heating heatingother totaltotalm³ per hourNumber of chimneys0+0=0x40 =0(6a)Number of open flues0+0=0x40 =0(6b)Number of intermittent fans2x10 =20(7a)Number of passive vents0x10 =0(7c)Number of flueless gas fires0x40 =0(7c)Number of storeys in the dwelling (ns)0x40 =0(7c)Additional infiltration(g)-1]x0.1 =0(11)(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 0.350.1 (sealed), else enter 00(12)If no draught lobby, enter 0.05, else enter 00.1 (sealed), else enter 00(12)0(13)Percentage of windows and doors draught stripped Window infiltration0.25 - [0.2 x (14) + 100] =0(15)Infiltration rate(a) + (10) + (12) + (12) + (15) =0(16)
Initial contractInitial
2. Ventilation rate: main heating secondary heating other total m³ per hour Number of chimneys 0 $+$ 0 $=$ 0 $x40 =$ 0 $(6a)$ Number of open flues 0 $+$ 0 $=$ 0 $x40 =$ 0 $(6a)$ Number of nummer 0 $+$ 0 $=$ 0 $x20 =$ 0 $(6b)$ Number of intermittent fans 2 $x10 =$ 2 $(7a)$ Number of passive vents 0 $x10 =$ 0 $(7b)$ Number of flueless gas fires 0 $x40 =$ 0 $(7c)$ Number of storeys in the dwelling (ns) $x40 =$ 0 $(7c)$ Additional infiltration $(9)-1]x0.1 =$ 0 (9) Structural infiltration $(9)-1]x0.1 =$ 0 (11) $ib \ obth \ obs of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 (12) If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (13) $
Interting heatingFreating 0Heating
Number of chimneys 0 $+$ 0 $+$ 0 $=$ 0 $x40$ $=$ 0 $(6a)$ Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $(x40)$ $=$ 0 $(6a)$ Number of intermittent fans 2 $x10$ $=$ 0 $(7a)$ Number of passive vents 0 $x40$ $=$ 0 $(7b)$ Number of flueless gas fires 0 $x40$ $=$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c)=$ $+$ $+$ (5) $=$ I' a pressurisation test has been carried out or is intended, proceed to (17) , otherwise continue from (9) to (16) (9) (9) Number of storeys in the dwelling (ns) (9) (9) (10) (9) Additional infiltration (9) (9) (10) (11) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (9) (11) i 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 (12) 0 (12) If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (13) Percentage of windows and doors draught stripped 0 (14) 0 (14) Window infiltration $0.25 - [0.2 \times (14) + 100] =$ 0 (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0 <td< td=""></td<>
Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $x 20$ $=$ 0 $(6b)$ Number of intermittent fans 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 10$ 2 $x 40$ 2
Number of intermittent fans 2 $x 10 =$ 20 $(7a)$ Number of passive vents 0 $x 10 =$ 0 $(7b)$ Number of flueless gas fires 0 $x 40 =$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $+ (5) =$ $+ (5) =$ If a pressurisation test has been carried out or is intended, proceed to (17) , otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) 0 (9) Additional infiltration $(9)-1]x0.1 =$ 0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 Percentage of windows and doors draught stripped 0 Window infiltration $0.25 - [0.2 \times (14) + 100] =$ 0 0 (13) 0 (14) 0 (15) 0 (15) 0 (15) 0 (15) 0 (15)
Number of passive vents 0 $x 10 =$ 0 $(7b)$ Number of flueless gas fires 0 $x 40 =$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $+(5) =$ $+(5) =$ (9) If a pressurisation test has been carried out or is intended, proceed to (17) , otherwise continue from (9) to (16) 0 (9) Number of storeys in the dwelling (ns) 0 0 (9) Additional infiltration $(9)-1]x0.1 =$ 0 (10) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11) if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 (12) If no draught lobby, enter 0.05 , else enter 0 0 (13) Percentage of windows and doors draught stripped 0 (14) Window infiltration $0.25 - [0.2 x (14) + 100] =$ 0 Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0
Number of flueless gas fires 0 $x 40 =$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $+ (5) =$ $+ (5) =$ $+ (5) =$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)Number of storeys in the dwelling (ns) 0 (9) Additional infiltration $[(9)-1]x0.1 =$ 0 Structural infiltration:0.25 for steel or timber frame or 0.35 for masonry construction 0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13) Percentage of windows and doors draught stripped 0 (14) Window infiltration $0.25 - [0.2 x (14) + 100] =$ 0 Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0
Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) =$ + $(5) =$ + $(5) =$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)0(9)Number of storeys in the dwelling (ns)0(9)Additional infiltration(9)-1]x0.1 =0(10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction0(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 0.350(12)If no draught lobby, enter 0.05, else enter 00(13)0Percentage of windows and doors draught stripped0(14)Window infiltration0.25 - [0.2 x (14) + 100] =0(15)Infiltration rate(8) + (10) + (11) + (12) + (13) + (15) =0(16)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) = $(5) = ($
Inflitration due to chimneys, flues and rans = $(60)+(70)+(70)+(70)+(70) = +(5$
If a pressubation test has been carried out on is intended, proceed to (17), otherwise continue non (9) to (10)Number of storeys in the dwelling (ns) 0 (9)Additional infiltration 0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 (12)If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped 0 (14)Window infiltration $0.25 - [0.2 \times (14) + 100] =$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0(16)
Additional infiltration (9) Additional infiltration (9) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 If no draught lobby, enter 0.05, else enter 0 0 Percentage of windows and doors draught stripped 0 Window infiltration $0.25 - [0.2 \times (14) + 100] =$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction0if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.350If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00If no draught lobby, enter 0.05, else enter 00Percentage of windows and doors draught stripped0Window infiltration $0.25 - [0.2 \times (14) + 100] =$ Infiltration rate(8) + (10) + (11) + (12) + (13) + (15) =0(16)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 (12) If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13) Percentage of windows and doors draught stripped 0 (14) Window infiltration $0.25 - [0.2 \times (14) + 100] =$ 0 Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0
deducting areas of openings); if equal user 0.35If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00If no draught lobby, enter 0.05, else enter 00Percentage of windows and doors draught stripped0Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate(8) + (10) + (11) + (12) + (13) + (15) =
If suspended wooden noot, enter 0.2 (unscaled) of 0.1 (scaled), enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13) Percentage of windows and doors draught stripped 0 (14) Window infiltration $0.25 - [0.2 \times (14) + 100] =$ 0 Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0
Percentage of windows and doors draught stripped $0 = 0$ Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0 Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0 (15) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$ 0.29 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered 2 (19) Challen factor (20) = 1, 10,075 x (10) = (20)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85$ (20)
Inflitration rate incorporating shelter factor $(21) = (10) \times (20) = 0.25$ (21)
Inflitration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Nonthly average wind speed from Table /
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

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_					
Calculate effective air change rate for the applicable case 0 (23a) If mechanical ventilation: if exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23a) a) If balanced mechanical ventilation with heat recovery (MVHR) (24a) m = (22b)m + (23b) × [1 - (23c) + 100] 0		0.31	0.31	0.3	0.27	0.26	0.23	0.23	0.23	0.25	0.26	0.28	0.29						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se											
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	lf exh	aust air h	eat numn	using Ann	endix N (2	(23a) = (23a	a) × Fmv (e	equation (1	N5)) other	rwise (23h) = (23a)			0					
$ \begin{array}{c c} 1 \text{ (2b)} \\ \hline \text{(24)} \text{(24)} \\ \hline \text{(24)} \text{(25)} \\ \hline \text{(24)} \\ \hline \text{(24)} \\ \hline \text{(25)} \\ \hline \text{(24)} \\ \hline \text{(25)} \\ \hline \text{(26)} \\ \hline \text{(27)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(26)} \\ \hline \text{(27)} \\ \hline \text{(28)} \\ \hline \text{(27)} \\ \hline \text{(28)} \\ \hline \text{(27)} \\ \hline \text{(28)} \\ \hline \text{(29)} \\ \hline \text{(21)} \\ \hline \text{(20)} \\ \hline \text$	lf bala	anced with	heat reco	overv: effic	ciency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(230)				
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	a) If	halance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	a)m = (22)	2h)m + (23h) x [1 - (23c)	÷ 1001	(200)				
b) if balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24a)m=	0	0			0	0		0	0	0		0]	(24a)				
$\begin{array}{c c} \label{eq:constraint} \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	b) If	balance	d mech	ı anical ve	L entilation	ı without	i heat rec	L Coverv (N	I //V) (24b))m = (22	1 2b)m + (;	1 23b)		1					
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)				
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)	c) If	whole h	use ex	tract ver	ntilation of	r positiv	input v	ventilatio	on from c	outside		1		1					
	í	if (22b)n	n < 0.5 >	‹ (23b) , †	then (24	c) = (23b); other	wise (24	c) = (22b	o) m + 0.	5 × (23b))							
d) if natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m ² x 0.5] (24d)m = 0.55 0.55 0.54 0.53 0.53 0.53 0.53 0.53 0.53 0.54 0.54 (24d) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25)m = 0.55 0.55 0.55 0.54 0.53 0.53 0.53 0.53 0.53 0.53 0.54 0.54 (25) 3. Heat losses and heat loss parameter: ELEMENT Gross area (m ²) Openings Net Area U-value A X U K K-value K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/K K, J/K V//K K, J/M ² -K K, J/K K, J/K V//K K, J/K K, J/K V//K K, J/K K, J/K K, J/K V//K K, J/K K, J/K K, J/K K, J/K V//K K, J/K K, J/K K, J/K V//K K, J/K K,	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)				
$ \begin{array}{c} (22b)m = 1, \ then (24d)m = (22b)m \ otherwise (24d)m = 0.5 + [(22b)m^2 \times 0.5] \\ (24d)m = 0.55 & 0.55 & 0.55 & 0.54 & 0.53 & 0.53 & 0.53 & 0.53 & 0.53 & 0.54 & 0.54 \\ \hline \\ Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) \\ (25)m = 0.55 & 0.55 & 0.54 & 0.53 & 0.53 & 0.53 & 0.53 & 0.53 & 0.54 & 0.54 \\ \hline \\ 3. Heat losses and heat loss parameter: \\ \hline \\ ELEMENT & Gross \\ area (m^2) & m^2 & A, m^2 & U-value \\ A, m^2 & W/m2K & (W/K) & K-value \\ A, m^2 & W/m2K & (W/K) & K-value \\ W/m0 ws Type 1 & 2.88 & x1f1/t (1.2) + 0.04] = 3.3 \\ \hline \\ Windows Type 2 & 1.36 & x1f1/t (1.2) + 0.04] = 2.13 \\ \hline \\ Windows Type 2 & 1.36 & x \ 0.13 & = 10.79 \\ \hline \\ Walls & 19.62 & 30.6 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.13 & = 10.79 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & Waldws and rod windows, use effective window U-value calculated using formula 1/(1/U-value)+0.04] as given in paragraph 3.2 \\ ^{*} include the areas on both sides of internal walls and partitions \\ ^{*} Fabric heat loss, W/K = S (A \times U) \\ (26)(30) + (32) = \\ \hline \\ For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1! \\ con design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1! \\ cont details of thermal bridging are not known (36) = 0.05 x (31) \\ \hline Other Heat loss calculated monthly \\ \hline \\ Ventilation heat loss calculated monthly \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (38)m \\ \hline $	d) lf	natural	ventilatio	on or wh	ole hous	se positiv	ve input	ventilatio	on from I	oft									
(240)m 0.53 0.53 0.53 0.53 0.53 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.55	(0.4.1)	if (22b)n	n = 1, th	en (24d))m = (22	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]	0.54	0.54	1	(244)				
Effective air change rate - enter (24a) or (24c) or (24c) or (24d) in box (25) (25)m= 0.55 0.55 0.55 0.54 0.53 0.53 0.53 0.53 0.53 0.53 0.53 0.54 0.54 0.54 0.54 0.54 0.54 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.57 0.55	(240)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	J	(24u)				
(2))// (2) (3.3)	Effe	ctive air		rate - ei	1 ter (24a)	1) or (24t)	0) or (24)	c) or (24		(25)	0.52	0.54	0.54	1	(25)				
3. Heat loss parameter: ELEMENT Gross area (m ²) Openings Met Area A.m ² U-value A X U (W/K) K-value kJ/m ² -K kJ/K Windows Type 1 2.88 x1(11(1.2)+0.04] = 3.3 (27) Windows Type 2 186 x1(11(1.2)+0.04] = 2.13 (27) Floor 83 x 0.13 = 10.79 (28) Windows Type 2 (28) x1(11(1.2)+0.04] = 2.13 (27) Floor 83 x 0.13 = 10.79 (28) Vindiagram of elements, m ² 133.22 (31) Party celling (32) 10 are of elements, m ² 0 (32) r/or windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ** * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (28)(30) + (32) = (33).76 (33)	(25)11-	0.55	0.55	0.55	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.54	J	(23)				
ELEMENT Gross area (m ²) Openings m ² Net Area A, m ² U-value W/m2K A X U k-value kJ/m ² ·K A X k k/K Windows Type 1 2.88 x1/[1/(1.2)+0.04] = 3.3 (27) Windows Type 2 1.86 x1/[1/(1.2)+0.04] = 2.13 (27) Floor 83 x 0.13 = 10.79 (28) Walls 19.62 30.6 x 0.18 = 5.51 (29) Total area of elements, m ² 133.22 (31) (32) Party wall 57.08 x 0 = 0 (32) Party wall 57.08 x 0.1 = 10 (32) ** include the areas on both sides of internal walls and partitions (26)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = (35) (35) For design assessments where the dails of the construction are not known precisely the indicative values of TMP in Table 11 (34) (35) (35) For design assessments where the dails of the construction are not known precisely the indicative values of TMP in Table 11 (36) (37) (36) </td <td>3. He</td> <td>at losse</td> <td>s and he</td> <td>eat loss</td> <td>paramet</td> <td>er:</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	3. He	at losse	s and he	eat loss	paramet	er:													
Windows Type 1 2.88 $x1[11/(1.2) + 0.04] = 3.3$ (27) Windows Type 2 1.86 $x1[11/(1.2) + 0.04] = 2.13$ (27) Floor 83 $x 0.13 = 10.79$ (28) Walls 19.62 30.6 $x 0.13 = 10.79$ (28) Walls 19.62 30.6 $x 0.13 = 5.51$ (29) Total area of elements, m ² 133.22 (31) (32) Party wall 57.08 $x 0 = 0$ (32) Party ceiling 83 (30) (32) (32) (32) (32) (33) (33) (26)(30) + (3	ELEN	IENT	Gros area	ss (m²)	Openin rr	igs າ²	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	<)	k-value kJ/m²·∣	e A K k	λXk ⟨J/Κ				
Windows Type 2 1.86 $x1[1/(1.2) + 0.04] = 2.13$ (27) Floor 83 x 0.13 = 10.79 (28) Walls 19.62 30.6 x 0.18 = 5.51 (29) Total area of elements, m ² 133.22 (31) (31) Party wall 57.08 x 0 = 0 (32) Party ceiling 83 0 = 0 (32) (32) * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (32) (32) Heat capacity Cm = S(A x k) ((28)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32)(32e) = 15941.96 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) can be used instead of a detailed calculation. 9.26 (36) Total fabric heat loss (31) + (36) = 48.03 (37) Ventil	Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)				
Floor 83 x 0.13 = 10.79 (28) Walls 19.62 30.6 x 0.18 = 5.51 (29) Total area of elements, m ² 133.22 (31) (31) (32) (32) Party wall 57.08 x 0 = 0 (32) Party ceiling 83 (32) (32) (32) (32) * for windows and roof windows, use effective window U-value calculated using formula 1/(1/U-value)+0.04] as given in paragraph 3.2 ** ** * include the areas on both sides of internal walls and partitions (26)(30) + (32) = (38.76 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = (38.76 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (34) Thermal bridges : S (L x Y) calculated using Appendix K (9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) (33) + (36) = (48.03 (37) Ventilation heat loss calculated monthly<	Windo	ws Type	2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)				
Walls19.62 30.6 x 0.18 = 5.51 (29)Total area of elements, m2133.22(31)Party wall 57.08 x 0 =(32)Party ceiling 83 (32)* for windows and roof windows, use effective window U-value calculated using formula $1/(1/U-value)+0.04$ as given in paragraph 3.2(32)** include the areas on both sides of internal walls and partitions(26)(30) + (32) = 38.76 Fabric heat loss, W/K = S (A x U)(26)(30) + (32) = 38.76 (33)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) = 15941.96 (34)Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium 250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f 250 (35)can be used instead of a detailed calculation. 9.26 (36)Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ $(33) + (36) =$ 48.03 (37)Ventilation heat loss calculated monthly $(38) m = 0.33 \times (25) m \times (5)$ $(38) m = 0.33 \times (25) m \times (5)$ $(38) m = 0.37 \times (25) m \times (5)$ (38) m= $40.61 + 40.47 + 40.33 + 39.68 + 39.95 + 38.99 + 38.89 + 39.21 + 39.65 + 39.81 + 40.06(38)(39) m = (37) + (38) m(39) m=88.64 + 88.49 + 88.6 + 87.71 + 87.59 + 87.02 + 87.02 + 87.02 + 87.99 + 87.83 + 88.09 + 87.71 + 87.59 + 87.02 + 87.71 + 87.59 + 87.32 + 87.71 + 87.59 + 87.02 + 87.71 + 87.59 + 87.32 + 87.71 + 87$	Floor						83	x	0.13	=	10.79				(28)				
Total area of elements, m ² Total area of elements, m ² Party wall Party wall 33.22 32.2 33.22 32.2 33.22 32.2 33.22 32.2 33.22 32.2 33.22 33.22 32.2 33.22 32.2 33.22 32.2 33.22 32.2 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 32.2	Walls				19.6	2	30.6	x	0.18	=	5.51				(29)				
Party wall 57.08 x 0 $=$ 0 (32) Party ceiling 83 $(32b)$ * for windows and roof windows, use effective window U-value calculated using formula $1/(1/U-value)+0.04$] as given in paragraph 3.2** include the areas on both sides of internal walls and partitionsFabric heat loss, $W/K = S (A \times U)$ $(26)(30) + (32) =$ 38.76 (33) Heat capacity Cm = $S(A \times k)$ $((28)(30) + (32) + (32a)(32e) =$ 15941.96 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² KIndicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1fcan be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36) (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly $(33) + (36) =$ 48.03 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ (38)m 40.61 40.47 40.33 39.68 39.56 38.99 38.89 39.21 39.56 39.89 (38) Heat transfer coefficient, W/K(39)m $(37) + (38)m$ (39)m $(39)m = (37) + (38)m$ (39)m $(39)m = (37) + (38)m$	Total a	rea of e	lements	, m²			133.2	2							(31)				
Party ceiling83(32b)* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2(32b)** include the areas on both sides of internal walls and partitionsFabric heat loss, W/K = S (A x U)(26)(30) + (32) =38.76(33)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) =15941.96(34)Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium250(35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.9.26(36)Thermal bridges : S (L x Y) calculated using Appendix K9.26(36)if details of thermal bridging are not known (36) = 0.05 x (31)(33) + (36) =48.03(37)Ventilation heat loss calculated monthly(38)m = 0.33 x (25)m x (5)(38)(38)m =40.6140.4740.3339.6839.5638.9938.9938.9339.2139.5639.8140.06(38)Heat transfer coefficient, W/K(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (32)m	Party v	vall					57.08	3 X	0	=	0				(32)				
* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 15941.96 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5) (38)m = $40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38)$ Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = $88.64 88.49 88.36 87.71 87.59 87.02 87.02 86.91 87.24 87.59 87.83 88.09$	Party o	ceiling					83							\neg	(32b)				
Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 15941.96 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) can be used instead of a detailed calculation. 9.26 (36) Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) 9.26 (36) Total fabric heat loss (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = (39)m = $(37) + (38)m$ (39)m = (38)m= 40.61 40.47 40.33 39.68 39.56 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (37) (39)m = (37) (39)m = (37) (38)	* for win ** inclua	dows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Is and part	alue calcul titions	lated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	ns given ir	n paragrapł	1 3.2					
Heat capacity $Cm = S(A \times k)$ ((28)(30) + (32) + (32a)(32e) = 15941.96 (34)Thermal mass parameter (TMP = $Cm + TFA$) in kJ/m²KIndicative Value: Medium250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1fcan be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K9.26 (36)f details of thermal bridging are not known (36) = 0.05 x (31)Total fabric heat loss(33) + (36) =Ventilation heat loss calculated monthly(38)m = 0.33 × (25)m x (5)(38)m = $0.33 \times (25)m x (5)$ (38)m = $0.44.47 + 40.33 + 39.68 + 39.56 + 38.99 + 38.99 + 38.89 + 39.21 + 39.56 + 39.81 + 40.06(38)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m$	Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				38.76	(33)				
Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium 250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K9.26 (36)if details of thermal bridging are not known (36) = 0.05 x (31)Total fabric heat loss(33) + (36) =(38)m = 0.33 × (25)m x (5)Ventilation heat loss calculated monthly(38)m = 0.33 × (25)m x (5)(38)m = 0.33 × (25)m x (5)(38)m = (37) + (38)m(38)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)mAverage = Sum(30), p (12= 47.4)Apy 7.187.7187.71Apy 7.1Apy 7.187.71Apy 7.1Apy <="" colspan="4" td=""><td>Heat c</td><td>apacity</td><td>Cm = S</td><td>(Axk)</td><td></td><td></td><td></td><td></td><td></td><td>((28)</td><td>.(30) + (32</td><td>2) + (32a)</td><td>(32e) =</td><td>15941.96</td><td>(34)</td></td>	<td>Heat c</td> <td>apacity</td> <td>Cm = S</td> <td>(Axk)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>((28)</td> <td>.(30) + (32</td> <td>2) + (32a)</td> <td>(32e) =</td> <td>15941.96</td> <td>(34)</td>				Heat c	apacity	Cm = S	(Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	15941.96	(34)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = $40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06$ Heat transfer coefficient, W/K (39)m = $88.64 88.49 88.36 87.71 87.59 87.02 87.02 86.91 87.24 87.59 87.83 88.09$ Average = Sum(39), w (12 = 197.71 (39))	Therm	al mass	parame	eter (TMI	P = Cm +	+ TFA) ir	ו kJ/m²K			Indica	tive Value	Medium		250	(35)				
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.29 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = $(37) + (38)m$ (39)m = $(36.4 + 88.49 + 88.36 + 87.71 + 87.59 + 87.02 + 87$	For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in T	able 1f						
if details of thermal bridging are not known $(36) = 0.05 \times (31)$ Total fabric heat loss $(33) + (36) =$ 48.03 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ $(38)m = 0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec $(38)m =$ 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K	Therm	al bridg	es : S (L	x Y) ca	culated	using Ap	pendix I	K						9.26	(36)				
I otal fabric heat loss (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (37) + (38)m<	if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)												
Ventilation neat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = $(37) + (38)m$ (39)m= 88.64 88.49 88.36 87.71 87.59 87.02 87.02 86.91 87.24 87.59 87.83 88.09	I otal fa	abric he	at loss							(33) +	(36) =	05)		48.03	(37)				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ventila	tion hea				у	1	1.1	Δ	(38)m	= 0.33 × (25)m x (5		1					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(20)	Jan		Mar	Apr	May 20.56	Jun		Aug	Sep	UCt	NOV		4	(38)				
Heat transfer coefficient, W/K $(39)m = (37) + (38)m$ $(39)m = 88.64$ 88.49 88.36 87.71 87.59 87.02 86.91 87.24 87.59 87.83 88.09 Average = Sum(30), $m (12) = 100$ 87.71 87.71 87.59 87.71 (39)	(30)11=	40.01	40.47	40.33	39.00	39.50	30.99	30.99	30.69	39.21	39.50	39.01	40.00	J	(30)				
$(39)^{\text{III}} = 00.04 \ 80.49 \ 80.30 \ 81.71 \ 81.39 \ 81.02 \ 81.02 \ 81.02 \ 81.02 \ 81.24 \ 81.59 \ 81.83 \ 88.09 \ 81.83 \ 88.09 \ 81.83 \ 81.91 \ 81$	Heat tr	anster o		nt, W/K	07 74	07 50	07.00	07.00	00.01	(39)m	= (37) + (3	38)m	00.00	1					
	(39)m=	00.04	00.49	00.30	07.71	07.59	07.02	07.02	00.91	07.24	07.59 Average =	5um(30)	00.09	87 71	(39)				

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.07	1.07	1.06	1.06	1.06	1.05	1.05	1.05	1.05	1.06	1.06	1.06		
Numbe	er of day	s in mo	nth (Tab	le 1a)						Average =	Sum(40) ₁ .	12 /12=	1.06	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	.lul	Αυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	52		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		
-		h = 1 = 1 =			and here a	400 ··· \/			-	Total = Su	m(44) ₁₁₂ =	- 1 -1)	1127.84	(44)
Energy	content of	not water	usea - cai	culated me	$\frac{1}{2}$	190 x Va,r	n x nm x L	JTM / 3600) kvvn/mor	nth (see Ta	adies 10, 1	c, 1a)	I	
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.56	106.21	107.48	125.26	136.73	148.48	4 4 7 0 7 7	
lf instan	taneous w	ater heati	ng at point	t of use (no	o hot water	^r storage),	enter 0 in	boxes (46) to (61)	l otal = Su	m(45) ₁₁₂ =		1478.77	(45)
(46)m=	23	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Water	storage	loss:	Į	Į		I	I	l	I	1				
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	nunity h	eating a	ind no ta	ank in dw	/elling, e	nter 110	litres in	i (47)		(0)				
Otherv Water	vise it no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b		`						0		(49)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:							
Hot wa	ater stora	age loss	factor fi	rom Tabl	le 2 (kW	h/litre/da	iy)					0		(51)
Volum	e factor	from Ta	ble 2a	011 4.5								n		(52)
Tempe	erature f	actor fro	m Table	2b								0		(52)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)									0		(55)
Water	storage	loss cal	culated ⁻	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	stat)		L	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	h month	(61)m =	(60)) ÷ 36	65 × (41))m						
(61)m=	16.27	14.67	16.18	15.59	16.05	1	5.47	15.95	16.02	15.53	16.13	15.69	16.25]	(61)
Total h	eat req	uired for	water h	neating c	alculated	l fo	r eacl	n month	(62)m	= 0.85 ×	(45)m -	+ (46)m +	(57)m +	- (59)m + (61)m	
(62)m=	169.58	148.76	154.55	136.22	131.8	1'	15.36	108.51	122.23	123.02	141.39) 152.42	164.73]	(62)
Solar DH	W input	calculated	using Ap	pendix G c	r Appendix	:Н(negativ	ve quantity	/) (enter '	0' if no sola	r contrib	ution to wate	er heating)	
(add ad	dditiona	al lines if	FGHRS	and/or	WWHRS	ap	plies,	, see Ap	pendix	G)					
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(63)
Output	from w	ater hea	ter	-						-	-		-	-	
(64)m=	169.58	148.76	154.55	136.22	131.8	1'	15.36	108.51	122.23	123.02	141.39	152.42	164.73]	
				•					Ou	put from w	ater hea	ter (annual)	I12	1668.57	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61)	n] + 0.8 x	x [(46)r	n + (57)m	+ (59)n	n]	
(65)m=	55.04	48.25	50.05	44.01	42.5	3	7.08	34.76	39.32	39.62	45.68	49.39	53.43]	(65)
inclu	de (57)	m in calo	ulation	of (65)m	n only if c	ylir	nder is	s in the c	dwelling	or hot w	ater is	from com	munity	- heating	
5. Int	ernal a	ains (see	e Table	5 and 5a):	5			-				-		
Metabo	olic gair	ne (Table	5) Wa	itte)-										
Melabl	Jan	Feb	Mar	Apr	Mav		Jun	Jul	Aua	Sep	Oct	Nov	Dec	1	
(66)m=	125.87	125.87	125.87	125.87	125.87	12	25.87	125.87	125.87	125.87	125.87	125.87	125.87	-	(66)
l iahtin	a gains	ı (calcula	I ted in A	ppendix	L equat	ion	19.0	(19a) a	lso see	Table 5		I		1	
(67)m=	20.11	17.86	14.53		8.22		5.94	7.5	9.75	13.08	16.61	19.39	20.67	1	(67)
Appliar		l ins (calc	ulated i				ion	13 or 1 1	30) 010		blo 5	1]	
	225 G						1011 L	168 77	3a), ais	17233		200 74	215.64	7	(68)
	225.0		222.04	209.40	1.00.00		10.75	an 145 a)				200.74	210.04]	(00)
COOKIN					L, equai		1 L 15	or L 15a)), also s		25	25.50	25.50	7	(60)
(09)11-	30.09		(7.1.1	55.59	35.59	3	5.59	30.09	35.59	35.59	35.59	35.59	35.59]	(03)
Pumps	and fa	ns gains	(lable	5a)			-						<u> </u>	-	(70)
(70)m=	3	3	3	3	3		3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	/aporatic	on (nega	ative valu	ies) (Tab	le	5)							-	
(71)m=	-100.69	-100.69	-100.69	-100.69	-100.69	-1	00.69	-100.69	-100.69	-100.69	-100.69	9 -100.69	-100.69		(71)
Water	heating	gains (T	able 5)		i							-		-	
(72)m=	73.98	71.81	67.28	61.12	57.12	5	51.5	46.73	52.85	55.03	61.4	68.59	71.82		(72)
Total i	nterna	gains =					(66)	m + (67)m	ı + (68)m	+ (69)m +	(70)m +	(71)m + (72))m	_	
(73)m=	383.45	381.37	367.6	345.36	322.73	30	00.93	286.76	292.79	304.2	326.66	352.48	371.89		(73)
6. Sol	ar gain	s:													
Solar g	ains are	calculated	using sol	ar flux from	Table 6a	and	associ	ated equa	tions to c	onvert to th	ne applic	able orientat	tion.		
Orienta	ation:	Access F	actor	Area	l		Flu	X No Go		g_ Tabla 6b		FF		Gains	
							Tac			able ob		Table oc		(VV)	_
Southw	est <mark>0.9x</mark>	0.77	>	2.	88	x	3	6.79		0.3	×	0.7	=	15.42	(79)
Southw	est <mark>0.9x</mark>	0.77	>	1.	86	x	3	6.79		0.3	×	0.7	=	89.64	(79)
Southw	est <mark>0.9x</mark>	0.77	>	2.	88	x	6	2.67		0.3	×	0.7	=	26.27	(79)
Southw	est <mark>0.9x</mark>	0.77	>	1.	86	x	6	2.67		0.3	x	0.7	=	152.68	(79)
Southw	est <mark>0.9x</mark>	0.77)	2.	88	x	8	5.75		0.3	x	0.7	=	35.94	(79)

Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	8	5.75]		0.3	x	0.7		=	208.91	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	x	1	06.25	Ī		0.3	×	0.7		=	44.53	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25	1		0.3	x	0.7		=	258.85	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	x	1	19.01	1		0.3	x	0.7		=	49.88	(79)
Southw	est <mark>o.9x</mark>	0.77		x	1.8	6	x	1	19.01	Ī		0.3	×	0.7		=	289.93	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15]		0.3	×	0.7		=	49.52	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15]		0.3	x	0.7		=	287.83	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91]		0.3	×	0.7		=	47.74	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.3	x	0.7		=	277.5	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39]		0.3	x	0.7		=	43.75	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39]		0.3	×	0.7		=	254.31	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	g	2.85]		0.3	x	0.7		=	38.92	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	g	2.85]		0.3	x	0.7		=	226.2	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27]		0.3	x	0.7		=	29.03	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27]		0.3	×	0.7		=	168.75	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07]		0.3	×	0.7		= [18.47	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07]		0.3	×	0.7		=	107.36	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	3	1.49]		0.3	x	0.7		=	13.2	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49]		0.3	x	0.7		=	76.71	(79)
Solar g	pains in	watts, ca	alculate	ed	for each	n mont	h			(83)m	ı = Su	ım(74)m .	(82) m					
(83)m=	105.06	178.95	244.8	5	303.38	339.81	1 3	37.35	325.24	298	.07	265.12	197.78	3 125.83	89.	91		(83)
Total g	jains – i	nternal a	nd sol	ar	(84)m =	: (73)m	ו + (ד	83)m	, watts						-			
(84)m=	488.51	560.32	612.4	5	648.74	662.54	4 6	38.28	612	590	.85	569.32	524.44	478.32	461	1.8		(84)
7. Me	an inter	rnal temp	eratur	e (heating	seaso	on)									-		
Temp	erature	during h	eating	pe	eriods ir	the liv	ving	area	from Tal	ble 9	, Th1	l (°C)					21	(85)
Utilisa	ation fac	ctor for g	ains fo	r li	ving are	a, h1,	m (s	ee Ta	ble 9a)	·					i			
	Jan	Feb	Mai	·	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov	D	ес		
(86)m=	1	1	0.99		0.97	0.92		0.78	0.61	0.6	65	0.87	0.98	1	1	l		(86)
Mean	interna	l tempera	ature i	n li	ving are	ea T1 (follo	w ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	19.86	20	20.22		20.5	20.76	2	20.93	20.99	20.	98	20.87	20.54	20.14	19.	83		(87)
Temp	erature	during h	eating	ре	eriods ir	rest c	of dv	/elling	from Ta	able 9	9, Th	12 (°C)						
(88)m=	20.03	20.03	20.03		20.04	20.04	2	20.04	20.04	20.	04	20.04	20.04	20.04	20.	03		(88)
Utilisa	ation fac	ctor for a	ains fo	r re	est of d	vellina	, h2	,m (se	e Table	9a)								
(89)m=	1	0.99	0.99	Τ	0.96	0.88		0.7	0.48	0.5	53	0.8	0.97	0.99	1	1		(89)
Mean	interna	l temper	ature i	n ti	he rest	of dwe	llina	T2 (f	ollow ste	eps 3	to 7	in Tabl	e 9c)					
								·· ("					,					

(90)m=	18.5	18.71	19.03	19.44	19.79	20	20.04	20.04	19.94	19.5	18.92	18.46		(90)
									f	LA = Livin	g area ÷ (4	1) =	0.3	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwel	lina) = fl	LA × T1	+ (1 – fL	A) × T2					

mean	interna	i temper				inig) ii		. (.,, .,		-		
(92)m=	18.91	19.1	19.39	19.76	20.08	20.28	20.32	20.32	20.22	19.81	19.29	18.87	(92

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

(93)m=	18.91	19.1	19.39	19.76	20.08	20.28	20.32	20.32	20.22	19.81	19.29	18.87		(93)
8. Spa	ace hea	ting req	uiremen	t										
Set Ti the ut	i to the i ilisation	mean inf factor fo	ternal te or gains	mperatui using Ta	re obtair able 9a	ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.98	0.96	0.88	0.72	0.52	0.56	0.82	0.96	0.99	1		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	486.83	556.14	602	620.07	585.25	459.49	319.06	333.21	464.27	505.19	474.82	460.6		(95)
Month	nly aver	age exte	ernal terr	perature	e 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	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1295.04	1256.8	1139.15	952.5	734.24	494.06	324.01	340.72	533.82	806.9	1070.65	1292.43		(97)
Space	e heatin	g requir	ement fo	or each n	nonth, k'	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	601.31	470.84	399.64	239.35	110.85	0	0	0	0	224.47	429	618.88		
		-	-		-	-		Tota	l per year	(kWh/yeai	r) = Sum(9	8)15,912 =	3094.33	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								37.28	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:												-
Fracti	on of sp	bace hea	at from s	econdar	y/supple	ementary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of s	seconda	iry/suppl	ementar	y heatin	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g requir	ement (o	calculate	d above)					-			
	601.31	470.84	399.64	239.35	110.85	0	0	0	0	224.47	429	618.88		
(211)m	n = {[(98)m x (20	04)] } x 1	100 ÷ (20)6)									(211)
	643.11	503.57	427.42	255.99	118.55	0	0	0	0	240.07	458.82	661.9		
					-			Tota	ll (kWh/yea	ar) =Sum(2	211) _{15,1012}	2	3309.44	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)]}x1	00 ÷ (20)8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	3												-
Output	from w	ater hea	ter (calc	ulated a	bove)									
	169.58	148.76	154.55	136.22	131.8	115.36	108.51	122.23	123.02	141.39	152.42	164.73		-
Efficier	ncy of w	ater hea	ater										87.3	(216)
(217)m=	89.78	89.71	89.58	89.31	88.73	87.3	87.3	87.3	87.3	89.24	89.64	89.81		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100	J ÷ (217))m 152.52	1/1.8 5/	122 14	12/1 2	140.01	140.01	158 11	170.04	183 12		
(213)11=	100.9	100.00	172.02	102.02	140.04	132.14	124.0		= Sum(2)	19a) =	170.04	100.42	1077 57	
	1 4 - 4 - 1 -							1010		· •••/ ₁₁₂ -	A/6 4		10//.3/](219)
Snace	heating	fuelue	nain he	system	1					K	wn/year		3300 //	1
Space	neating		su, main	system	I								JJU9.44]

			1877.57	
		30]	(230c)
		45]	(230e)
sum of (23	0a)(230g) =		75	(231)
			355.19	(232)
231) + (232)(237b) =			5617.2	(338)
including micro-CHP				
Energy kWh/year	Emission fa kg CO2/kWh	ctor	Emissions kg CO2/yea	ar
(211) x	0.216	=	714.84	(261)
(215) x	0.519	=	0	(263)
(219) x	0.216	=	405.55	(264)
(261) + (262) + (263) + (264) =			1120.39	(265)
(231) x	0.519	=	38.93	(267)
(232) x	0.519	=	184.34	(268)
su	m of (265)(271) =		1343.66	(272)
(2)	72) ÷ (4) =		16.19	(273)
			86	(274)
	sum of (23 (231) + (232)(237b) = including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x su (2	$sum of (230a)(230g) =$ $(231) + (232)(237b) =$ $(231) + (232)(237b) =$ $(231) \times (216) \times (21$	30 45 $sum of (230a)(230g) =$ $2(31) + (2(32)(237b) =$ $2(31) + (2(32)(237b) =$ $2(31) + (2(32)(237b) =$ $2(31) \times 0.216 =$ $(2(1) \times 0.216 =$ $(2(1) + (2(2) + (2(3) + (2(4)) =$ $(2(1) + (2(1) + (2(3) + (2(4)) =$ $(2(1) + (2(1) + (2(3) + (2(4)) =$ $(2(1) + (2(1) + (2(3) + (2(4)) =$ $(2(1) + (2(1) + (2(3) + (2(4)) =$ $(2(1) + (2(1) + (2(3) + (2$	1877.57 30 45 355.19 355.19 $231) + (232)(237b) = 5617.2$ 5617.2 5

		Use	er Details:						
Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Numi ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Prope	rty Address:	Kingsto	n Bridge	e 3BF 83	3 GND G	AS	
Address :	ncione:								
	11510115.		(m ²)			iaht(m)		Volume(m ³)	
Ground floor		, 	83	(1a) x		7	(2a) =	224 1](3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e		83	(4)				227.1	
Dwelling volume		, , , _		`(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	224.1] (5)
2 Ventilation rate:									_ , ,
2. ventilation rate:	main s	econdary	other		total			m ³ per hour	•
Number of chimneys	heating h	neating +] = [0	x 4	40 =	-	
Number of channeys			0		0		20 =	0	
Number of open lives		0	0		0		10 -	0	(6b)
Number of intermittent fai	ns			Ľ	3	× 1	10 -	30	(7a)
Number of passive vents					0	X 1	10 =	0	(7b)
Number of flueless gas fin	res				0	x 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimnes	$\sqrt{5}$ flues and fans = (6)	a)+(6b)+(7a)+(7	'b)+(7c) =	Г		<u> </u>	÷ (5) =	• •	٦
If a pressurisation test has be	een carried out or is intende	ed, proceed to (1	17), otherwise c	ontinue fro	om (9) to ((16)	. (0) –		
Number of storeys in th	ne dwelling (ns)							0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or 0.35	5 for masonr	y constru	uction			0	(11)
if both types of wall are pr deducting areas of openin	esent, use the value corres	ponding to the g	greater wall area	a (after					
If suspended wooden f	loor, enter 0.2 (unseal	led) or 0.1 (se	ealed), else	enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else enter 0							0	(13)
Percentage of windows	s and doors draught st	tripped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cub	pic metres pe	r hour per so	luare me	etre of e	nvelope	area	5	(17)
If based on air permeabili	ity value, then (18) = [(1	7) ÷ 20]+(8), oth	nerwise (18) = (16)				0.38	(18)
Air permeability value applies	s if a pressurisation test ha: d	s been done or a	a degree air per	meability i	is being us	sed			
Shelter factor	u		(20) = 1 - [0.075 x (1	9)] =			2	$-\binom{(19)}{(20)}$
Infiltration rate incorporati	ing shelter factor		(21) = (18)	x (20) =				0.03	$\int_{(21)}^{(20)}$
Infiltration rate modified for	or monthly wind speed	4	. , . ,	. ,				0.00	_()
Jan Feb	Mar Apr May	- Jun Ju	ul 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	8 3.7	4	4.3	4.5	4.7		
\sim	2)m : 4	· ·							
(22a)m = 1.27 + 1.25	≤)···· · · · · · · · · · · · · · · · · ·	0.95 0.0	95 0.92	1	1 08	1 12	1 18		
			0.02	·	1.00				

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
.	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se							(220)
lf exh	aust air h	eat nump i	using App	endix N (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)) other	rwise (23h) = (23a)			0	(238)
lf bala	anced with	n heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (200)			0	(230)
a) If	balance	ed mech	anical ve	ntilation	with he	at recove	erv (MVI	HR) (24a	, a)m = (22	2b)m + ()	23h) × [1 – (23c)	÷ 1001	(200)
(24a)m=				0	0	0			0	0		0		(24a)
b) If	balance	ed mecha	i anical ve	entilation	u without	heat rec	L Coverv (N	I MV) (24b))m = (22	L 2b)m + (;	1 23b)		ł	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	r positiv	e input v	ventilatio	n from c	outside		1		1	
i	if (22b)r	n < 0.5 ×	(23b), t	then (24	c) = (23b); otherv	wise (24	c) = (22b	o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22I	se positiv b)m othe	ve input [,] erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. He	at losse	s and he	eat loss i	paramet	er:									
ELEN	IENT	Gros	SS	Openin	igs	Net Ar	ea	U-valı	ue	AXU		k-value	e A	A X k
		area	(m²)	'n	0 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²∙l	K k	J/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.4)+	0.04] =	3.82				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.4)+	0.04] =	2.47				(27)
Floor						83	x	0.13	=	10.79				(28)
Walls				19.6	2	30.6	x	0.18	=	5.51				(29)
Total a	area of e	elements	, m²			133.2	2							(31)
Party v	wall					57.08	3 X	0	=	0				(32)
Party o	ceiling					83								(32b)
* for win ** inclua	idows and le the area	l roof wind as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given ir	n paragraph	1 3.2	
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				42.31	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	15941.96	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	ו kJ/m²K			Indica	tive Value:	Medium		250	(35)
For desi can be ι	ign asses: used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are not	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	K						6.42	(36)
if details	of therma	al bridging	are not kr	10wn (36) =	= 0.05 x (3	1)			(33) +	(36) =			<u> </u>	(27)
Ventila	abile he	at loss of	alculator	monthly	M.				(38)m	(30) =	25)m v (5)	48.73	(37)
ventile	Jan	Feh	Mar	Anr	y Mav	Jun	Jul	Aug	Sen	- 0.00 m (Nov	Dec	I	
(38)m=	43.38	43.13	42.88	41.74	41.53	40.53	40.53	40.34	40.91	41.53	41.96	42.41		(38)
Heat tr	L	Coefficier	nt \N//K	I	I	I		ļ	(30)m	= (37) + ('	1 38)m	1	1	
(39)m=	92.1	91.86	91.61	90.47	90.25	89.26	89.26	89.07	89.64	90.25	90.69	91.14		
	L	I	ļ	I	I	I	I	I	<u>ا</u> ــــــــــــــــــــــــــــــــــــ	Average =	L Sum(39)	112 /12=	90.47	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.11	1.11	1.1	1.09	1.09	1.08	1.08	1.07	1.08	1.09	1.09	1.1		
Numbe	er of day	us in mo	nth (Tab	le 1a)						Average =	Sum(40) _{1.}	₁₂ /12=	1.09	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
								1						
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.0	0013 x (⁻	TFA -13.	9) 2.	52		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		_
Enerav (content of	hot water	used - cal	culated m	onthly $= 4$	190 x Vd.r	m x nm x I)))))))))))))))))))) kWh/mor	Total = Su	m <mark>(44)</mark> 112 = ables 1b. 1	c. 1d)	1127.84	(44)
(45)m=	153.32	134.09	138.37	120.64	115 75	99.89	92.56	106.21	107.48	125.26	136 73	148.48		
(40)	100.02	104.00	100.07	120.04	110.70	00.00	02.00	100.21		Total = Su	m(45) _{1 12} =	140.40	1478.77	(45)
lf instant	taneous v	ater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)		(),	L	-	
(46)m=	23	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Water	storage	loss:) includir		olar or M		storage	within ea	amo vos	ما				(47)
If com	nunity h	eating a	and no te	ank in dw	vellina e	nter 110) litres in	(47)		501		0		(47)
Otherw	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m _	anufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):					0		(48)
lempe	erature f	actor fro	m I able	2b				(10)				0		(49)
b) If m	/ lost fro	om water urer's de	eclared of	e, Kvvn/ye cvlinder	ear loss fact	or is not	known:	(48) X (49)) =			0		(50)
Hot wa	iter stor	age loss	factor fr	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
If comr	nunity h	eating s	ee secti	on 4.3										
Volum	e factor	from Ta	ble 2a	26								0		(52)
Tempe				: ZU				(47) × (64)) y (EQ) y (F2) -		0		(53)
Enter	(50) or ((54) in (5	storage	e, kvvn/y	ear			(47) X (51)) X (52) X (55) -		0 N		(54) (55)
Water	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)	m		<u> </u>		()
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Appendi	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			/==-
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	ch r	month (61)m =	(60) ÷ 36	65 × (41))m									
(61)m=	50.96	45.86	48.85		45.42	45.02	4	1.71	43.11	45.0	2	45.42	48.8	5	49.13	50	.96]	(61)
Total h	eat req	uired for	water	hea	ating ca	lculated	l fo	r eacl	n month	(62)n	า =	0.85 × ((45)m	+	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	204.28	179.95	187.22	2	166.06	160.77	1	41.6	135.66	151.2	23	152.9	174.1	1	185.86	199	9.44		(62)
Solar DH	- IW input	calculated	using Ap	ppe	ndix G or	Appendix	: H (negativ	ve quantity	/) (ente	r '0'	if no sola	r contril	bu	tion to wate	er hea	ating)		
(add a	dditiona	al lines if	FGHR	S a	nd/or V	VWHRS	ap	plies	, see Ap	pendi	x G	6)							
(63)m=	0	0	0		0	0		0	0	0		0	0		0	(0		(63)
Output	from w	ater hea	iter															-	
(64)m=	204.28	179.95	187.22	2	166.06	160.77	1	41.6	135.66	151.2	23	152.9	174.1	1	185.86	199	9.44		
										C	Outp	ut from wa	ater hea	ate	er (annual)	12		2039.09	(64)
Heat g	ains fro	m water	heating	g, ł	(Wh/mo	onth 0.2	5 ´	[0.85	× (45)m	+ (61)m] + 0.8 >	(46) (m	+ (57)m	+ (5	59)m]	
(65)m=	63.72	56.05	58.22	Τ	51.47	49.74	4	3.64	41.55	46.5	7	47.09	53.8	6	57.75	62	.11		(65)
inclu	de (57))m in cal	ulatior	n of	f (65)m	only if c	ylir	nder is	s in the c	dwellii	ng d	or hot w	ater is	s f	rom com	mun	nity h	eating	
5. Int	ernal o	ains (see	e Table	5 8	and 5a):	5				Ū						,	U U	
Metab	olic gai	ns (Table	5) Wa	atte															
Metab	Jan	Feb	Mar		, Apr	Mav		Jun	Jul	Au	a	Sep	Oc	t	Nov	C)ec]	
(66)m=	125.87	125.87	125.87	,	125.87	125.87	12	25.87	125.87	125.8	37	125.87	125.8	37	125.87	125	5.87		(66)
Liahtin	a aains	(calcula	ted in A	- I Apr	pendix l	. equat	ion	L9 or	r L9a), a	lso se	e T	able 5	I					1	
(67)m=	20.11	17.86	14.53	1	11	8.22	6	6.94	7.5	9.75	;	13.08	16.6	1	19.39	20	.67]	(67)
Annlia	nces da	ins (calc	ulated	in .	Annenc	lix lea	L Llat	ion L	13 or I 1	3a) a	lso	see Ta	l ble 5		1			1	
(68)m=	225.6	227.94	222.04	i T	209.48	193.63	1	78.73	168.77	166.4	13	172.33	184.8	39	200.74	215	5.64	1	(68)
Cookin	L	L s (calcula	L	_L Ani	nendix	l equat	L ior	1 15	or I 15a			e Table	5					1	
(69)m=	35.59	35.59	35.59		35.59	35.59		5.59	35.59	35.5	9	35.59	35.5	9	35.59	35	.59	1	(69)
Pumps	and fa	ne gaine	(Table	5	3)						-			-				1	
(70)m=				1	3	3		3	3	3		3	3		3		3	ו	(70)
						e) (Tab		5)	.	Ů		0	Ů		ů			J	(- /
(71)m=	-100 69				100 69	-100 69			-100.69	-100 (30	-100 69	-100 6	30	-100.69	-100	1 60	1	(71)
(/ I)III-	hooting			<u>`</u>	100.00	-100.00	- 1	00.00	-100.00	-100.0	55	-100.00	-100.0		-100.00	-100	0.00]	()
		gains (i) 	71 40	66.96	6	0.61	55 95	62.6		65.41	72.2	0	00.2	02	10	1	(72)
(72)11-	05.04	03.41	70.25		71.40	00.00		0.01	00.00	02.0	,	(60)m + ((70)m	9	00.2 (1)m + (72)	00	.40	J	(12)
I otal I	nterna	i gains =	-		255 70	222.47		(00)				014 50		· (/	(1) (12)			1	(73)
(73)m=	395.11	392.97	378.58	·	355.72	332.47	3	10.04	295.88	302.5	53	314.58	337.0	00	364.09	383	5.55		(13)
Solar o	ains are	s. calculated	usina so	lari	flux from	Table 6a :	and	associ	iated equa	tions to		overt to th	e annli	cal	hle orientat	ion			
Orienta	ation.	Access F	Factor		Area		and	Flu	X		, 001	a	e appli	ou	FF	1011.		Gains	
onona		Table 6d	uotor		m²			Tat	ole 6a		Та	able 6b		Т	able 6c			(W)	
Southw	est <mark>o.9x</mark>	0.77		×「	2.8	8	x	3	6 79	I F		0.63	┐ ×	Г	0.7		_	32.38] (79)
Southw	esto 9x	0.77		∩ [x [1.8	6	x	3	6 79	I L I T		0.63	۲°,	F	0.7		_	188.24](79)
Southw	esto 9x	0.77		∵ L x [1.0 2 Q	8	x	6	2 67	I L I T		0.63	٦ [°]	L	0.7		_	55 16](79)
Southw	esto ov	0.77		î [<mark>v</mark> [2.0	6	Ϋ́	6	2.67	L T		0.63	╡ Û		0.7		=	320 64](79)
Southw	esto 9x	0.77		∩ L x [1.0 	8	x	0	5 75	L T		0.63	╡ Ŷ	L	0.7	\neg	=	75 / 2](79)
		0.77		^	∠.0	· ·	^	0	0.10			0.03	1 ^	1	0.7		_	10.40	1,1,2,1

Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	8	35.75]		0.63	x	0.7		=	438.71	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	x	1	06.25	j		0.63	×	0.7		= [93.52	(79)
Southw	est <mark>o.9x</mark>	0.77		x	1.8	6	x	1	06.25	1		0.63	x	0.7		=	543.58	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	x	1	19.01	Ī		0.63	x	0.7		=	104.75	(79)
Southw	est <mark>o.9x</mark>	0.77		x	1.8	6	İ x	1	19.01	Ī		0.63	x	0.7		= [608.85	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	İ x	1	18.15	ĺ		0.63	x	0.7		=	103.99	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15	1		0.63	x	0.7		=	604.45	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	×	1	13.91]		0.63	x	0.7		=	100.26	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	×	1	13.91]		0.63	×	0.7		=	582.76	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	×	1	04.39]		0.63	×	0.7		=	91.88	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	×	1	04.39]		0.63	×	0.7		=	534.06	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	×	g	92.85]		0.63	x	0.7		=	81.73	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	×	9	92.85]		0.63	×	0.7		= [475.03	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	×	6	69.27]		0.63	×	0.7		= [60.97	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	×	6	69.27]		0.63	x	0.7		= [354.37	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	×	4	4.07]		0.63	x	0.7		= [38.79	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	×	4	4.07]		0.63	x	0.7		=	225.46	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	×	3	31.49]		0.63	x	0.7		=	27.71	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49]		0.63	x	0.7		= [161.09	(79)
Solar g	ains in	watts, ca	alculate	ed	for each	n mon	th			(83)m	1 = St	um(74)m .	(82)m	-				
(83)m=	220.62	375.8	514.18	3	637.1	713.6	;	708.44	683.01	625	.94	556.75	415.34	4 264.25	188	.81		(83)
l otal g	ains – i	nternal a	and sol	ar	(84)m =	• (73)n	n +	(83)m	, watts		1							
(84)m=	615.73	768.77	892.76	5	992.82	1046.0)7	1018.48	978.9	928	.47	871.33	752.99	628.35	572	.36		(84)
7. Me	an inter	mal temp	beratur	e (heating	seaso	on)											_
Temp	erature	during h	neating	pe	eriods ir	the liv	ving	g area	from Tal	ble 9	, Th′	1 (°C)					21	(85)
Utilisa	ation fac	ctor for g	ains fo	r li	ving are	ea, h1,	<u>m (</u>	see Ta	ble 9a)						i			
	Jan	Feb	Mar	·	Apr	Ma	y	Jun	Jul	A	ug	Sep	Oct	Nov	D	ec		(00)
(86)m=	0.99	0.98	0.95		0.88	0.74		0.55	0.4	0.4	14	0.67	0.92	0.99	1			(86)
Mean	interna	I temper	ature i	n li	iving are	ea T1	(foll	low ste	ps 3 to 7	7 in T	able	e 9c)		_				
(87)m=	19.94	20.18	20.46		20.74	20.92		20.99	21	2	1	20.96	20.72	20.27	19.	.9		(87)
Temp	erature	during h	neating	ре	eriods ir	rest o	of d	welling	from Ta	able	9, Th	n2 (°C)						
(88)m=	19.99	20	20		20.01	20.01		20.02	20.02	20.	02	20.02	20.01	20.01	20	0		(88)
Utilisa	ation fac	ctor for g	ains fo	r re	est of d	velling	, h	2,m (se	e Table	9a)								
(89)m=	0.99	0.98	0.94		0.85	0.68		0.47	0.31	0.3	35	0.59	0.89	0.98	1			(89)
Mean	interna	I temper	ature i	n tl	he rest	of dwe	ellin	g T2 (f	ollow ste	eps 3	6 to 7	in Tabl	e 9c)					
(90)m=	18.6	18.94	19.34		19.73	19.94		20.01	20.02	20.	02	19.99	, 19.71	19.08	18.	55		(90)
		-							-						-			_

 $fLA = Living area \div (4) = 0.3$ (91)

Mean	internal	l temper	ature (fo	r the wh	ole dwel	ling) = fl	_A × T1	+ (1 – fL	A) × T2				
(92)m=	19.01	19.31	19.67	20.04	20.24	20.31	20.31	20.32	20.28	20.01	19.44	18.95	(92)

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

(93)m=	19.01	19.31	19.67	20.04	20.24	20.31	20.31	20.32	20.28	20.01	19.44	18.95		(93)
8. Spa	ace hea	ting requ	uirement	i i										
Set Ti the ut	i to the i ilisation	mean int factor fo	ternal tei or gains	mperatui using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm											
(94)m=	0.99	0.97	0.94	0.85	0.69	0.49	0.34	0.37	0.61	0.89	0.98	0.99		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m		•				•			
(95)m=	609.99	748.79	835.34	839.95	722.69	502.77	330.86	347.54	534.69	667.29	614.55	568.52		(95)
Month	nly aver	age exte	ernal tem	perature	e from Ta	able 8	-	-			-	-		
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1354.44	1323.57	1206.8	1007.48	770.37	509.3	331.57	348.74	554.28	849.31	1118.86	1344.71		(97)
Space	e heatin	g require	ement fo	r each n	honth, k\	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	553.87	386.25	276.36	120.62	35.47	0	0	0	0	135.42	363.1	577.48		-
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	2448.59	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								29.5	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space Fracti	e heatii	1g: Dace hea	at from s	econdar	v/sunnle	mentary	system						0	1 (201)
Fracti	on of or		at from m		y/Supple	mentary	System	(202) = 1	(201) =				0	
Fracti	on or sp			iain syst	em(s)			(202) = 1 - 1	- (201) -	(000)]			1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –)	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatin	g require	ement (c	alculate	d above)								
	553.87	386.25	276.36	120.62	35.47	0	0	0	0	135.42	363.1	577.48		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	593.01	413.55	295.89	129.14	37.98	0	0	0	0	144.99	388.76	618.29		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2621.62	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)]}x1	00 ÷ (20	8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water	heating	9												
Output	from w	ater hea	ter (calc	ulated a	bove)	r						r		
	204.28	179.95	187.22	166.06	160.77	141.6	135.66	151.23	152.9	174.11	185.86	199.44		-
Efficier	ncy of w	ater hea											80.3	(216)
(217)m=	87.44	86.93	86.03	84.26	81.96	80.3	80.3	80.3	80.3	84.43	86.71	87.57		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(∠19)m (219)m=	233.63	207.01	217.63	197.08	196.17	176.34	168.95	188.34	190.42	206.23	214.35	227.74		
(= / • / • · ·								Tota	I = Sum(2'	19a), ,, =			2423.87	(219)
Δnnua	l totale								、-	×112	Wh/vear		kWh/vear](=10)
Space	heating	fuel use	ed, main	system	1					N	yeai		2621.62	1
			.,	.,									_~_~	1

Water heating fuel used				2423.87]
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 (230	0a)(230g) =		75	(231)
Electricity for lighting				355.19	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			5475.67	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216	=	566.27	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	523.56	(264)
					-
Space and water heating	(261) + (262) + (263) + (264) =			1089.83	(265)
Space and water heating Electricity for pumps, fans and electric keep-hot	(261) + (262) + (263) + (264) = (231) x	0.519	=	1089.83 38.93	(265)
Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	(261) + (262) + (263) + (264) = (231) x (232) x	0.519	=	1089.83 38.93 184.34	(265) (267) (268)
Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	(261) + (262) + (263) + (264) = (231) x (232) x su	0.519 0.519 m of (265)(271) =	=	1089.83 38.93 184.34 1313.09	(265) (267) (268) (272)

TER =

15.82 (273)

		Use	er Details:						
Assessor Name: Software Name:	Stroma FSAP 20	12	Stroma Softwa	a Numi ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Prope	erty Address:	Kingsto	n Bridge	e 3BF 83	3 MID GA	45	
Address :	oncione:								
			Aroa(m²)			iaht(m)		Volumo(m ³)	
Ground floor		, 	83	(1a) x	2	2.7	(2a) =	224.1](3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1	∟ e)+(1n)	83	(4)]`´], ,
Dwelling volume	, , , , , , , , , , , , , , , , , , , ,	, , , L		(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	224.1] (5)
2 Vantilation rate:									
	main s	econdary	other		total			m ³ per hour	
Number of chimneys	heating I	heating +	0] = [0	×4	40 =	0] (6a)
Number of open flues		0 +	0	」 <u>「</u>] = 「	0	x2	20 =	0](6b)
Number of intermittent fa	ans			」 「	2	x ^	10 =	20](7a)
Number of passive vents	S			F	0	x ^	10 =	0	_](7b)
Number of flueless gas	fires				0	x 4	40 =	0	_](7c)
							A :		
				_			Air ch	anges per no	ur —
Infiltration due to chimne	eys, flues and fans = (6	6a)+(6b)+(7a)+(7	′b)+(7c) =				÷ (5) =		
It a pressurisation test has	been carried out or is intend the dwelling (ns)	led, proceed to (17), otherwise c	ontinue fro	om (9) to (16)		0	٦
Additional infiltration	ine dwelling (IIS)					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: (0.25 for steel or timber	frame or 0.38	5 for masonr	y constru	uction		1	0](11)
if both types of wall are p deducting areas of open	oresent, use the value corres ings); if equal user 0.35	sponding to the g	greater wall area	a (after					-
If suspended wooden	floor, enter 0.2 (unsea	led) or 0.1 (s	ealed), else	enter 0				0	(12)
lf no draught lobby, er	nter 0.05, else enter 0							0	(13)
Percentage of window	/s and doors draught s	tripped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value	, q50, expressed in cul	bic metres pe	r hour per so	quare me	etre of e	envelope	area	4	(17)
If based on air permeab	ility value, then $(18) = [(7)]$	17) ÷ 20]+(8), otr	1erwise (18) = (16) 		!		0.29	(18)
Number of sides shelter	es il a pressurisation test na ed	is been done or a	a degree air pei	meability i	s being us	sea	ĺ	2	7(19)
Shelter factor			(20) = 1 - [0.075 x (1	9)] =			0.85	(10)
Infiltration rate incorpora	ating shelter factor		(21) = (18)	x (20) =				0.25] ₍₂₁₎
Infiltration rate modified	for monthly wind spee	d							
Jan Feb	Mar Apr May	Jun Ju	ul Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.	8 3.7	4	4.3	4.5	4.7		
Wind Factor $(22a)m = (2a)m =$									
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 0.9	95 0.92	1	1.08	1.12	1.18		
_	_								

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
<u> </u>	0.31	0.31	0.3	0.27	0.26	0.23	0.23	0.23	0.25	0.26	0.28	0.29		
Calcul If me	ate etter echanica	ctive air al ventila	change	rate for t	ne appli	cable ca	ISE						0	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)) . othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(23c)
a) If	balance	d mech	anical ve	entilation	with her	at recove	erv (MVI	HR) (24a	, a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	covery (I	u MV) (24b)m = (22	1 2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	tilation of	or positiv	/e input v	ventilatio	on from c	outside				1	
	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22k	o) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	e positiv	ve input	ventilatio	on from I	oft	0.51				
(24d)m=	0.55	n = 1, tn	en (240)	m = (22)		$\frac{1}{0.53}$	(40)m =	$0.5 + [(2)]_{0.53}$	20)m ² X	0.5]	0.54	0.54	1	(24d)
Effo		0.55		$\int_{-0.04}^{0.04}$	0.00	0.00	0.00		(25)	0.55	0.54	0.54		(240)
(25)m=		0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	1	(25)
()	0.00	0.00	0.00		0.00			0.00	0.00	0.00	0.01]	(- /
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs 1²	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	K)	k-value kJ/m²·l	e k	A X k kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	2				1.86		/[1/(1.2)+	0.04] =	2.13	=			(27)
Walls				19.6	2	30.6	x	0.18] = [5.51	ו ד			(29)
Total a	area of e	lements	, m²			50.22	2							(31)
Party v	wall					57.08	3 X	0	=	0				(32)
Party f	loor					83	=				i			(32a)
Party of	ceiling					83					[≓	(32b)
* for win ** inclua	dows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				27.97	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	16356.96	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign assess used inste	sments wh ad of a de	ere the de	etails of the	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al brida	es : S (L	x Y) cal	culated i	usina Ap	pendix I	ĸ						4 21	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								()
Total f	abric he	at loss							(33) +	(36) =			32.18	(37)
Ventila	tion hea	at loss ca	alculated	d monthly	y		i		(38)m	= 0.33 × (25)m x (5)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	40.61	40.47	40.33	39.68	39.56	38.99	38.99	38.89	39.21	39.56	39.81	40.06		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	72.79	72.65	72.51	71.86	71.74	71.17	71.17	71.07	71.39	71.74	71.98	72.24		
										Average =	Sum(39)1	12 /12=	71.86	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.88	0.88	0.87	0.87	0.86	0.86	0.86	0.86	0.86	0.86	0.87	0.87		
Numbe	er of dav	/s in mo	nth (Tab	le 1a)				-		Average =	Sum(40) _{1.}	₁₂ / 12=	0.87	(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)
			I										1	
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9	9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	52]	(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					1	
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		
Enorm	contant of	botwator	upped op	loulotod m	onthly - 1	100 v Vd r		Tm / 2600	lull/h/mor	Total = Su	m(44) ₁₁₂ =	= 0.1d)	1127.84	(44)
					011111y = 4.							(, 10)	1	
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.50	106.21	107.48	Total = Su	m(45)=	148.48	1478 77	(45)
lf instant	taneous w	ater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	10tal – Su	III(43)112 -		1470.77	(40)
(46)m=	23	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Water	storage	loss:		1			1	I			·		1	
Storag	e volum	e (litres)) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h vise if no	eating a	and no ta	ank in dw ar (this ir	velling, e scludes i	nter 110 netantar) litres in	ı (47) Əmbi boil	ore) onto	ər 'O' in <i>(</i>	(17)			
Water	storage	loss:	not wate		iciuues i	iistailtai			ers) erne		<i>+1)</i>			
a) If m	anufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	/ lost fro	m water	r storage	e, kWh/y	ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared (cylinder	loss facto	or is not	known:					•	1	(54)
If com	nunity h	leating s	see secti	on 4.3		1/11110/02	iy)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	r storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)									0		(55)
Water	storage	loss cal	culated	for each	month	i	1	((56)m = (55) × (41)	m	i		1	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 30	65 × (41)	m		-1-1			
(moo							ler neati	ng and a				0	1	(50)
(59)11-	U	0				0		0	0			0		

Combi	loss ca	lculated	for eac	ch r	month (61)m =	(60)) ÷ 36	65 × (41))m									
(61)m=	16.27	14.67	16.18		15.59	16.05	1	5.47	15.95	16.0	2	15.53	16.13	3	15.69	16.	25		(61)
Total h	eat req	uired for	water	hea	ating ca	lculated	l fo	r eacł	n month	(62)m	า = (0.85 × ((45)m	+ (4	46)m +	(57)ı	n +	(59)m + (61)m	
(62)m=	169.58	148.76	154.55	5	136.22	131.8	1'	15.36	108.51	122.2	23	123.02	141.3	9	152.42	164	.73		(62)
Solar D⊦	IW input	calculated	using Ap	ope	ndix G or	Appendix	н (negativ	ve quantity	/) (ente	r '0' i	if no sola	r contrib	outic	on to wate	er hea	ting)		
(add ad	dditiona	I lines if	FGHR	Sa	and/or V	VWHRS	ap	plies,	, see Ap	pendi	x G)	-					_	
(63)m=	0	0	0		0	0		0	0	0		0	0		0	0			(63)
Output	from w	ater hea	ter																
(64)m=	169.58	148.76	154.55	5	136.22	131.8	1'	15.36	108.51	122.2	23	123.02	141.3	9	152.42	164	.73		
		-								С	utpu	ut from wa	ater hea	ater	(annual)	12		1668.57	(64)
Heat g	ains fro	m water	heating	g, ł	kWh/mo	onth 0.2	5 í	[0.85	× (45)m	+ (61)m]	+ 0.8 x	(46)	m +	- (57)m	+ (5	9)m]	
(65)m=	55.04	48.25	50.05		44.01	42.5	3	7.08	34.76	39.3	2	39.62	45.68	3	49.39	53.4	43		(65)
inclu	de (57)	m in calo	culatior	ı of	f (65)m	only if c	ylir	nder is	s in the c	dwellir	ng c	or hot w	ater is	fro	om com	muni	ity h	leating	
5. Int	ernal g	ains (see	e Table	5	and 5a)):													
Metabo	olic gair	ns (Table	e 5). Wa	atts	5														
	Jan	Feb	Mar	·	Apr	May		Jun	Jul	Au	g	Sep	Oct	t	Nov	D	ес		
(66)m=	125.87	125.87	125.87	7	125.87	125.87	12	25.87	125.87	125.8	37	125.87	125.8	7	125.87	125	.87		(66)
Lighting	g gains	(calcula	ted in A	٩pp	bendix l	_, equat	ion	L9 or	r L9a), a	lso se	e T	able 5						1	
(67)m=	20.11	17.86	14.53	Ť	11	8.22	6	6.94	7.5	9.75		13.08	16.61	1	19.39	20.	67		(67)
ı Appliar	nces ga	ins (calc	ulated	in .	Append	lix L, eq	uat	ion L'	13 or L1	3a), a	lso	see Tal	ble 5					1	
(68)m=	225.6	227.94	222.04	i	209.48	193.63	17	78.73	168.77	166.4	3	172.33	184.8	9	200.74	215	.64		(68)
Cookin	g gains	(calcula	ted in a	Ар	pendix	L, equat	ior	n L15	or L15a)), also	see	e Table	5					1	
(69)m=	35.59	35.59	35.59	Ť	35.59	35.59	3	5.59	35.59	35.5	9	35.59	35.59	9	35.59	35.	59		(69)
Pumps	and fa	ns dains	(Table	52	ı a)													1	
(70)m=	3	3	3	Т	3	3		3	3	3	Т	3	3		3	3			(70)
Losses	e.a. ev	/aporatio	n (nea	ativ	ve value	es) (Tab	le :	5)										1	
(71)m=	-100.69	-100.69	-100.69	3	-100.69	-100.69	-1	00.69	-100.69	-100.6	69	-100.69	-100.6	9	-100.69	-100	.69		(71)
Water I	heating	I gains (T	able 5)														1	
(72)m=	73.98	71.81	67.28	Ť	61.12	57.12	Ę	51.5	46.73	52.8	5	55.03	61.4		68.59	71.	82		(72)
l Total i	nternal	l aains =	I	_				(66)	m + (67)m	+ (68)	 m +	(69)m + ((70)m +	(71)m + (72)	m		1	
(73)m=	383.45	381.37	367.6	Т	345.36	322.73	30	00.93	286.76	292.7	'9	304.2	326.6	6	352.48	371	.89		(73)
6. Sol	ar gain	S:	<u> </u>											_]	
Solar g	ains are	calculated	using so	lar	flux from	Table 6a a	and	associ	ated equa	tions to	con	vert to th	e applic	cabl	e orientat	ion.			
Orienta	ation:	Access F	actor		Area			Flu	х			g_			FF			Gains	
	-	Table 6d			m²			Tat	ole 6a		Та	able 6b		Та	ble 6c			(W)	
Southw	est <mark>0.9x</mark>	0.77		×	2.8	8	x	3	6.79	ΙΓ		0.63	x	Γ	0.7		=	32.38	(79)
Southw	est <mark>0.9x</mark>	0.77		x [1.8	6	x	3	6.79	Ī		0.63	x		0.7		=	188.24	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	6	2.67	ĪĪ		0.63	x	Γ	0.7		=	55.16	(79)
Southw	est <mark>0.9x</mark>	0.77		x [1.8	6	x	6	2.67	İΓ		0.63	×	Ē	0.7		=	320.64	(79)
Southw	est <mark>0.9x</mark>	0.77		× [2.8	8	x	8	5.75	İΓ		0.63	×	F	0.7		=	75.48	(79)

Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	8	35.75]		0.63	×	0.7		= [438.71	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25]		0.63	_ × [0.7		= [93.52	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25]		0.63	×	0.7		= [543.58	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	19.01]		0.63	×	0.7		=	104.75	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01	1		0.63	_ × [0.7		= [608.85	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15	1		0.63	_ × [0.7		= [103.99	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15]		0.63	_ × [0.7		= [604.45	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91]		0.63] × [0.7		= [100.26	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.63	_ × [0.7		= [582.76	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39	Ī		0.63	_ × [0.7		= [91.88	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39	ĺ		0.63	= × [0.7		= [534.06	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	9	2.85	i		0.63		0.7		= [81.73	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	9	2.85	ĺ		0.63		0.7		= [475.03	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27	1		0.63		0.7		= [60.97	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27	1		0.63	_ × [0.7		= [354.37	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07	ĺ		0.63	= × [0.7		= [38.79	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07	1		0.63		0.7		= [225.46	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	3	31.49	i		0.63		0.7		= [27.71	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49	i		0.63		0.7		= [161.09	(79)
	-									•						-		
Solar g	gains in	watts, ca	alcula	ted	for each	n montl	า		_	(83)m	า = Sเ	um(74)m .	(82)m		-			
(83)m=	220.62	375.8	514.	18	637.1	713.6	7	08.44	683.01	625	.94	556.75	415.34	264.25	188.	.81		(83)
Total g	gains – i	nternal a	and so	olar	(84)m =	: (73)m	+ ((83)m	, watts									
(84)m=	604.07	757.16	881.	78	982.46	1036.33	3 1	009.37	969.77	918	.73	860.96	742	616.74	560.	.69		(84)
7. Me	ean inter	nal temp	beratu	ıre (heating	seaso	n)											
Temp	perature	during h	neatin	g pe	eriods ir	the liv	ing	area	from Tal	ole 9	, Th′	1 (°C)					21	(85)
Utilis	ation fac	tor for g	ains f	or li	ving are	a, h1,r	n (s	вее Та	ble 9a)									
	Jan	Feb	Ma	ar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	De	ec		
(86)m=	0.99	0.98	0.93	3	0.81	0.63		0.45	0.32	0.3	36	0.57	0.87	0.98	1			(86)
Mear	interna	l temper	ature	in li	iving are	ea T1 (1	follo	ow ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	20.27	20.49	20.7	2	20.91	20.98		21	21	2	1	20.99	20.88	20.53	20.2	22		(87)
Temp	berature	during h	neatin	a pe	eriods ir	rest o	f dv	velling	from Ta	able	9. Tł	ים. 12 (°C)			-			
(88)m=	20.19	20.19	20.1	9	20.2	20.2	T	20.2	20.2	20	.2	20.2	20.2	20.2	20.1	19		(88)
Utilis	ation fac	tor for a	ains f	or re	est of d	vellina	h2	m (se	e Table	9a)								
(89)m=	0.99	0.97	0.9	1	0.77	0.58	T	0.39	0.26	0.2	29	0.5	0.83	0.98	0.9	9		(89)
Mear		l tomnor		in t ⁱ	ha rest :	of dwo	line	1 T2 /f				7 in Tabl		1	I			
(90)m=	19.22	19.53	19.8	6 I	20.1	20.18	T	<u>,</u> 1∠ (1 20.2	20.2	20	.2	20.2	20.07	19.6	19 1	15		(90)
<u>, , , , , , , , , , , , , , , , , , , </u>			L	-					I	<u> </u>		f	LA = Livii	ng area ÷ (4	1 4) =		0.3) (91)
																- 1	-	- 1° '

Mean internal temperature (for the whole dwelling) = $f(A \times T1 + (1 - f(A) \times T2))$

Incal	interna	liemper				iiiiig) – ii		· (<u>, , , , , , , , , , , , , , , , , , , </u>			
92)m=	19.53	19.82	20.12	20.34	20.42	20.44	20.44	20.44	20.44	20.31	19.88	19.47

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

(93)m=	19.53	19.82	20.12	20.34	20.42	20.44	20.44	20.44	20.44	20.31	19.88	19.47		(93)
8. Spa	ace hea	iting requ	uirement	t										
Set Ti the ut	i to the ilisation	mean int factor fo	ternal ter or gains	mperatui using Ta	re obtair Ible 9a	ied at ste	ep 11 of	Table 9	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	ation fac	tor for g	ains, hr	1:										
(94)m=	0.99	0.97	0.91	0.78	0.59	0.41	0.28	0.31	0.52	0.84	0.97	0.99	I	(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m	-		-						
(95)m=	597.93	731.37	799.48	762.9	615.51	414.97	273.49	287.3	448.8	619.92	599.71	556.84	I	(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8	r	· · · · ·	r	r	r	,		
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1108.74	1083.87	987.31	822.28	625.81	415.81	273.55	287.41	452.36	696.83	919.92	1103.23		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Nh/mon	th = 0.02	24 x [(97])m – (95)m] x (4 	1)m			
(98)m=	380.04	236.88	139.75	42.75	7.66	0	0	0	0	57.22	230.55	406.51		
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	1501.37	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								18.09	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatii	ng:										-		_
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1							İ	93.5	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g requir	ement (c	alculate	d above)								
	380.04	236.88	139.75	42.75	7.66	0	0	0	0	57.22	230.55	406.51	l	
(211)m	n = {[(98	s)m x (20	04)]}x1	00 ÷ (20)6)									(211)
	406.46	253.35	149.46	45.73	8.19	0	0	0	0	61.2	246.58	434.77		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1605.75	(211)
Space = {[(98	e heatin)m x (2(g fuel (s)1)] } x 1	econdar 00 ÷ (20	y), kWh/)8)	month									-
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
		Į	Į			I		Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	3										I		J
Output	from w	ater hea	ter (calc	ulated a	bove)									
-	169.58	148.76	154.55	136.22	131.8	115.36	108.51	122.23	123.02	141.39	152.42	164.73		
Efficier	ncy of w	ater hea	iter										87.3	(216)
(217)m=	89.49	89.24	88.79	88.04	87.47	87.3	87.3	87.3	87.3	88.2	89.2	89.55		(217)
Fuel fo	r water	heating,	kWh/m	onth			-							
(219)m	n = (64)	m x 100) ÷ (217))m	450.55	400 11	404-5	4 40	4 (0	400 -	4-0		1	
(219)m=	189.5	166.7	174.06	154.72	150.69	132.14	124.3	140.01	140.91	160.3	170.88	183.94		1
-								Iota	n = Sum(2)	19a) ₁₁₂ =	 -		1888.16	(219)
Annua	I totals	fuelue	ad main	evetor	1					k	Wh/year		kWh/year	1
Space	neating		eu, main	system	I								1605.75	

Water heating fuel used				1888.16	
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 (2	30a)(230g) =		75	(231)
Electricity for lighting				355.19	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			3924.09	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fa kg CO2/kWh	ctor	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216	=	346.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	407.84	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		754.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	184.34	(268)
Total CO2, kg/year	S	um of (265)(271) =		977.95	(272)
Dwelling CO2 Emission Rate	(2	272) ÷ (4) =		11.78	(273)
El rating (section 14)				90	(274)

		ι	Jser De	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2	:	Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Pro	perty A	Address:	Kingsto	n Bridge	e 3BF 83	8 MID GA	AS	
Address :										
1. Overall dwelling dime	nsions:			(a)						
Ground floor			Area	(m²) 83	(1a) x	Av. He	ight(m) 2.7	(2a) =	224.1	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	6	83	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	224.1	(5)
2. Ventilation rate:										
	main s heating h	econdary neating	(other		total			m ³ per hour	
Number of chimneys		0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues		0	+	0	1 = C	0	x 2	20 =	0	_](6b)
Number of intermittent fa	ns				, r	3	x 1	10 =	30] (7a)
Number of passive vents					Ē	0	x 1	10 =	0	_ (7b)
Number of flueless gas fi	res					0	x 4	40 =	0	_](7c)
								Air ch	anges per ho	ur
Infiltration due to chimpe	$v_{\rm c}$ fluce and fanc - (6)	a)+(6b)+(7a)	+(7h)+(7	(c) =	Г			. (5) -		
If a pressurisation test has b	een carried out or is intende	ed. proceed to	o (17). o	o, therwise c	ontinue fro	om (9) to ((16)	÷ (5) =		
Number of storeys in th	ne dwelling (ns)	,					-/		0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	.25 for steel or timber	frame or 0	.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pr	resent, use the value corres	ponding to th	ne greate	er wall area	a (after					
If suspended wooden f	loor, enter 0.2 (unsea	led) or 0.1	(sealed	d), else (enter 0			[0] (12)
If no draught lobby, ent	ter 0.05, else enter 0	·							0	(13)
Percentage of windows	s and doors draught st	ripped							0	– (14)
Window infiltration			(0.25 - [0.2	x (14) ÷ 1	= [00		ĺ	0	(15)
Infiltration rate			((8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cut	oic metres	per hou	ur per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabili	ity value, then (18) = [(1	7) ÷ 20]+(8),	otherwis	se (18) = (16)				0.38	(18)
Air permeability value applie	s if a pressurisation test ha. d	s been done (or a degi	ree air per	meability i	is being us	sed	ſ		
Shelter factor	a		((20) = 1 - [0.075 x (1	9)] =			2	(19)
Infiltration rate incorporat	ing shelter factor		((21) = (18)	x (20) =				0.33	$\int_{(21)}^{(20)}$
Infiltration rate modified for	or monthly wind speed	4	Ì	. , . ,				l	0.55	
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7		•							
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Eactor $(22a)m = (22a)m $	2)m ÷ 4		1	ı						
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
	I	I					I			

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se							(220)
lf evh	sust air h		usina Ann	endix N (2	(23h) = (23a)	a) x Emv (e	equation (1		rwise (23h) = (23a)			0	(238)
If bal	ancod with	boot roce	wory: offic		.50) – (258	i) ^ i iiiv (e	actor (fron	$\mathbf{x}_{\mathbf{x}}$) –) - (238)			0	(230)
		d moob) = (2)	Dh)m ⊥ (00h) v [1 (02a)		(23c)
a) II								ΠR) (248 Γ	(22 0		230) × [1 - (230)) ÷ 100]]	(24a)
(24a)III-		d maab				hoot roc			\sim		00k)	0	J	(210)
D) II								VIV) (240 1	o)m = (22	2) + m(a2	230)		1	(24b)
(240)III-										0	0	0	J	(240)
C) II	if (22b)n	1 < 0.5	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22t	o) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation	on or wh en (24d)	ole hous m = (221	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]			-	
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(24d)
Effe	ctive air	change	rate - ei	nter (24a	ı) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(25)
3 Ho	at lossa	s and he	at loss	naramet	or:	•	•	•		•	•	•	-	
		Gros	35	Onenin		Net Ar	rea	U-valı	IP	ΑΧΠ		k-value	<u> </u>	AXk
		area	(m²)	m	190 1 ²	A ,r	n²	W/m2	K	(W/I	K)	kJ/m²·l	κ i	kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.4)+	0.04] =	3.82				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.4)+	0.04] =	2.47				(27)
Walls				19.6	2	30.6	x	0.18] = [5.51				(29)
Total a	area of e	lements	, m²			50.22	2							(31)
Party v	wall					57.08	3 X	0	=	0				(32)
Party f	loor					83		L			[\dashv	(32a)
Party of	ceiling					83					[\dashv	(32b)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of il	effective wi nternal wal	indow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	n 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				31.52	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	16356.96	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) ca	culated	using Ap	pendix I	K						3.05	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			34.57	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y I a a			1	(38)m	= 0.33 × (25)m x (5)	1	
(0.5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	4	(00)
(38)m=	43.38	43.13	42.88	41.74	41.53	40.53	40.53	40.34	40.91	41.53	41.96	42.41	J	(38)
Heat tr	ansfer o	coefficie	nt, W/K				1		(39)m	= (37) + (38)m		1	
(39)m=	77.95	77.7	77.46	76.31	76.1	75.1	75.1	74.92	75.49	76.1	76.53	76.98		
									1	Average =	Sum(39)	₁₂ /12=	76.31	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	0.94	0.94	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93		
Numb			nth (Tab				!	Į		Average =	Sum(40) _{1.}	12 /12=	0.92	(40)
NULLIO		Eab	Mar		May	lup		Δυσ	Son	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31 31	30	31	30	31		(41)
()								01		01		01		(,
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	349 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . 9)	52		(42)
Annua Reduce not mor	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		_
Energy	content of	hot water	used - ca	lculated m	onthly — 4	100 v Vd r	n v nm v l) Tm / 3600	kW/h/mor	Total = Su	m(44) ₁₁₂ =	c 1d)	1127.84	(44)
(4E)m=	152.22	124.00	120 27	120.64	115 75		02.56	106.21	107.40	125.26	126 72	140 40		
(45)11-	103.32	134.09	130.37	120.04	115.75	99.09	92.50	100.21	107.40	Total = Su	m(45),=	140.40	1478 77	(45)
lf instan	taneous w	ater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	rotar – Ou	III(+0) 112 -		1470.77	
(46)m=	23	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Water	storage	loss:									·			
Storag	le volum	e (litres)) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity r vise if no	eating a	and no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres in Deous co	1 (47) ambi boil	ers) ente	r '0' in <i>(</i>	47)			
Water	storage	loss:	not wat			notantai								
a) If m	nanufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energ	y lost fro	m water	storage	e, kWh/y	ear			(48) x (49)) =			0		(50)
b) If m	nanufact	urer's de	eclared (cylinder com Tab	loss fact	or is not b/litro/da	known:					0		(51)
If com	munity h	leating s	ee secti	on 4.3		n/nue/ue	a y)					0		(31)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energ	y lost fro	m water	storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (8	55)									0		(55)
Water	storage	loss cal	culated ·	for each	month	i	1	((56)m = (55) × (41)	m	i			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain:	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Append	IX H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		-1-1			
(mo							ler neati	ng and a						(50)
(59)m=		0			0			0		0	0	U		(33)

Combi	loss ca	lculated	for eac	ch r	month (61)m =	(60) ÷ 36	65 × (41))m									
(61)m=	50.96	45.86	48.85		45.42	45.02	4	1.71	43.11	45.0	2	45.42	48.8	5	49.13	50	.96]	(61)
Total h	eat req	uired for	water	hea	ating ca	lculated	l fo	r eacl	n month	(62)n	า =	0.85 × ((45)m	+	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	204.28	179.95	187.22	2	166.06	160.77	1	41.6	135.66	151.2	23	152.9	174.1	1	185.86	199	9.44		(62)
Solar DH	- IW input	calculated	using Ap	ppe	ndix G or	Appendix	: H (negativ	ve quantity	/) (ente	r '0'	if no sola	r contril	bu	tion to wate	er hea	ating)		
(add a	dditiona	al lines if	FGHR	S a	nd/or V	VWHRS	ap	plies	, see Ap	pendi	x G	6)							
(63)m=	0	0	0		0	0		0	0	0		0	0		0	(0		(63)
Output	from w	ater hea	iter															-	
(64)m=	204.28	179.95	187.22	2	166.06	160.77	1	41.6	135.66	151.2	23	152.9	174.1	1	185.86	199	9.44		
										C	Outp	ut from wa	ater hea	ate	er (annual)	12		2039.09	(64)
Heat g	ains fro	m water	heating	g, ł	(Wh/mo	onth 0.2	5 ´	[0.85	× (45)m	+ (61)m] + 0.8 >	(46) (m	+ (57)m	+ (5	59)m]	
(65)m=	63.72	56.05	58.22	Τ	51.47	49.74	4	3.64	41.55	46.5	7	47.09	53.8	6	57.75	62	.11		(65)
inclu	de (57))m in cal	ulatior	n of	f (65)m	only if c	ylir	nder is	s in the c	dwellii	ng d	or hot w	ater is	s f	rom com	mun	nity h	eating	
5. Int	ernal o	ains (see	e Table	5 8	and 5a):	5				Ū						,	U U	
Metab	olic gai	ns (Table	5) Wa	atte															
Metab	Jan	Feb	Mar		, Apr	Mav		Jun	Jul	Au	a	Sep	Oc	t	Nov	C)ec]	
(66)m=	125.87	125.87	125.87	,	125.87	125.87	12	25.87	125.87	125.8	37	125.87	125.8	37	125.87	125	5.87		(66)
Liahtin	a aains	(calcula	ted in A	- I Apr	pendix l	. equat	ion	L9 or	r L9a), a	lso se	e T	able 5	I					1	
(67)m=	20.11	17.86	14.53	1	11	8.22	6	6.94	7.5	9.75	;	13.08	16.6	1	19.39	20	.67]	(67)
Annlia	nces da	ins (calc	ulated	in .	Annenc	lix lea	L Llat	ion L	13 or I 1	3a) a	lso	see Ta	l ble 5		1			1	
(68)m=	225.6	227.94	222.04	i T	209.48	193.63	1	78.73	168.77	166.4	13	172.33	184.8	39	200.74	215	5.64	1	(68)
Cookin	L	L s (calcula	L	_L Ani	nendix	l equat	L ior	1 15	or I 15a			e Table	5					1	
(69)m=	35.59	35.59	35.59		35.59	35.59		5.59	35.59	35.5	9	35.59	35.5	9	35.59	35	.59	1	(69)
Pumps	and fa	ne gaine	(Table	5	3)						-			-				1	
(70)m=				1	3	3		3	3	3		3	3		3		3	ו	(70)
						e) (Tab		5)	.	Ů		0	Ů		ů			J	(- /
(71)m=	-100 69				100 69	-100 69			-100.69	-100 (30	-100 69	-100 6	30	-100.69	-100	1 60	1	(71)
(/ I)III-	hooting			<u>`</u>	100.00	-100.00	- 1	00.00	-100.00	-100.0	55	-100.00	-100.0		-100.00	-100	0.00]	()
		gains (1) 	71 40	66.96	6	0.61	55 95	62.6		65.41	72.2	0	80.2	02	10	1	(72)
(72)11-	05.04	03.41	70.25		71.40	00.00		0.01	00.00	02.0	,	(60)m + ((70)m	9	00.2 (1)m + (72)	00	.40	J	(12)
I otal I	nterna	i gains =	-		255 70	222.47		(00)				014 50		· (/	(1) (12)			1	(73)
(73)m=	395.11	392.97	378.58	·	355.72	332.47	3	10.04	295.88	302.5	53	314.58	337.0	00	364.09	383	5.55		(13)
Solar o	ains are	s. calculated	usina so	lari	flux from	Table 6a :	and	associ	iated equa	tions to		overt to th	e annli	cal	hle orientat	ion			
Orienta	ation.	Access F	Factor		Area		and	Flu	X		, 001	a		ou	FF	1011.		Gains	
onona		Table 6d	uotor		m²			Tat	ole 6a		Та	able 6b		Т	able 6c			(W)	
Southw	est <mark>o.9x</mark>	0.77		×「	2.8	8	x	3	6 79	I F		0.63	┐ ×	Г	0.7		_	32.38] (79)
Southw	esto 9x	0.77		∩ [x [1.8	6	x	3	6 79	I L I T		0.63	۲°,	F	0.7		_	188.24](79)
Southw	esto 9x	0.77		∵ L x [1.0 2 Q	8	x	6	2 67	I L I T		0.63	٦ [°]		0.7		_	55 16](79)
Southw	esto ov	0.77		î [<mark>v</mark> [2.0	6	Ϋ́	6	2.67	L T		0.63	╡ Û		0.7		=	320 64](79)
Southw	esto 9x	0.77		∩ L x [1.0 	8	x	0	5 75	L T		0.63	╡ Ŷ	L	0.7	\neg	=	75 / 2](79)
		0.77		^	∠.0	· ·	^	0	0.10			0.03	1 ^	1	0.7		_	10.40	1,1,2,1

Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	8	5.75]		0.63	×	0.7		=	438.71	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25	Ī		0.63	_ × [0.7		=	93.52	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25]		0.63	×	0.7		=	543.58	(79)
Southw	Southwest _{0.9x} 0.77			x	2.8	8	x	1	19.01]		0.63	x	0.7		=	104.75	(79)
Southw	Southwest _{0.9x} 0.77			x	1.8	6	x	1	19.01]		0.63	x	0.7		=	608.85	(79)
Southw	Southwest _{0.9x} 0.77			x	2.8	8	x	1	18.15]		0.63	_ × [0.7		=	103.99	(79)
Southwest0.9x 0.77			x	1.8	6	x	1	118.15			0.63	x	0.7		=	604.45	(79)	
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91]		0.63	x	0.7		=	100.26	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.63	x	0.7		=	582.76	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39]		0.63	x	0.7		=	91.88	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39	ĺ		0.63		0.7		=	534.06	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	9	2.85	i		0.63		0.7		=	81.73	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	9	2.85	i		0.63		0.7		=	475.03	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27	i		0.63		0.7		=	60.97	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27	i		0.63		0.7		=	354.37	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07	i		0.63	آ × آ	0.7		=	38.79	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07	i		0.63		0.7		=	225.46	(79)
Southwest0.9x 0.77			x	2.8	8	x	3	31.49	1		0.63		0.7	=	=	27.71	(79)	
Southwest0.9x 0.77			x	1.8	6	x	3	31.49	1		0.63	ī × Ī	0.7		=	161.09	(79)	
	L							L										
Solar g	gains in	watts, ca	alcula	ted	for each	n montl	h		-	(83)m	n = Su	m(74)m	.(82)m	_				
(83)m=	220.62	375.8	514.	18	637.1	713.6	7	708.44	683.01	625	5.94	556.75	415.34	264.25	188.8	81		(83)
Total g	gains – i	nternal a	and so	olar	(84)m =	: (73)m	+ ((83)m	, watts									
(84)m=	615.73	768.77	892.	76	992.82	1046.07	7 1	018.48	978.9	928	8.47	871.33	752.99	628.35	572.3	36		(84)
7. Me	ean inter	nal temp	beratu	ıre (heating	seaso	n)											
Temp	perature	during h	neatin	g pe	eriods ir	the liv	ring	area	from Tab	ole 9	, Th1	(°C)					21	(85)
Utilis	ation fac	tor for g	ains f	or li	ving are	a, h1,r	n (s	вее Та	ble 9a)									
	Jan	Feb	Ma	ar	Apr	May	'	Jun	Jul	A	ug	Sep	Oct	Nov	De	с		
(86)m=	0.99	0.98	0.9	3	0.82	0.65		0.47	0.34	0.3	37	0.59	0.88	0.98	1			(86)
Mear	n interna	I temper	ature	in li	iving are	ea T1 (foll	ow ste	ps 3 to 7	7 in T	Table	9c)						
(87)m=	20.19	20.41	20.6	6	20.88	20.97		21	21	2	1	20.99	20.85	20.47	20.1	5		(87)
Temp	perature	during h	neatin	g pe	eriods ir	rest o	f dv	velling	from Ta	able 9	9, Th	2 (°C)						
(88)m=	20.13	20.14	20.1	4	20.15	20.15	Т	20.16	20.16	20.	.17	20.16	20.15	20.15	20.1	4		(88)
Utilis	ation fac	tor for a	ins f	or r	est of d	vellina		m (se	e Table	9a)	I	I		-				
(89)m=	0.99	0.97	0.92	2	0.79	0.6	<u> </u>	0.41	0.27	0.	3	0.52	0.84	0.98	0.99	9		(89)
Mear		l temper		in t	ho rost i	of dwo		1 T2 (f	l ollow sta		to 7	in Tabl		1	I			
(90)m=	19.06	19.38	19.7	'3	20.02	20.13	T	יב (ד 20.16	20.16	20	.17	20.15	19.99	19.48	19.0	1		(90)
				- [L	<u> </u>	fl	_A = Livi	ing area ÷ (4	1) =		0.3) (91)
																		· · · ·

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

mean	internu	i temper				iiiig) i		. (1 16			-	
(92)m=	19.4	19.69	20.01	20.28	20.38	20.41	20.42	20.42	20.4	20.25	19.78	19.35

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

(93)m=	19.4	19.69	20.01	20.28	20.38	20.41	20.42	20.42	20.4	20.25	19.78	19.35		(93)
8. Spa	ace hea	ting req	uirement	i i										
Set Ti the ut	i to the ilisation	mean inf	ternal tei or gains	mperatui using Ta	re obtain able 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.29	0.32	0.54	0.85	0.97	0.99		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	609.36	743.95	816.73	788.86	645.09	435.18	286.42	300.69	470.37	637.92	611.38	568.23		(95)
Month	nly aver	age exte	ernal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1177	1149.45	1046.46	868.32	660.82	436.58	286.53	300.9	475.87	734.37	970.5	1166.36		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	422.33	272.5	170.92	57.21	11.71	0	0	0	0	71.76	258.57	445		_
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	1710	(98)
Space	e heatin	g requir	ement in	kWh/m²	²/year							[20.6	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space Eracti	e heatii	ng:	ot from a	ocondar	v/supplo	montany	system					ſ	0	7(201)
Fraction of space neat from secondary/supplementary system										0				
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												93.4	(206)	
Efficiency of secondary/supplementary heating system, %												0	(208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above))								
	422.33	272.5	170.92	57.21	11.71	0	0	0	0	71.76	258.57	445		
(211)m	n = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	452.17	291.75	183	61.26	12.54	0	0	0	0	76.83	276.84	476.45		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	-	1830.83	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							•		_
= {[(98)m x (20	01)]}x1	00 ÷ (20	8)	-			-			-			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	9										-		
Output	from w	ater hea	ter (calc	ulated a	bove)									
	204.28	179.95	187.22	166.06	160.77	141.6	135.66	151.23	152.9	174.11	185.86	199.44		_
Efficier	ncy of w	ater hea	ater										80.3	(216)
(217)m=	86.84	86.09	84.82	82.67	80.91	80.3	80.3	80.3	80.3	83.01	85.88	87.01		(217)
Fuel fo	or water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100	J ÷ (217)	m	109 7	176.04	169.05	189.24	100 42	200 76	216 41	220.24		
(219)111=	230.23	209.01	220.72	200.00	190./	170.34	100.90	Tota	I = Sum(2)	209.70	210.41	229.21	0440.05	
A	14-4							TUId	- Juiii(2	- Jul ₁₁₂ –	A/I. 4 -		2443.95	(219)
Space	n totals	fuelue	niem he	svetem	1					K	wn/year		1830 93	7
Space heating fuel used, main system 1 183											1030.03			

Water heating fuel used				2443.95	
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 (75	(231)		
Electricity for lighting				355.19	(232)
Total delivered energy for all uses (211)(221) +	4704.97	(338)			
12a. CO2 emissions – Individual heating systems	s including micro-CHP				_
	Energy kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216	=	0.07.10	
• · · · · · ·		0.210		395.46	(201)
Space heating (secondary)	(215) x	0.519	=	<u> </u>	(263)
Space heating (secondary) Water heating	(215) x (219) x	0.519	= =	0 527.89	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	(215) x (219) x (261) + (262) + (263) + (264)	0.519 0.216	=	0 527.89 923.35	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	(215) x (219) x (261) + (262) + (263) + (264) (231) x	0.519 0.216 0.519	=	0 527.89 923.35 38.93	(261) (263) (264) (265) (267)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	(215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	0.519 0.216 0.519 0.519 0.519	=	0 527.89 923.35 38.93 184.34	(261) (263) (264) (265) (265) (267) (268)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	(215) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	0.210 0.519 0.216 0.519 0.519 0.519 0.519 sum of (265)(271) =	= = =	395.46 0 527.89 923.35 38.93 184.34 1146.62	(261) (263) (264) (265) (267) (268) (268) (272)

TER =

13.81 (273)

User Details:														
Assessor Name: Software Name:	Stroma FSAP 201	9	Stroma Softwa	on: 1.0.5.59										
A		Pro	perty A	Address:	Kingsto	on Bridge	e 3BF 83	STOP G	AS					
Address :	sions:													
	50115.		Area	(m²)			iaht(m)		Volume(m ³)					
Ground floor				83	(1a) x		911(11) 7	(2a) =	224 1	(3a)				
Total floor area TFA = $(1a)$	+(1b)+(1c)+(1d)+(1e	a)+ (1n)		••	(4)		/	()	227.1					
		,,(III)		03	(*) (3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	224.4					
					() ()	, (, (., (,		224.1	(3)				
2. Ventilation rate:	main s	econdary		other		total			m ³ per hour					
	heating h	neating	. —		. –	totai				-				
Number of chimneys	0 +	0	+	0		0	X 4	40 =	0	(6a)				
Number of open flues	0 +	0	+	0] = [0	x 2	20 =	0	(6b)				
Number of intermittent fans	3					2	x ^	10 =	20	(7a)				
Number of passive vents					Γ	0	x *	10 =	0	(7b)				
Number of flueless gas fire	S					0	x 4	40 =	0	(7c)				
								Air ch	anges per ho	ur				
	flue a sural face of (-)(2-)(7-)	.(76).(7	(a) _	_					ui 7				
Inflitration due to chimneys	, flues and fans = (0)	$(0)^+(0)^+(7)$	(17) + (17)	thorwise o	ontinuo fr	$\frac{1}{2}$	(16)	÷ (5) =						
Number of storevs in the	dwelling (ns)	eu, proceeu i	0 (17), 0	uner wise c	onunue no	0111 (9) 10 (10)		0	(9)				
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)				
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0	(11)				
if both types of wall are pres	sent, use the value corres	ponding to th	ne greate	er wall area	a (after					_				
If suspended wooden flo	s); if equal user 0.35 or enter 0.2 (unseal	led) or 0 1	(sealed	d) else (enter ()				0	7(12)				
If no draught lobby, ente	r 0.05. else enter 0		(000.00	u), 0100 ·					0	(12)				
Percentage of windows a	and doors draught st	ripped							0					
Window infiltration	Ū		C	0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)				
Infiltration rate			((8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)				
Air permeability value, q	50, expressed in cub	oic metres	per hou	ur per so	quare m	etre of e	nvelope	area	4	(17)				
If based on air permeability	v value, then (18) = [(1	7) ÷ 20]+(8),	otherwis	se (18) = (16)				0.29	(18)				
Air permeability value applies i	f a pressurisation test has	s been done	or a degi	ree air per	meability	is being u	sed			_				
Number of sides sheltered			((20) - 1 [0 075 v (1	0)1 -			2	(19)				
Sheller lactor	a abaltar faatar		((20) - 1 - [0.075 X (1	9)] –			0.85	(20)				
Initiation rate incorporation	g sheller lactor	J	((10)	x (20) -				0.25	(21)				
	monthly wind speed		1.1	Aug	Son	Oct	Nov	Dee						
		Jun	Jui	Aug	Sep	UCI	INOV	Dec						
(22)m=	ed from Table 7	20	20	27	Α	4.2	A E	47						
(22)11- 0.1 5 4.	3 4.4 4.3	3.0	3.0	3.1	4	4.3	4.3	4.7						
Wind Factor (22a)m = (22)	m ÷ 4													
(22a)m= 1.27 1.25 1.2	23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18						
Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
------------------------	--------------------------	--------------------------	---------------------------	---------------------	--------------------------	------------------------------------	------------------------	---------------------------	----------------------	----------------	---------------	-----------------	---------------	-------
	0.31	0.31	0.3	0.27	0.26	0.23	0.23	0.23	0.25	0.26	0.28	0.29		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se		-	-	-	-		
II IIIt			ucing App	ondix N (2	3h) - (23a) x Emy (c	ocuation (N	NE)) othou	nuico (23h) - (23a)			0	(238)
If bal	ancod with	boot roce			.50) – (258	or in uso f	actor (from	$\mathbf{x}_{\mathbf{x}}$) –) - (208)			0	(230)
) - .) (0(]]h)ma (/)	00k) v r	4 (22.5)	0	(23c)
a) IT								HR) (24a T	i)m = (22	20)m + (. 0	230) × [1 - (23C)) ÷ 100]]	(24a)
(24a)III-						U	()					0		(244)
D) IT					without	neat rec		VIV) (240 T	o)m = (22	20)m + (. 	230)		1	(24b)
(240)11-					0					0	0	0		(240)
C) IT	if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), 1	then (240	c) = (23b); otherv	ventilatio wise (24	c) = (22b	outside b) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	e positiv o)m othe	ve input [.] erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)			•		
(25)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54		(25)
3 40	atlossa	s and he	at loss i	naramet	or.								•	
		Groe	201 1055	Onenin	л. Л	Not Δr	·ea	l I-valı	IA	ΔΧΠ		k-value	<u></u>	AXk
		area	(m²)	m	90 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K	kJ/K
Windo	ws Type	e 1				2.88	x1.	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	e 2				1.86	x1.	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				19.6	2	30.6	x	0.18] = [5.51				(29)
Roof				0		83	x	0.13	= =	10.79	i F		\exists	(30)
Total a	area of e	lements	, m²			133.2	2							(31)
Party v	wall					57.08	3 X	0	= [0				(32)
Party f	floor					83			เ		i		\dashv	(32a)
* for win ** incluc	ndows and le the area	roof wind	ows, use e sides of ir	effective wi	ndow U-va Is and part	alue calcul titions	ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	s given in	n paragraph	I 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				38.76	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	8803.96	(34)
Therm	al mass	parame	ter (TM	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi can be i	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the	constructi	ion are not	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al brida	es : S (L	x Y) cal	culated u	usina Ap	pendix ł	<						10.77	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)							10.11	(00)
Total f	abric he	at loss							(33) +	(36) =			49.53	(37)
Ventila	ation hea	at loss ca	alculated	monthl	ý			_	(38)m	= 0.33 × (25)m x (5)	_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	40.61	40.47	40.33	39.68	39.56	38.99	38.99	38.89	39.21	39.56	39.81	40.06		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	90.14	90	89.86	89.21	89.09	88.52	88.52	88.42	88.74	89.09	89.34	89.59		
								-		Average =	Sum(39)	112 /12=	89.21	(39)

Heat lo	oss para	imeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.09	1.08	1.08	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.08	1.08		
Numbe	er of day	, s in mo	nth (Tab	le 1a)				•	,	Average =	Sum(40)1.	12 /12=	1.07	(40)
- turnot	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13. A £ 13.	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	349 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	52		(42)
Annua Reduce not more	l averag the annua e that 125	je hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		
_										Total = Su	m(44) ₁₁₂ =		1127.84	(44)
Energy	content of	hot water	used - cal	culated me	Some $1 = 4$.	190 x Vd,r	m x nm x L	JTM / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	I	
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.56	106.21	107.48	125.26	136.73	148.48		
lf instan	taneous v	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1478.77	(45)
(46)m=	23	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Water	storage	loss:												. ,
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comin Otherw Water	munity h vise if no storage	eating a o stored loss:	nd no ta hot wate	ank in dw er (this ir	velling, e ncludes i	nter 110 nstantar) litres in neous co	n (47) ombi boil	ers) ente	er '0' in (47)	0	I	(49)
Tempe	erature f	actor fro	m Table	2h			n'ady).					0		(40)
Enera	/ lost fro	om water	storage	. kWh/ve	ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:	(- / (-)	,			0		(00)
Hot wa If com	ater stora munity h	age loss neating s	factor fi ee secti	rom Tabl on 4.3	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	storage	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	o5)	6				((50))				0		(55)
vvater	storage	loss cal	culated ⁻	for each	montn	I		((56)m = (55) × (41) 	m I			I	
(56)m=	0	0 dedicate		0	0 = (F6)m	0	0	0	0		0	0	iv I I	(56)
				iage, (57)	n – (50)n I	x [(50) – ()] + (5 		7)iii – (50) I					()
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	tor each	month (59)m = ((58) ÷ 36	65 × (41)	m	r thermo	etat)			
(1100 (59)m=												0		(59)
(00)111	Ŭ	L Ŭ	L Ŭ	Ľ	Ľ	l	Ľ	Ĭ	L Ŭ	l	Ľ	L Ŭ	l	()

Combi	loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	16.27	14.67	16.18	15.59	16.05	1	5.47	15.95	16.02	15.53	16.13	15.69	16.25]	(61)
Total h	eat req	uired for	water h	eating ca	alculated	foi	r each	n month	(62)m	= 0.85 ×	(45)m	+ (46)m +	(57)m +	- ⊦ (59)m + (61)m	
(62)m=	169.58	148.76	154.55	136.22	131.8	11	5.36	108.51	122.2	3 123.02	141.3	9 152.42	164.73]	(62)
Solar DH	W input	calculated	using App	pendix G or	Appendix	Н (negativ	/e quantity	/) (enter	'0' if no sola	ar contrib	ution to wate	er heating)	
(add a	dditiona	I lines if	FGHRS	and/or \	WWHRS	ар	plies,	see Ap	pendix	G)					
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(63)
Output	from w	ater hea	ter												
(64)m=	169.58	148.76	154.55	136.22	131.8	11	5.36	108.51	122.2	3 123.02	141.3	9 152.42	164.73]	
									0	utput from w	ater hea	ter (annual)	112	1668.57	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61	m] + 0.8	x [(46)	m + (57)m	+ (59)n	n]	
(65)m=	55.04	48.25	50.05	44.01	42.5	3	7.08	34.76	39.32	39.62	45.68	49.39	53.43]	(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylin	nder is	s in the c	dwellin	g or hot w	vater is	from com	munity	heating	
5. Int	ernal g	ains (see	e Table s	5 and 5a):										
Metabo	olic gair	ns (Table	e 5). Wa	tts	/										
motab	Jan	Feb	Mar	Apr	May	,	Jun	Jul	Auç	Sep	Oct	Nov	Dec	1	
(66)m=	125.87	125.87	125.87	125.87	125.87	12	25.87	125.87	125.8	125.87	125.8	7 125.87	125.87	1	(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equati	on	L9 or	[.] L9a), al	lso se	e Table 5			1	-	
(67)m=	20.11	17.86	14.53	11	8.22	6	6.94	7.5	9.75	13.08	16.61	19.39	20.67	1	(67)
Appliar	nces aa	ins (calc	ulated i	n Append	dix L. ea	uati	ion L'	13 or L1	3a), al	so see Ta	uble 5		I	7	
(68)m=	225.6	227.94	222.04	209.48	193.63	17	78.73	168.77	166.4	3 172.33	184.8	9 200.74	215.64	1	(68)
Cookin	a gains	L s (calcula	L Ited in A	L ppendix	L equat	ion	1 15	or I 15a)	also	 see Table	1 2.5			7	
(69)m=	35.59	35.59	35.59	35.59	35.59	3	5.59	35.59	35.59	35.59	35.59	35.59	35.59	1	(69)
Pumps	and fa	I ns dains	I (Table	1 5a)										7	
(70)m=	3			3	3		3	3	3	3	3	3	3	1	(70)
				tive valu	es) (Tab		5)	-		1 -				7	
(71)m=	-100 69	-100 69	-100 69	-100 69	-100 69	-10) 00.69	-100 69	-100.6	-100 69	-100.6	9 -100 69	-100 69	1	(71)
Watar	hooting		- 100.00	100.00	100.00		.00	100.00	100.0		100.0	100.00	100.00	7	(,
(72)m=	73 98	yanıs (1	able 5)	61 12	57 12	5	1.5	46 73	52.85	55.03	61.4	68 59	71.82	1	(72)
Tetel:	10.00		07.20	01.12	01.12		(66)	+0.73	- (68)r	(60)m +	(70)m +	(71)m + (72))m	7	()
(73)m-	282.45	291 37	367.6	345.36	322 73	30	00)	286.76	202 7	304.2	326.6	6 352 48	371.80	г	(73)
6 Sol	ar gain	01.07	307.0	345.50	522.75	50	0.95	200.70	292.1	504.2	520.0	0 332.40	571.09	_	(10)
Solar o	ains are	s. calculated	using sola	ar flux from	Table 6a a	and	associ	ated equa	tions to	convert to t	he applic	able orienta	tion.		
Orienta	ation:	Access F	actor	Area			Flu	х Х		a		FF		Gains	
		Table 6d		m²			Tat	ole 6a		Table 6b		Table 6c		(W)	
Southw	est <mark>o.9x</mark>	0 77	x	28	38	× [3	6 79		0.35	Тx	0.7	=	17 99] (79)
Southw	est <mark>o.9x</mark>	0.77	x	1.5	36	x [3	6 79		0.35	⊢ ×	0.7		104 58](79)
Southw	est <mark>0.9x</mark>	0.77		29	38	L X	5 م	2 67		0.35		0.7		30.65	ן`י' (79)
Southw	esto 9x	0.77		1 5	36	۱ ن ۲ 🗙	0 	2 67		0.35		0.7		178.13](79)
Southw	esto av	0.77		20	38	⊤ L × Γ	0 م	5 75		0.35				41.03](79)
		0.11		2.0		<u> </u>	0	5.75		0.00	~	0.7		41.55	()

Southw	vest <mark>0.9x</mark>	0.77		×	1.8	6	×	8	35.75]		0.35	×	0.7		=	243.73	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	2.8	8	×	1	06.25	j		0.35	×	0.7		=	51.96	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25]		0.35	×	0.7		=	301.99	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	19.01	1		0.35	x	0.7		=	58.19	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01	Ī		0.35	×	0.7		=	338.25	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15	j		0.35	×	0.7		=	57.77	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	×	1	18.15]		0.35	×	0.7		=	335.81	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	2.8	8	x	1	13.91]		0.35	×	0.7		=	55.7	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.35	×	0.7		=	323.75	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39]		0.35	×	0.7		=	51.04	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39	Ī		0.35	×	0.7		=	296.7	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	2.8	8	x		92.85	İ		0.35	_ × [0.7		=	45.4	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	1.8	6	×		92.85	j		0.35	×	0.7		=	263.9	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	6	69.27	Ī		0.35	×	0.7		=	33.87	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	1.8	6	x	6	69.27	j		0.35	×	0.7		=	196.87	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	4	14.07]		0.35	×	0.7		=	21.55	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	1.8	6	x		14.07]		0.35	×	0.7		=	125.26	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x		31.49]		0.35	×	0.7		=	15.4	(79)
Southw	vest <mark>0.9x</mark>	0.77		×	1.8	6	x		31.49	İ		0.35	_ × [0.7		=	89.49	(79)
	-						•			•						•		
Solar g	gains in	watts, ca	alculate	d	for each	n mont	th			(83)m	n = Si	um(74)m	.(82)m					
(83)m=	122.57	208.78	285.66		353.94	396.45	5	393.58	379.45	347	.74	309.31	230.74	146.81	104.	.89		(83)
Total g	gains – i	nternal a	nd sol	ar	(84)m =	(73)m	ו + 	(83)m	, watts			r						
(84)m=	506.02	590.14	653.26		699.3	719.18	3	694.51	666.21	640).53	613.51	557.4	499.29	476.	.78		(84)
7. Me	ean inter	nal temp	beratur	e (I	heating	seasc	on)											
Temp	perature	during h	eating	pe	eriods in	the liv	ving	area	from Tab	ole 9	, Th	1 (°C)					21	(85)
Utilis	ation fac	tor for g	ains fo	r liv	ving are	a, h1,	m (see Ta	ble 9a)									
	Jan	Feb	Mar		Apr	May	y	Jun	Jul	A	ug	Sep	Oct	Nov	De	ес		
(86)m=	1	0.99	0.99		0.96	0.89		0.75	0.57	0.6	51	0.84	0.97	1	1			(86)
Mear	<u>interna</u>	l temper	ature i	n li	ving are	a T1 ((foll	ow ste	ps 3 to 7	7 in T	Table	e 9c)			-			
(87)m=	19.85	20.01	20.25		20.53	20.79		20.94	20.99	20.	.98	20.89	20.56	20.15	19.8	82		(87)
Temp	perature	during h	eating	ре	eriods in	rest c	of d	welling	from Ta	able	9, Tł	ר2 (°C)						
(88)m=	20.01	20.01	20.02		20.02	20.02		20.03	20.03	20.	.03	20.03	20.02	20.02	20.0	02		(88)
Utilis	ation fac	tor for g	ains fo	r re	est of dv	velling	j, h2	2,m (se	ee Table	9a)								
(89)m=	1	0.99	0.98	Τ	0.95	0.85	T	0.66	0.45	0.4	49	0.77	0.96	0.99	1			(89)
Mear	, interna	l temper	ature i	י tł ר	he rest o	of dwe	elline	a T2 (f	ollow ste	eps 3	3 to 7	7 in Table	e 9c)	•				
(90)m=	18.48	18.72	19.05	Ţ	19.47	19.81	Τ	19.99	20.02	20.	.02	19.94	19.51	18.91	18.4	44		(90)
	L		I						!			fl	A = Liv	ing area ÷ (4	4) =		0.3	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

						0,			, ,				
(92)m=	18.9	19.11	19.41	19.79	20.1	20.28	20.31	20.31	20.22	19.83	19.29	18.85	(92)

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

(93)m=	18.9	19.11	19.41	19.79	20.1	20.28	20.31	20.31	20.22	19.83	19.29	18.85		(93)
8. Spa	ace hea	iting requ	uiremen	t										
Set Ti the ut	i to the ilisation	mean int factor fo	ternal te or gains	mperatui using Ta	re obtair Ible 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	1:										
(94)m=	1	0.99	0.98	0.94	0.86	0.68	0.49	0.53	0.79	0.96	0.99	1		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	503.98	584.7	639.1	660.15	617.07	474.24	324.96	339.88	482.76	532.47	494.92	475.35		(95)
Month	nly aver	age exte	ernal ten	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1315.74	1278.54	1160.37	971.46	748.69	502.57	328.84	345.91	543.44	821.93	1088.59	1312.89		(97)
Space	e heatin	g requir	ement fo	or each n	nonth, k	Nh/mont	th = 0.02	24 x [(97)m – (95)m] x (4 ⁻	1)m			
(98)m=	603.95	466.26	387.82	224.14	97.92	0	0	0	0	215.36	427.44	623.13		
		-	-	-				Tota	l per year	(kWh/year	·) = Sum(9	8)15,912 =	3046.04	(98)
Space	e heatin	g require	ement ir	ı kWh/m²	/year								36.7	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatii	ng:												
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	1	(202)											
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	encv of	main spa	ace heat	ina svste	em 1								93.5	(206)
Efficie	ancy of	seconda	ry/eunnl	omontar	v hoatin	n evetor	n %						0]`´´´](208)
Lineic		Ech	Mor	Apr	Mov		I, 70	Aug	Son	Oct	Nov	Dee	k)Mb/yoo](200)
Snace	boatin		ement (d above		Jui	Aug	Sep		INUV	Dec	KWII/yea	1
Opact	603.95	466.26	387.82	224.14	97.92	, 0	0	0	0	215.36	427.44	623.13		
(011)m)m v (20				-	-							(011)
(211)11	1 - {[(90) III X (20	(4)] } X	$100 \div (20)$	104 73	0	0	0	0	220.23	457 16	666 45		(211)
	045.94	490.00	414.79	239.73	104.75	0	0	Tota	l (k\\/h/vea	230.33	437.10 211)	000.45	2257 70	1(211)
0		c 1 /						1014	r (itter # yee				3257.79	(211)
	e neatin	g tuei (s 1 ע גוויר	econdar	'Y), KVVN/ VQV	month									
- {[(90					0	0	0	0	0	0	0	0		
(210)	Ū	Ů	Ů	ů	Ū	Ŭ	Ŭ	Tota	(kWh/vea	ar) =Sum(2	215)	=	0	(215)
Meter	heating	_							() · · ·		- 15,1012		0](=:=)
	from w	j ator hoa	iter (calc	ulated a	hove)									
Output	169.58	148.76	154.55	136.22	131.8	115.36	108.51	122.23	123.02	141.39	152.42	164.73		
Efficier	L CV of w	i ater hea	iter										87.3	(216)
(217)m=	89 78	89.7	89 56	89.26	88 64	87.3	87.3	87.3	87.3	89.2	89.64	89 81		(217)
Fuel fo	r water	heating	k\//h/m	onth	00.04				01.0			00.01		× /
(219)m	n = (64)	m x 100) ÷ (217)m										
(219)m=	188.89	165.84	172.56	152.61	148.7	132.14	124.3	140.01	140.91	158.5	170.04	183.41		
I		-						Tota	I = Sum(2	19a) ₁₁₂ =			1877.91	(219)
Annua	I totals	i								k\	Wh/year	, ,	kWh/year	-
Space	heating	fuel use	ed, main	system	1								3257.79	

Water heating fuel used		1977.01	٦
		1077.91	
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		355.19	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =		5565.89	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP			
EnergyEmission factorkWh/yearkg CO2/kWh	ctor	Emissions kg CO2/yea	ar
Space heating (main system 1) (211) x 0.216	=	703.68	(261)
Space heating (secondary) (215) x 0.519	=	0	(263)
Water heating (219) x 0.216	=	405.63	(264)
Space and water heating (261) + (262) + (263) + (264) =		1109.31	(265)
Electricity for pumps, fans and electric keep-hot (231) × 0.519	=	38.93	(267)
Electricity for lighting (232) x 0.519	=	184.34	(268)
Total CO2, kg/year sum of (265)(271) =		1332.58	(272)
Dwelling CO2 Emission Rate (272) ÷ (4) =		16.06	(273)
El rating (section 14)		86	(274)

		ι	Jser De	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2	:	Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.5.59	
A		Pro	perty A	Address:	Kingsto	on Bridge	e 3BF 83	STOP G	AS	
Address :	sions:									
	510115.		Aroa	(m²)			iaht(m)		Volume(m ³)	
Ground floor				83	(1a) x		911(11) 7	(2a) =	224 1	(3a)
Total floor area TFA = $(1a)$	+(1h)+(1c)+(1d)+(1e)+ (1n)		••	(12)		/	()	227.1	
Dwelling volume		·/····(····)		03	('') (3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	224.4	
					() ()	, (, (., (,		224.1	(3)
2. Ventilation rate:	main se	econdary		other		total			m ³ per hour	
	heating h	eating			. –	totai				-
Number of chimneys	0 +	0	+	0		0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fans	3					3	x ^	10 =	30	(7a)
Number of passive vents					Γ	0	x *	10 =	0	(7b)
Number of flueless gas fire	S					0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
	flue a sead for a sea (C	-) (((h)) (7 -)		(a) _	_					ui 7
Inflitration due to chimneys	s, flues and fans = (0)	a)+(00)+(7a)	(17) o	thorwise o	ontinuo fr	$\frac{1}{2}$	(16)	÷ (5) =		
Number of storevs in the	e dwelling (ns)	a, proceeu i	0 (17), 0	uner wise c	onunue n	0111 (9) 10 (10)		0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	5 for steel or timber f	frame or 0	.35 for	masonr	y constr	uction		·	0	(11)
if both types of wall are pres	sent, use the value corres	ponding to th	he greate	er wall area	a (after					_
If suspended wooden flo	s); if equal user 0.35 or enter 0.2 (unseal	ed) or 0 1	(sealed	d) else (enter ()				0	7(12)
If no draught lobby, ente	r 0.05, else enter 0	00) 01 011	(00010)	u), 0100 ·					0	(12)
Percentage of windows a	and doors draught st	ripped							0	
Window infiltration	0		(0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			((8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, q	50, expressed in cub	ic metres	per hou	ur per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeability	/ value, then (18) = [(1	7) ÷ 20]+(8),	otherwis	se (18) = (16)				0.38	(18)
Air permeability value applies i	if a pressurisation test has	s been done	or a degi	ree air per	meability	is being u	sed			_
Number of sides sheltered			((20) - 1 [0 075 v (1	0)1 -			2	(19)
Sheller lactor	a chaltar factor		((20) - 1 - [v (20) -	9)] –			0.85	(20)
Initiation rate incorporation	g sheller lactor	1	((10)	x (20) -				0.33	(21)
	monthly wind speed		1.1	Aug	Son	Oct	Nov	Dee		
		Jun	Jui	Aug	Sep	UCI	INOV	Dec		
(22)m=	ed from Table 7	2.0	201	27	Α	4.2	A E	47		
(22)11- 0.1 0 4.	.7 4.4 4.3	3.0	3.0	3.1	4	4.3	4.3	4.7		
Wind Factor (22a)m = (22)	m ÷ 4									
(22a)m= 1.27 1.25 1.2	23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ng for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m				_	
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
Calcul	ate effe	ctive air	change	rate for t	the appli	cable ca	se		-		-		-	
II IIIt			ucing App	ondix N (2	(22h) = (22c)	x = m v (c)	oquation (I		nuico (23h) = (23a)			0	(238)
If bol		eat pump			(200) = (200)	i) ~ I IIIV (e	Squation (i	n Table 4b) –) = (238)			0	(230)
) - .)	⊃h.)ma i (00k) v I	(00.0)	0	(23c)
a) ir								HR) (24a 1	i)m = (22	20)m + (23D) × [1 - (23c)) ÷ 100]]	(242)
(24a)m=			0		0	0	0					0	J	(244)
D) IT	balance		anical ve				covery (r	VIV) (240 T	o)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0			 					0	0	0	J	(240)
C) IT	if (22b)r	iouse ex n < 0.5 >	tract ver (23b), f	tilation (24)	c) = (23b)); other	ventilatio wise (24	c) = (22b)	outside b) m + 0.	5 × (23b)	-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a	a) or (24b	o) or (24	c) or (24	d) in bo	(25)				-	
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57]	(25)
3 He	at losse	s and he	eat loss i	naramet	er.									
		Gros	ss	Openin	as	Net Ar	ea	U-valı	Je	AXU		k-value	<u>,</u>	AXk
		area	(m²)	n	1 ²	A ,r	n²	W/m2	K	(W/	<)	kJ/m²·l	K	kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.4)+	0.04] =	3.82				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.4)+	0.04] =	2.47				(27)
Walls				19.6	2	30.6	x	0.18	=	5.51				(29)
Roof				0		83	x	0.13	= =	10.79			\exists	(30)
Total a	area of e	elements	, m²			133.2	2							(31)
Party v	wall					57.08	3 X	0	= [0				(32)
Party f	loor					83		L	(\dashv	(32a)
* for win ** incluc	idows and le the area	l roof wind as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Ils and par	alue calcul titions	lated using	g formula 1	/[(1/U-valı	ie)+0.04] a	ns given ir	n paragraph	1 3.2	
Fabric	heat los	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				42.31	(33)
Heat c	apacity	Cm = S	(Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	8803.96	(34)
Therm	al mass	parame	ter (TMI	- = Cm -	+ TFA) ir	ו kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For desi can be ı	ign asses: used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	e construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in T	Table 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	K						7.08	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			49.39	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y		1		(38)m	= 0.33 × (25)m x (5	5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	43.38	43.13	42.88	41.74	41.53	40.53	40.53	40.34	40.91	41.53	41.96	42.41	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	92.76	92.52	92.27	91.13	90.91	89.92	89.92	89.73	90.3	90.91	91.35	91.8		
										Average =	Sum(39)	112 /12=	91.13	(39)

Heat Ic	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.12	1.11	1.11	1.1	1.1	1.08	1.08	1.08	1.09	1.1	1.1	1.11		
Numbe	er of day	us in mo	nth (Tab	le 1a)			•	•	,	Average =	Sum(40) ₁ .	12 /12=	1.1	(40)
Turnoc	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	349 x (TF	⁻ A -13.9	9)2)] + 0.(0013 x (⁻	TFA -13.	<u>2</u> . .9)	52		(42)
Annual Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		
_									-	Total = Su	m(44) ₁₁₂ =		1127.84	(44)
Energy o	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r 1	m x nm x L 1	DTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.56	106.21	107.48	125.26	136.73	148.48		-
lf instant	taneous w	ater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	•	1478.77	(45)
(46)m=	23	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Water	storage	loss:	ļ	Į	Į	Į	Į	1		I	I			
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel	(0		(47)
If comr	nunity h	eating a	and no ta	nk in dw	velling, e	nter 110) litres in	ı (47) Əmbi boil	ore) onto	or 'O' in <i>(</i>	(17)			
Water	storage	loss:	not wate	21 (1113 11		nstantai								
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	/ lost fro	m water	⁻ storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:							
Hot wa	iter stora	age loss	tactor fr		e 2 (kvv	h/litre/da	ay)					0		(51)
Volume	e factor	from Ta	ble 2a	011								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	⁻ storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (8	55)	-								0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 30	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ing and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	ch r	month (61)m =	(60) ÷ 36	65 × (41))m									
(61)m=	50.96	45.86	48.85		45.42	45.02	4	1.71	43.11	45.0	2	45.42	48.8	5	49.13	50	.96]	(61)
Total h	eat req	uired for	water	hea	ating ca	lculated	l fo	r eacl	n month	(62)n	า =	0.85 × ((45)m	+	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	204.28	179.95	187.22	2	166.06	160.77	1	41.6	135.66	151.2	23	152.9	174.1	1	185.86	199	9.44		(62)
Solar DH	- IW input	calculated	using Ap	ppe	ndix G or	Appendix	: H (negativ	ve quantity	/) (ente	r '0'	if no sola	r contril	bu	tion to wate	er hea	ating)		
(add a	dditiona	al lines if	FGHR	S a	nd/or V	VWHRS	ap	plies	, see Ap	pendi	x G	6)							
(63)m=	0	0	0		0	0		0	0	0		0	0		0	(0		(63)
Output	from w	ater hea	iter															-	
(64)m=	204.28	179.95	187.22	2	166.06	160.77	1	41.6	135.66	151.2	23	152.9	174.1	1	185.86	199	9.44		
										C	Outp	ut from wa	ater hea	ate	er (annual)	12		2039.09	(64)
Heat g	ains fro	m water	heating	g, ł	(Wh/mo	onth 0.2	5 ´	[0.85	× (45)m	+ (61)m] + 0.8 >	(46) (m	+ (57)m	+ (5	59)m]	
(65)m=	63.72	56.05	58.22	Τ	51.47	49.74	4	3.64	41.55	46.5	7	47.09	53.8	6	57.75	62	.11		(65)
inclu	de (57))m in cal	ulatior	n of	f (65)m	only if c	ylir	nder is	s in the c	dwellii	ng d	or hot w	ater is	s f	rom com	mun	nity h	eating	
5. Int	ernal o	ains (see	e Table	5 8	and 5a):	5				Ū						,	U U	
Metab	olic gai	ns (Table	5) Wa	atte															
Metab	Jan	Feb	Mar		, Apr	Mav		Jun	Jul	Au	a	Sep	Oc	t	Nov	C)ec]	
(66)m=	125.87	125.87	125.87	,	125.87	125.87	12	25.87	125.87	125.8	37	125.87	125.8	37	125.87	125	5.87		(66)
Liahtin	a aains	(calcula	ted in A	- I Apr	pendix l	. equat	ion	L9 or	r L9a), a	lso se	e T	able 5	I					1	
(67)m=	20.11	17.86	14.53	1	11	8.22	6	6.94	7.5	9.75	;	13.08	16.6	1	19.39	20	.67]	(67)
Annlia	nces da	ins (calc	ulated	in .	Annenc	lix lea	L Llat	ion L	13 or I 1	3a) a	lso	see Ta	l ble 5		1			1	
(68)m=	225.6	227.94	222.04	i T	209.48	193.63	1	78.73	168.77	166.4	13	172.33	184.8	39	200.74	215	5.64	1	(68)
Cookin	L	L s (calcula	L	_L Ani	nendix	l equat	L ior	1 15	or I 15a			e Table	5					1	
(69)m=	35.59	35.59	35.59		35.59	35.59		5.59	35.59	35.5	9	35.59	35.5	9	35.59	35	.59	1	(69)
Pumps	and fa	ne gaine	(Table	5	3)						-			-				1	
(70)m=				1	3	3		3	3	3		3	3		3		3	ו	(70)
						e) (Tab		5)	.	Ů		0	Ů		ů			J	(- /
(71)m=	-100 69				100 69	-100 69			-100.69	-100 (30	-100 69	-100 6	30	-100.69	-100	1 60	1	(71)
(/ I)III-	hooting			<u>`</u>	100.00	-100.00	- 1	00.00	-100.00	-100.0	55	-100.00	-100.0		-100.00	-100	5.00]	()
		gains (i) 	71 40	66.96	6	0.61	55 95	62.6		65.41	72.2	0	00.2	02	10	1	(72)
(72)11-	05.04	03.41	70.25		71.40	00.00		0.01	00.00	02.0	,	(60)m + ((70)m	9	00.2 (1)m + (72)	00	.40	J	(12)
I otal I	nterna	i gains =	-		255 70	222.47		(00)				014 50		· (/	(1) (12)			1	(73)
(73)m=	395.11	392.97	378.58	·	355.72	332.47	3	10.04	295.88	302.5	53	314.58	337.0	00	364.09	383	5.55		(13)
Solar o	ains are	s. calculated	usina so	lari	flux from	Table 6a :	and	associ	iated equa	tions to		overt to th	e annli	cal	hle orientat	ion			
Orienta	ation.	Access F	Factor		Area		and	Flu	X		, 001	a	e appli	ou	FF	1011.		Gains	
onona		Table 6d	uotor		m²			Tat	ole 6a		Та	able 6b		Т	able 6c			(W)	
Southw	est <mark>o.9x</mark>	0.77		×「	2.8	8	x	3	6 79	I F		0.63	┐ ×	Г	0.7		_	32.38] (79)
Southw	esto 9x	0.77		∩ [x [1.8	6	x	3	6 79	I L I T		0.63	۲°,	F	0.7		_	188.24](79)
Southw	esto 9x	0.77		∵ L x [1.0 2 Q	8	x	6	2.67	I L I T		0.63	٦ [°]		0.7		_	55 16](79)
Southw	esto ov	0.77		î [<mark>v</mark> [2.0	6	Ϋ́	6	2.67	L T		0.63	╡ Û		0.7		=	320 64](79)
Southw	esto 9x	0.77		∩ L x [1.0 	8	x	0	5 75	L T		0.63	╡ Ŷ	L	0.7	\neg	=	75 / 2](79)
		0.77		^	∠.0	· ·	^	0	0.10			0.03	1 ^	1	0.7		_	10.40	1,1,2,1

Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	8	35.75	1		0.63	×	0.7		=	438.71	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25	Ī		0.63	_ × [0.7		= [93.52	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25]		0.63	×	0.7		=	543.58	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	19.01]		0.63	_ × [0.7		=	104.75	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01]		0.63	×	0.7		=	608.85	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15]		0.63	_ × [0.7		=	103.99	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15]		0.63	_ × [0.7		=	604.45	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91]		0.63	×	0.7		=	100.26	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.63	×	0.7		=	582.76	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39]		0.63	×	0.7		=	91.88	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39]		0.63	×	0.7		=	534.06	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	9	2.85]		0.63	_ × [0.7		=	81.73	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	g	92.85]		0.63	_ x [0.7		=	475.03	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27]		0.63	×	0.7		=	60.97	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27]		0.63	×	0.7		=	354.37	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07]		0.63	×	0.7		=	38.79	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07]		0.63	x	0.7		=	225.46	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	2.8	8	x	3	31.49]		0.63	x	0.7		=	27.71	(79)
Southw	vest <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49]		0.63	×	0.7		=	161.09	(79)
	_									_						-		
Solar g	gains in	watts, ca	alcula	ted	for each	n mont	h			(83)m	า = Sเ	um(74)m .	(82)m	1				
(83)m=	220.62	375.8	514.	18	637.1	713.6		708.44	683.01	625	.94	556.75	415.34	264.25	188.8	81		(83)
l otal g	gains – i	nternal a	and so	olar	(84)m =	(73)m	+ ((83)m	, watts					1				(0.4)
(84)m=	615.73	768.77	892.	76	992.82	1046.07	7 1	018.48	978.9	928	.47	871.33	752.99	628.35	572.3	36		(84)
7. Me	ean inter	nal temp	beratu	ure (heating	seaso	n)											
Temp	perature	during h	neatin	g pe	eriods in	the liv	ring	area	from Tab	ole 9	, Th′	1 (°C)					21	(85)
Utilis	ation fac	tor for g	ains f	or li	ving are	a, h1,r	n (s	see Ta	ible 9a)					-i	. <u> </u>			
	Jan	Feb	Ma	ar	Apr	Мау	<u></u>	Jun	Jul	A	ug	Sep	Oct	Nov	De	ec		
(86)m=	0.99	0.98	0.90	6	0.88	0.74		0.55	0.4	0.4	14	0.68	0.92	0.99	1			(86)
Mear	n interna	l temper	ature	in li	iving are	ea T1 (foll	ow ste	ps 3 to 7	7 in T	able	e 9c)		1				
(87)m=	19.93	20.16	20.4	5	20.74	20.92		20.99	21	2	1	20.96	20.71	20.26	19.8	9		(87)
Temp	perature	during h	neatin	g pe	eriods in	rest o	f dv	velling	from Ta	able	9, Tł	n2 (°C)		-	-			
(88)m=	19.99	19.99	19.9	9	20	20		20.01	20.01	20.	02	20.01	20	20	20			(88)
Utilis	ation fac	tor for g	ains f	or r	est of dv	velling	, h2	2,m (se	e Table	9a)								
(89)m=	0.99	0.98	0.94	4	0.85	0.68		0.47	0.31	0.3	35	0.59	0.89	0.98	1			(89)
Mear	n interna	I temper	ature	in t	he rest of	of dwel	llind	72 (f	ollow ste	eps 3	6 to 7	in Tabl	e 9c)					
(90)m=	18.58	18.92	19.3	32	19.72	19.93	Ť	20.01	20.01	20.	01	19.98	, 19.69	19.06	18.5	2		(90)
	-		-	-						•		f	LA = Livi	ng area ÷ (4	4) =		0.3	(91)

 $fLA = Living area \div (4) = 0.3$ Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

Incan	interna	liemper				iiiiig) – i		· (<u></u>				_
(92)m=	18.99	19.29	19.66	20.02	20.23	20.3	20.31	20.31	20.28	20	19.42	18.94	(93

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

(93)m=	18.99	19.29	19.66	20.02	20.23	20.3	20.31	20.31	20.28	20	19.42	18.94		(93)
8. Spa	ace hea	ting requ	uirement	i i										
Set Ti the ut	i to the i ilisation	mean int factor fo	ternal tei or gains	mperatui using Ta	re obtain able 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm											
(94)m=	0.99	0.97	0.94	0.85	0.69	0.5	0.34	0.38	0.62	0.89	0.98	0.99		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	610.01	748.93	835.92	841.67	725.69	505.69	332.85	349.62	537.3	668.24	614.64	568.52		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1362.5	1331.46	1214.04	1013.74	775.31	512.6	333.6	350.9	557.82	854.47	1125.58	1352.8		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	559.85	391.46	281.33	123.89	36.92	0	0	0	0	138.56	367.88	583.5		_
								Tota	l per year	(kWh/year	⁻) = Sum(9	8)15,912 =	2483.39	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								29.92	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:	_											-
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ו, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above))		-						
	559.85	391.46	281.33	123.89	36.92	0	0	0	0	138.56	367.88	583.5		
(211)m	n = {[(98)m x (20)4)] } x 1	00 ÷ (20)6)									(211)
	599.41	419.13	301.21	132.64	39.53	0	0	0	0	148.35	393.87	624.74		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2658.88	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									-
= {[(98)m x (20	01)] } x 1	00 ÷ (20	8)	-	-	-	-			-	-		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	3												-
Output	from w	ater hea	ter (calc	ulated a	bove)									
	204.28	179.95	187.22	166.06	160.77	141.6	135.66	151.23	152.9	174.11	185.86	199.44		-
Efficier	ncy of w	ater hea	iter										80.3	(216)
(217)m=	87.46	86.96	86.07	84.33	82.01	80.3	80.3	80.3	80.3	84.48	86.74	87.59		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	1 = (64)	m x 100) ÷ (217)	106.02	106.04	176.24	168.05	188 24	100 / 2	206.00	21/ 22	227 60		
(213)111=	200.07	200.94	217.01	190.92	130.04	170.34	100.90	Tota	= Sum(2)	200.09 19a) =	214.20	221.09	0400 0 7	
A nn	1 40401-							, ota			Mhhine		2423.07	L ⁽²¹⁹⁾
Space	heating	fueluse	ed, main	system	1					K	wn/year		2658.88	1
Space		1001 000	- a, main	5,50011	•								2000.00	

Water heating fuel used				2423.07]
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 (23	0a)(230g) =		75	(231)
Electricity for lighting				355.19	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =			5512.14	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Enorgy			Fusiaalaua	
	kWh/year	kg CO2/kWh	or	kg CO2/yea	ar
Space heating (main system 1)	kWh/year (211) x	kg CO2/kWh	er	kg CO2/yea	ar](261)
Space heating (main system 1) Space heating (secondary)	(211) x (215) x	kg CO2/kWh	or = =	kg CO2/yea	ar](261)](263)
Space heating (main system 1) Space heating (secondary) Water heating	(211) x (215) x (219) x	Emission fact kg CO2/kWh 0.216 0.519 0.216	= = =	kg CO2/yea	ar](261)](263)](264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	 kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = 	kg CO2/kWh 0.216 0.519 0.216	= = =	Emissions kg CO2/yea 574.32 0 523.38 1097.7	ar](261)](263)](264)](265)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	<pre>Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x</pre>	Emission factor kg CO2/kWh 0.216 0.519 0.216	e = = =	Emissions kg CO2/yea 574.32 0 523.38 1097.7 38.93	ar](261)](263)](264)](265)](267)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	<pre>Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x</pre>	Emission factorization kg CO2/kWh 0.216 0.519 0.216 0.519 0.519	er = = = =	Emissions kg CO2/yea 574.32 0 523.38 1097.7 38.93 184.34	ar (261) (263) (264) (265) (267) (268)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x su	Emission factors kg CO2/kWh 0.216 0.519 0.216 0.519 0.519 0.519 0.519 0.519 0.519 0.519 0.519 0.519 0.519	er 	Emissions kg CO2/yea 574.32 0 523.38 1097.7 38.93 184.34 1320.97	ar (261) (263) (264) (265) (267) (268) (272)

TER =

15.92 (273)



Appendix 2: 'Be Lean' SAP 10 Spreadsheet

Be Lean - SAP 2012 Methodology SAP 10 Carbon Factors

Γ

Project	Kingston Bridge House, Hampton Wick
Client	Westcombe
Date	Mar-23
Rev	С



SAP 2012Carbon FactorSAP 10Gas0.216GasGrid Elec0.519Grid Elec Carbon Factor 0.210 0.233

					TER			
Plot	Bedrooms	Floor Area	Location	Space Htg	Water Htg	Pumps/	Emissions	PI
		00.7	01/5	0700	0500		1010	
1	3	80.7 EE C	GND	2739	2032	449	1212	
2	1	55.6	GND	2619	2110	302	1120	-
3	2	67.9	GND	2018	2269	402	1054	
4	1	60.0	GND	2062	2485	420	1054	4
5	2	61.4	GND	2307	2052	364	1013	
5	1	51.2	GND	1012	1943	333	824	
/	1	50.0	GND	1574	1897	325	805	
8	1	50.0	GND	1574	1897	325	805	
9	1	50.0	GND	1574	1897	325	1028	1
10	2	02.3	GND	2402	2002	309	1020	1
10	3	64.3 60.5	MID	1000	2402	437	1014	1
12	2	74.0	MID	2060	2310	394	1067	1
13	2	74.9	MID	2009	2022	443	1007	1
14	2	00.2	MID	1907	2490	424	900	1
15	3	62.0	MID	1897	2032	440	1034	1
10	2	63.9	MID	1/00	2151	378	911	1
19	2	51.0	MID	1000	1058	301	705	1
10	1	50.0	MID	1011	1016	325	600	1
20	1	50.0	MID	1011	1016	325	690	1
20	1	50.0	MID	1011	1016	325	690	2
21	et.	37.5	MID	759	1437	244	519	2
22	1	53.0	MID	1090	2065	244	744	2
23	3	94.3	MID	1860	2003	437	1014	2
24	1	60.5	MID	1223	2402	394	835	2
25	2	74.9	MID	2069	2570	443	1067	2
20	2	65.2	MID	1319	2322	443	900	2
29	3	86.0	MID	1907	2430	424	1034	2
20	2	63.9	MID	1765	2151	378	911	2
30	2	61.0	MID	1685	2054	361	869	3
31	1	51.0	MID	1033	1958	332	705	3
32	1	50.0	MID	1011	1916	325	690	3
33	1	50.0	MID	1011	1916	325	690	3
34	1	50.0	MID	1011	1916	325	690	3
35	ST	37.5	MID	758	1437	244	518	3
36	1	53.9	MID	1090	2065	351	744	3
37	3	84.3	TOP	2701	2461	437	1186	3
38	1	60.5	TOP	1955	2294	394	984	3
39	2	74.9	TOP	2687	2508	443	1194	3
40	2	65.2	TOP	2339	2183	386	1040	4
40	3	86.0	TOP	2755	2511	446	1210	-
42	2	63.9	TOP	2292	2139	378	1019	
43	2	61.0	MID	1685	2054	361	869	4
44	1	51.1	MID	1033	1958	332	705	4
45	1	50.0	MID	1011	1916	325	690	4
46	1	50.0	MID	1011	1916	325	690	4
47	1	50.0	MID	1011	1916	325	690	4
48	ST	37.5	MID	758	1437	244	518	4
49	1	53.9	MID	1090	2065	351	744	4
50	2	61.0	MID	1685	2054	361	869	5
51	1	51.1	MID	1033	1958	332	705	5
52	1	50.0	MID	1011	1916	325	690	5
53	1	50.0	MID	1011	1916	325	690	5
54	1	50.0	MID	1011	1916	325	690	5
55	ST	37.5	MID	758	1437	244	518	5
56	1	53.9	MID	1090	2065	351	744	5
57	2	61.0	MID	1685	2054	361	869	5
58	1	51.1	MID	1033	1958	332	705	5
59	1	50.0	MID	1011	1916	325	690	5
60	1	50.0	MID	1011	1916	325	690	6
61	1	50.0	MID	1011	1916	325	690	6
62	ST	37.5	MID	758	1437	244	518	6
63	1	53.9	MID	1090	2065	351	744	6
64	2	61.0	TOP	2188	2042	361	973	6
65	1	51.1	TOP	1651	1938	332	831	6
66	1	50.0	TOP	1616	1896	325	813	6
67	1	50.0	TOP	1616	1896	325	813	6
68	1	50.0	TOP	1616	1896	325	813	6
69	ST	37.5	TOP	1212	1422	244	610	6
70	1	53.9	TOP	1742	2044	351	877	7
		4026.0					57979.6	

	DER - Based	on Gas Heating v Carbon Factors	vith SAP 10]
Plot	Space Htg	Water Htg	Pumps/ Lighting	Emissions
4	0457	1000	440	12425
2	2088	1962	449 362	874.0
3	2903	1782	402	1077.7
4	2460	1970	426	1029.6
5	2626	1611	364	974.5
6	1923	1540	333	804.8
/	1878	1504	326	786.0
9	1878	1504	326	786.0
10	2664	1635	369	988.8
11	1631	1918	437	847.0
12	1100	1829	394	706.8
13	2005	1972	444	938.5
14	1664	1971	424	761.7 864 1
16	1710	1682	379	800.7
17	1633	1606	361	764.3
18	929	1545	333	597.0
19	909	1512	326	584.1
20	909	1512	326	584.1
21	682	1134	244	438.1
23	980	1630	351	629.7
24	1631	1918	437	847.0
25	1100	1829	394	706.8
26	2005	1972	444	938.5
27	1185	1971	424	761.7
29	1710	1682	379	800.7
30	1633	1606	361	764.3
31	929	1545	333	597.0
32	909	1512	326	584.1
33	909	1512	326	584.1
35	682	1134	244	438.1
36	980	1630	351	629.7
37	3309	1907	437	1197.3
38	2324	1819	394	961.6
39	2856	1968	444	1116.4
40	3376	1946	446	1221.4
42	2436	1679	379	952.4
43	1633	1606	361	764.3
44	929	1545	333	597.0
45	909	1512	326	584.1
40	909	1512	326	584.1
48	682	1134	244	438.1
49	980	1630	351	629.7
50	1633	1606	361	764.3
51	929	1545	333	597.0
52	909	1512	326	584.1
54	909	1512	326	584.1
55	682	1134	244	438.1
56	980	1630	351	629.7
57	1633	1606	361	764.3
59	929	1545	333 326	597.0
60	909	1512	326	584.1
61	909	1512	326	584.1
62	682	1134	244	438.1
63	980	1630	351	629.7
64 65	2326	1603	361	909.2
66	1920	1503	326	794.7
67	1920	1503	326	794.7
68	1920	1503	326	794.7
69	1440	1127	244	596.1
70	2070	1620	351	856.7

52074.2

Total Site Target Emissions

Total Site Design Emissions (Be Clean)

Total Reduction

% Reduction

52,074 kgCO₂ per year 10.19%

5,905 kgCO₂ per year

57,980 kgCO₂ per year



Appendix 3 – DER Worksheets for Modelled Units using a Communal ASHP System

		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property A	Address:	Kingsto	n Bridge	e 1BF GI	ND 52 A	SHP	
Address :									
1. Overall dwelling dimer	nsions:	٨	(100.2)			a h t (ma)		\/elume(m3)	
Ground floor		Area	a(m²)	(1a) v	AV. He		(2a) =	120.05	J (3a)
Total floor area $TEA = (1a)$	a)+(1b)+(1c)+(1d)+(1c)+	(1n)	1.5	(14)			(20) -	139.05	(Ja)
		(111)	01.5	(*) (3a)+(3b))+(3c)+(3d)+(3e)+	(3n) =	100.05	
Dweiling volume				(02) (02)	, (00) (00	,, (oo)	.(0.1)	139.05	(5)
2. Ventilation rate:	main seco	ndarv	other		total			m ³ per hour	
	heating heat	ing	other		totai				-
Number of chimneys	0 + 0	0 +	0	=	0	x 4	40 =	0	(6a)
Number of open flues	0 + (0 +	0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	IS				1	x 1	10 =	10	(7a)
Number of passive vents					0	x 1	10 =	0	(7b)
Number of flueless gas fir	es				0	x 4	40 =	0	(7c)
							Air ch	anges per hoj	ır
Infiltration due to chimpon	$(a, f _{1}) = a + a + f + a + a + a + b + b + b + b + b + b + b$	2h)+(7a)+(7h)+(7	70) -	F					
Iniliation due to chimney	S, flues and fans = $(0a)^+(0$	$(7a)^{+}(7a)^{+}(7b)$	(C) -	ontinue fri	nm(0) to ((16)	÷ (5) =		
Number of storevs in th	e dwelling (ns)	00000 <i>10 (11),</i> 0			5111 (5) 10 (10)	ĺ	0	(9)
Additional infiltration	0 ()					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber fram	ne or 0.35 for	masonr	y constr	uction		·	0	(11)
if both types of wall are pre	esent, use the value correspond	ling to the greate	er wall area	a (after					-
If suspended wooden fl	oor, enter 0.2 (unsealed)	or 0.1 (seale	d), else (enter 0				0	7(12)
If no draught lobby, ent	er 0.05. else enter 0		.,,					0	(13)
Percentage of windows	and doors draught stripp	ed						0	(14)
Window infiltration	0		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10) -	- (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o	ຊ50, expressed in cubic m	netres per ho	ur per so	luare m	etre of e	nvelope	area	4	(17)
If based on air permeabilit	ty value, then (18) = [(17) ÷ 2	20]+(8), otherwi	se (18) = (16)				0.27	(18)
Air permeability value applies	if a pressurisation test has bee	en done or a deg	iree air per	meability i	is being us	sed	i		-
Number of sides sheltered	1		(20) = 1 - [0 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	ng shaltar factor		(21) = (18)	x(20) =	0)]			0.85	$\int_{(20)}^{(20)}$
Infiltration rate modified for	r monthly wind anood		(21) - (10)	x (20) -				0.23	(21)
	Mar Apr May I		Διια	Sen	Oct	Nov	Dec		
	vial Api Way J		Aug	Seb	001	NOV	Dec		
$(22)m = \begin{bmatrix} 51 \\ 51 \end{bmatrix} \begin{bmatrix} 51 \\ 5 \end{bmatrix}$		8 20	37	4	12	15	47		
(22)III ⁻ 3.1 3 4	T.O T.H 4.0 0.	3.0	5.7	4	7.3	4.5	+ ./		
Wind Factor (22a)m = (22	.)m ÷ 4						-		
(22a)m= 1.27 1.25 1	.23 1.1 1.08 0.1	95 0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-				-	-	
II IIIt			ucing App	ondix N (2	(25) = (22)	x = m v (c)	oquation (nuico (23h) = (22a)			0	(23a)
If bal	ancod with	eat pump	wory: offic		.50) – (258	i) ^ i iiiv (e	actor (from	n Table 4b) –) = (238)			0	(230)
) -)]]h)ma_i (/	00k) v I	·1 (00 a)	0	(23c)
a) ir	balance							HR) (24a T	a)m = (22	20)m + (. 	230) × [(23c)) ÷ 100]]	(242)
(24a)11-			0		0		0					0	J	(240)
D) IT	balance		anical ve				covery (i	VIV) (240 T	5)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0		0	 					0	0	0		(240)
C) If	whole h if (22b)r	iouse ex n < 0.5 ×	tract ver (23b), f	then (24	or positiv c) = (23b); other	ventilatio wise (24	c) = (22b)	outside b) m + 0.	5 × (23b))		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous)m = (221	se positiv b)m othe	ve input erwise (2	ventilati 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54]	(24d)
Effe	ctive air	change	rate - ei	nter (24a	i) or (24t	o) or (24	c) or (24	d) in boy	x (25)	-	-	-	-	
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(25)
3 He	at losse	s and he	at loss	naramet	≏r.			-				-	-	
		Gros	35	Openin		Net Ar	rea	U-valı	lie	ΑΧΠ		k-value	<u> </u>	AXk
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	2K	(W/I	K)	kJ/m²·	K	kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Floor						51.5	x	0.13	=	6.695				(28)
Walls				6.6		24.15	5 X	0.18	=	4.35			\neg	(29)
Total a	area of e	lements	, m²			82.25	5							(31)
Party v	wall					53.34	1 X	0	= [0				(32)
Party o	ceilina					51.1] [\dashv	(32b)
* for win	dows and	l roof wind	ows, use e	effective wi	indow U-va	alue calcul	lated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given ir	n paragraph	L h 3.2	()
Fabric	heat los	ss. W/K :	= S (A x	U)	io una pun			(26)(30)) + (32) =				18.6	(33)
Heat c	apacity	Cm = S(Άxk)	•)					((28)	(30) + (32	2) + (32a)	(32e) =	10256 59	(34)
Therm	al mass	parame	ter (TMI	P = Cm +	+ TFA) ir	ו k.l/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign asses	sments wh	ere the de	etails of the	construct	ion are not	t known pi	recisely the	e indicative	values of	TMP in 1	able 1f	230	(00)
can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) ca	lculated	using Ap	pendix I	K						7.32	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
	abric ne	atioss							(33) +	(36) =			25.92	(37)
ventila	ation hea			a monthly	y L na				(38)m	= 0.33 × (25)m x (5		1	
(20)	Jan	Feb		Apr	May	Jun	Jul	Aug	Sep	Uct	NOV	Dec	4	(20)
(38)m=	24.94	24.86	24.78	24.43	24.36	24.05	24.05	23.99	24.17	24.36	24.49	24.64	J	(30)
Heat tr	ansfer o		nt, W/K	I				[(39)m	= (37) + (3	38)m	1	1	
(39)m=	50.86	50.78	50.71	50.35	50.28	49.97	49.97	49.92	50.09	50.28	50.42	50.56		
										Average =	Sum(39)	112 /12=	50.35	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.99	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.98	0.98	0.98		
Numb		<u> </u>	I					1		Average =	Sum(40) ₁ .	12 /12=	0.98	(40)
NUMDE					Mov	lup	1.1	Aug	Son	Oct	Nov	Dee		
(41)m=	31	28	1VId1 31	30	1VIdy	30	31	Aug 31	30	31	30	21 21		(41)
(41)11-	51	20	51	50	51	- 50	51	51	- 50	51	- 50	51		(++)
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	([1 - exp	0(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.0	0013 x (⁻	TFA -13.	.9) .9)	73		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	: (43)					I	
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
Energy	content of	hot water	used - cal	lculated m	onthly = 4.	190 x Vd,r	m x nm x L	OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	904.68	(44)
(45)m=	122.98	107.56	110.99	96.77	92.85	80.12	74.24	85.2	86.21	100.47	109.68	119.1		
If inclose	tonoouou		ng ot point	t of upp (p)		r otorogo)	ontor 0 in	hoves (46	·) to (61)	Total = Su	m(45) ₁₁₂ =		1186.18	(45)
ir instan	taneous w	ater neati	ng at point	t of use (ne		r storage),		Doxes (46					I	(40)
(46)m= Water	^{18.45} storage	16.13 Ioss:	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(40)
Storag	e volum	e (litres) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)
If com	munity h	eating a	and no ta	ank in dv	velling, e	nter 110) litres in	ı (47)						
Otherv	vise if no	stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in ((47)			
Water	storage	loss: urer's d	oclarod I	oss fact	or is kno	wp (k\//	n/dav).					0		(49)
Tompo	raturo f	actor fro	m Tabla	25 100			i/uay).				1	.2		(40)
Energy	lost fro	acior nu	storage	; 20 x k/Mb/w	oor			(48) v (40) =		0	.6		(49)
b) If m	anufact	urer's d	eclared of	cylinder	loss fact	or is not	known:	(40) X (49)) –		0.	72		(50)
Hot wa	ater stor	age loss	factor fi	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
IT COMI	nunity r e factor	from Ta	see secti ble 2a	on 4.3								0	l	(52)
Tempe	erature f	actor fro	m Table	2b								0		(52)
Energy	/ lost fro	m water	storage	∝ kWh/v	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (55)	,					/ (- / (0.	72		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	i0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss ca	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor f	rom Tab	le H5 if t	there is s	solar wat	ter heati	ng and a	cylinde	r thermo	ostat)		I	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	lculated	for eac	h month	(61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(61)
Total h	eat req	uired for	water I	neating	calculated	l foi	r each	n month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	168.56	148.73	156.58	140.88	138.43	12	4.23	119.83	130.78	130.33	146.06	153.79	164.68]	(62)
Solar DH	W input	calculated	using Ap	pendix G	or Appendix	(H (negativ	/e quantity	/) (enter	0' if no sola	ar contribu	ition to wate	er heating)		
(add ad	dditiona	I lines if	FGHR	S and/or	WWHRS	s ap	plies,	see Ap	pendix	G)					
(63)m=	0	0	0	0	0		0	0	0	0	0	0	0]	(63)
Output	from w	ater hea	ter											-	
(64)m=	168.56	148.73	156.58	140.88	138.43	12	4.23	119.83	130.78	130.33	146.06	153.79	164.68		
I		•	•		•		•		Οι	tput from w	ater heat	er (annual)	12	1722.88	(64)
Heat g	ains fro	m water	heating	g, kWh/n	nonth 0.2	5 ´	[0.85	× (45)m	+ (61)	m] + 0.8 :	x [(46)m	n + (57)m	+ (59)m	1]	
(65)m=	77.36	68.7	73.37	67.46	67.34	6	1.93	61.15	64.79	63.96	69.87	71.76	76.07]	(65)
inclu	de (57)	n in calo	ulation	of (65)r	n only if c	vlin	der is	s in the c	dwelling	or hot w	/ater is i	from com	munity ł	neating	
5. Int	ernal g	ains (see	e Table	5 and 5	a):	,							,	Ū	
Metabo	olic gair	e (Table	5) Wa	otte											
Melan	Jiic gaii Jan		<u> </u>	Anr	May	Γ.	lun	Jul	Αυσ	Sep	Oct	Nov	Dec]	
(66)m=	86.72	86.72	86.72	86.72	86.72	8	6.72	86.72	86.72	86.72	86.72	86.72	86.72		(66)
Lightin	a agine	(calcula	ted in A	nnendiv		ion		· ()a) a		Table 5				J	
(67)m=	9 9an 3 14 74	13.09	10.65			5		55	7 14	9 59	12 17	14 21	15 15	1	(67)
(or)iii								12 or 1	20) 04		hlo 5	14.21	10.10	J	()
Applia	10es ga							112 00 L I	5a), ais			124 49	144.46	1	(68)
(00)11=		152.7	140.74	140.33	129.71		9.73	113.00	111.48	<u> </u>	123.00	134.40	144.40	J	(00)
Cookin	g gains		ated in A		k L, equa	tion	L15	or L15a)), also s) 5	04.07	04.07	1	(00)
(69)m=	31.67	31.67	31.67	31.67	31.67	3	1.67	31.67	31.67	31.67	31.67	31.67	31.67	J	(69)
Pumps	and fa	ns gains T	(Table	5a)							1	1	1	1	
(70)m=	0	0	0	0	0		0	0	0	0	0	0	0	J	(70)
Losses	s e.g. e\	/aporatic	on (nega	ative val	ues) (Tab	le 5	5)			-					
(71)m=	-69.37	-69.37	-69.37	-69.37	-69.37	-6	9.37	-69.37	-69.37	-69.37	-69.37	-69.37	-69.37	J	(71)
Water	heating	gains (T	able 5									_			
(72)m=	103.97	102.23	98.62	93.7	90.51	8	6.01	82.19	87.09	88.83	93.92	99.66	102.24		(72)
Total i	nternal	gains =	•				(66)	m + (67)m	ı + (68)m	+ (69)m +	(70)m + (71)m + (72))m	_	
(73)m=	318.86	317.04	307.02	291.11	275.26	25	9.85	249.77	254.74	262.88	278.96	297.37	310.86		(73)
6. Sol	ar gain	s:													
Solar g	ains are o	calculated	using sol	ar flux froi	n Table 6a	and	associ	ated equa	tions to o	convert to th	ne applica	ble orientat	tion.		
Orienta	ation: /	Access F	actor	Are	а		Flu	X		g_	_	FF		Gains	
	_	able 60				_	Tac	ble 6a		Table 6b		able 6c		(vv)	_
Southea	ast <mark>0.9x</mark>	0.77	1	x 2	.88	x	3	6.79	x	0.3	x	0.7	=	15.42	(77)
Southea	ast <mark>0.9x</mark>	0.77	2	K 1	.86	x [3	6.79	x	0.3	×	0.7	=	19.92	(77)
Southea	ast <mark>0.9x</mark>	0.77		x 2	.88	× [6	2.67	x	0.3	×	0.7	=	26.27	(77)
Southea	ast <mark>0.9x</mark>	0.77	2	K _ 1	.86	x [6	2.67	x	0.3	x	0.7	=	33.93	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	× 2	.88	× [8	5.75	x	0.3	×	0.7	=	35.94	(77)

Southea	ast <mark>0.9x</mark>	0.77	;	ĸ	1.8	6	x	8	5.75	×	C).3] × [0.7		= [46.42	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	<	2.8	8	x	1	06.25	x	C).3		0.7		= [44.53	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	(1.80	6	x	1	06.25	x	C).3		0.7		= [57.52	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	<	2.8	8	x	1	19.01	x	C).3		0.7		= [49.88	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	(1.8	6	x	1	19.01	×	C).3	Ī×Ī	0.7		= [64.43	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	<	2.8	8	x	1	18.15	x	C).3] × [0.7		= [49.52	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	<	1.8	6	x	1	18.15	×	C).3] × [0.7		= [63.96	(77)
Southea	ast <mark>0.9x</mark> [0.77	;	<	2.8	8	x	1	13.91	x	C).3] × [0.7		= [47.74	(77)
Southea	ast <mark>0.9x</mark>	0.77	2	ĸ	1.8	6	x	1	13.91	x	C).3	x	0.7		= [61.67	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	ĸ	2.8	В	x	1	04.39	x	C).3	x	0.7		= [43.75	(77)
Southea	ast <mark>0.9x</mark>	0.77	3	ĸ	1.8	6	x	1	04.39	x	C).3] × [0.7		= [56.51	(77)
Southea	ast <mark>0.9x</mark>	0.77	3	ĸ	2.8	8	x	g	2.85	×	C).3] × [0.7		= [38.92	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	<	1.8	6	x	g	2.85	x	C).3] × [0.7		= [50.27	(77)
Southea	ast <mark>0.9x</mark> [0.77	;	<	2.8	8	x	6	9.27	x	C).3] × [0.7		= [29.03	(77)
Southea	ast <mark>0.9x</mark>	0.77	3	ĸ	1.8	6	x	6	9.27	×	C).3] × [0.7		= [37.5	(77)
Southea	ast <mark>0.9x</mark>	0.77	3	ĸ	2.8	В	x	4	4.07	x	C).3	x	0.7		= [18.47	(77)
Southea	ast <mark>0.9x</mark>	0.77	2	ĸ	1.8	6	x	4	4.07	x	C).3	×	0.7		= [23.86	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	ĸ	2.8	В	x	3	31.49	x	C).3	x	0.7		= [13.2	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	ĸ	1.8	ô	x	3	31.49	x	C).3	_ × [0.7		= [17.05	(77)
Solar g	ains in	watts, ca	alculate	d	for each	n mont	th		·	(83)m	n = Sum	(74)m	.(82)m		-			
(83)m=	35.34	60.2	82.37		102.05	114.31	1 1	113.48	109.41	100	.27 8	9.18	66.53	42.33	30.:	24		(83)
l otal g	ains – i	nternal a	and sola	ar ((84)m =	(73)m	ו + (_ ד ב	(83)m	, watts			<u> </u>						(2.4)
(84)m=	354.2	377.23	389.39		393.16	389.57	7 3	373.33	359.18	355	.01 3	52.06	345.5	339.7	341	.11		(84)
7. Me	an inter	rnal temp	perature	e (I	heating	seaso	on)									_		
Temp	erature	during h	neating	ре	eriods in	the liv	ving	area	from Tab	ole 9	, Th1 (°C)					21	(85)
Utilisa	ation fac	ctor for g	ains for	· liv	ving are	a, h1,	m (s	see Ta	ble 9a)						-			
	Jan	Feb	Mar	4	Apr	May	/	Jun	Jul	A	ug	Sep	Oct	Nov	D	ec		
(86)m=	1	0.99	0.99		0.97	0.92		0.78	0.6	0.6	63 (0.84	0.97	0.99	1			(86)
Mean	interna	al temper	ature ir	ı li	ving are	a T1 ((follo	ow ste	ps 3 to 7	7 in T	able 9)c)						
(87)m=	20.07	20.17	20.34		20.57	20.79	:	20.95	20.99	20.	99 2	20.91	20.64	20.32	20.	04		(87)
Temp	erature	during h	neating	ре	eriods in	rest c	of dv	velling	from Ta	able 9	9, Th2	(°C)						
(88)m=	20.09	20.09	20.1		20.1	20.1		20.11	20.11	20.	.11 2	20.11	20.1	20.1	20	.1		(88)
Utilisa	ation fac	ctor for g	ains for	· re	est of dv	velling	, h2	2,m (se	e Table	9a)								
(89)m=	0.99	0.99	0.98	Τ	0.96	0.88		0.7	0.48	0.5	52 (0.78	0.95	0.99	1			(89)
Mean	interna	al temper	ature ir	n tł	he rest o	of dwe	llinc	a T2 (f	ollow ste	eps 3	to 7 ir	n Table	e 9c)		•			
(90)m=	18.85	19	19.25	Ţ	19.59	19.89		20.07	20.1	20	1 2	20.03	19.69	19.22	18.	82		(90)

 $fLA = Living area \div (4) = 0.49$ (91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.44	19.57	19.78	20.06	20.33	20.49	20.53	20.53	20.46	20.15	19.75	19.41	(9
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----

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

(93)m=	19.44	19.57	19.78	20.06	20.33	20.49	20.53	20.53	20.46	20.15	19.75	19.41		(93)
8. Sp	ace hea	ting requ	uirement											
Set T the ut	i to the r tilisation	mean int factor fo	ernal ter or gains	mperatui using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m and	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.98	0.96	0.89	0.74	0.54	0.57	0.81	0.95	0.99	0.99		(94)
Usefu	ıl gains,	hmGm ,	, W = (94	4)m x (84	4)m									
(95)m=	351.88	373.33	381.97	376.45	348.02	274.75	193.81	202.41	283.82	329.1	335.34	339.28		(95)
Mont	nly avera	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	770.11	744.81	673.39	562.09	433.78	294.56	196.61	206.27	318.46	480.41	637.86	769.15		(97)
Spac	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m=	311.17	249.64	216.81	133.67	63.81	0	0	0	0	112.57	217.82	319.82		1
								Tota	l per year	(kWh/year	[.]) = Sum(98	8) _{15,912} =	1625.31	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								31.56	(99)
9b. En	ergy rec	luiremer	nts – Coi	mmunity	heating	scheme								-
This pa	art is use	ed for sp	ace hea	iting, spa	ace cooli	ng or wa	ater hea	ting prov	ided by	a comm	unity sch	neme.		1
Fractio	on of spa	ace heat	from se	condary	/supplen	nentary l	neating	(Table 1'	1) '0' if n	one			0	(301)
Fractic	on of spa	ace heat	from co	mmunity	system	1 – (301	1) =						1	(302)
The con	nmunity so	cheme mag	y obtain he	eat from se	everal sour	rces. The p	procedure	allows for	CHP and u	up to four (other heat	sources; tl	he latter	
Fractic	boilers, h	eat pumps at from C	s, geotheri Commun	nal and wa ity heat i	aste heat fi numn	rom powei	r stations.	See Apper	ndıx C.				1	(303a)
Fractic	on of tota	al space	heat fro	m Comn	nunity he	eat pump	0			(3	02) x (303a	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commi	unity hea	iting sys	tem			1	(305)
Distrib	ution los	s factor	(Table 1	l2c) for c	òmmun	ity heatir	ng syste	m	0 ,				1.05	(306)
Space	heating	a										I	kWh/vear	1
Annua	l space	heating	requiren	nent									1625.31]
Space	heat fro	om Comr	nunity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) =	=	1706.57	(307a)
Efficie	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	require	ment fro	m secon	dary/sup	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water Annua	heating I water h	j neating r	eauirem	ent									1722.88	1
If DHV Water	/ from contract from the state of the state	ommunii m Comn	ty schen nunity he	ne: eat pumr	0				(64) x (3()3a) x (30	5) x (306) =	=	1809.02] (310a)
Electri	city user	d for hea	at distrib	ution	-			0.01	× [(307a)	(307e) +	(310a) (310e)] =	35.16	(313)
Coolin	g Syster	n Enera	v Efficie	ncv Ratio	D					</td <td>,</td> <td>- 74</td> <td>0</td> <td>) (314)</td>	,	- 74	0) (314)
Space	coolina	(if there	is a fixe	d coolin	g svsterr	n, if not e	enter 0)		= (107) ÷	(314) =			0) (315)
Electri	city for n	oumps a	nd fans v	within dv	velling (1	Table 4f)	:		. ,			l	-] , ,
mecha	inical ve	ntilation	- balanc	ed, extra	act or po	sitive in	put from	outside					0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/ye	ear	=(330a) + (330b)) + (330g) =		0	(331)
Energy for lighting (calculated in App	endix L)				260.28	(332)
Total delivered energy for all uses (3	07) + (309) + (310	0) + (312) + (315) + (331) + (33	2)(237b) =		3775.88	(338)
12b. CO2 Emissions – Community h	eating scheme					
		Energy kWh/year	Emission facto kg CO2/kWh	or En kg	nissions CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)	d water heating (r If there i	not CHP) s CHP using two fuels repeat (363) to ((366) for the second	fuel	401	(367a)
CO2 associated with heat source 1		[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= [455.01	(367)
Electrical energy for heat distribution		[(313) x	0.52	= [18.25	(372)
Total CO2 associated with communit	y systems	(363)(366) + (368)(372)	= [473.26	(373)
CO2 associated with space heating (secondary)	(309) x	0	= [0	(374)
CO2 associated with water from imm	ersion heater or i	nstantaneous heater (312) x	0.52	= [0	(375)
Total CO2 associated with space and	d water heating	(373) + (374) + (375) =		[473.26	(376)
CO2 associated with electricity for pu	imps and fans wit	hin dwelling (331)) x	0.52	= [0	(378)
CO2 associated with electricity for lig	hting	(332))) x	0.52	= [135.09	(379)
Total CO2, kg/year	sum of (376)(3	82) =			608.34	(383)
Dwelling CO2 Emission Rate					11.81	(384)
El rating (section 14)					91.55	(385)

		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	Numl re Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property A	Address:	Kingsto	n Bridge	e 1BF MI	ID 52 AS	SHP	
Address :									
1. Overall dwelling dimer	nsions:	A	(100.2)			ark (ma)			
Ground floor		Area	a(m²)	1a) x			(2a) =	139.05] (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 5	51.5	4)			()	100.00	
Dwelling volume			, iii	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	139.05	(5)
2 Vontilation rate:							l],,
2. Ventilation rate.	main seco	ondary	other		total			m ³ per hour	
Number of chimneys	heating hea	oting +	0	= [0	x 4	40 =	0	(6a)
Number of open flues		0 +	0		0	x 2	20 =	0	(6b)
Number of intermittent far	່ <u>ເ</u>				1	x 1	0 =	10	(7a)
Number of passive vents					0	x 1	0 =	0	(7b)
Number of flueless gas fir	es				0	x 4	40 =	0	(7c)
							Air ch	anges per hou	
Infiltration due to chimmon	(a, f)	(6b)+(7c)+(7b)+(7	70) -						יי ר
Initiation due to chimney	S, IIUES and Ians = $(0a)$ +	$(00)^+(7a)^+(70)^+(7a)$	otherwise co	ntinue fra	om (0) to ((16)	+ (5) =		
Number of storevs in th	e dwelling (ns)),,,,(3),10 (10)		0	(9)
Additional infiltration	e arrennig (110)					[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber fra	me or 0.35 for	masonry	constru	uction			0	(11)
if both types of wall are pre	esent, use the value correspon	nding to the greate	er wall area	(after			-		-
If suspended wooden fl	oor, enter 0.2 (unsealed)) or 0.1 (seale	d), else e	enter 0				0	7(12)
If no draught lobby, ent	er 0.05. else enter 0		u), 0.00 c					0	(12)
Percentage of windows	and doors draught strip	ped						0	(14)
Window infiltration	0 11		0.25 - [0.2 >	k (14) ÷ 10	00] =			0	(15)
Infiltration rate			(8) + (10) +	(11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o	q50, expressed in cubic	metres per ho	ur per sq	uare me	etre of e	nvelope	area	4	(17)
If based on air permeabilit	ty value, then (18) = [(17) ÷	+ 20]+(8), otherwis	se (18) = (1	6)				0.27	(18)
Air permeability value applies	if a pressurisation test has be	een done or a deg	ree air perr	neability i	s being us	sed			-
Number of sides sheltered	1		(20) = 1 - [0) 075 x (1	9)1 =			2	(19)
Infiltration rate incorporati	ng shaltar factor		(20) = (18)	x (20) =	0)]		l	0.85	$\int_{(20)}$
Infiltration rate modified for	r monthly wind anood		(21) - (10)	x (20) -			l	0.23	(21)
			Δυα	Son	Oct	Nov	Dec		
	ad from Table 7		Aug [Sep	001	INOV	Dec		
$(22)m = \begin{bmatrix} 51 \\ 51 \end{bmatrix} = \begin{bmatrix} 51 \\ 5 \end{bmatrix}$		38 38	37	4	43	45	47		
(22)III ⁻ 3.1 3 4	T.U T.H 4.0	0.0 0.0	3.1	4	4.5	7.0	7.1		
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		

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Adjuste	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_		
Calculate effective air change rate for the applicable case 0 (Za) If mechanical ventilation: 0 (Za) If balanced mechanical ventilation with heat recovery (MVH) (24b)m = (22b)m + (23b) × [1 - (23c) + 100] 0 0 (Za) 0 0 0 0 0 0 (Za) 0 0 0 0 0 0 0 (Za) 0 0 0 0 0 0 0 0 (Za) 0 0 0 0 0 0 0 0 0 0 (Za) 0		0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Calcula	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-				·			
$ \begin{array}{c} 1 classical and map pump regressive (add) (2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2$	lf ovb				ondix N (2	(25) = (22)	$) \times Emy (c$	oquation (nvico (23h) = (23a)			0	(23a)	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	If bala	aust all th	boot roce	wory: offic		.50) – (258	or in uso f	actor (fron	n Table 4b) –) = (238)			0	(230)	
(a) to balanced mechanical verification with real recovery (MV) (24a) m = (22b) m + (23b) (24a) m (24b) m 0		holonoo	d moob) = (2)	Dh)m ⊥ (00h) v [1 (02a)	0	(23c)	
$ \begin{array}{c} \text{ch} \text{(2 b)} & \text{(2 b)}$	a) II									a)ni – (24 1 o	$\frac{20}{10}$	230) × [1 - (230)	 	(24a)	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	(24a)II-		d moob				hoot roo			$\frac{1}{2}$	$\frac{1}{2}$	22h)	0		(210)	
$ \begin{array}{c} [24] \\ (24] \\ (24] \\ (24] \\ (26] \\ ($	D) II								VIV) (240 1	m = (22)	2) + m(a2	230)		1	(24b)	
	(240)III-										0	0	0		(240)	
	i c) ii	if (22b)n	ouse ex 1 < 0.5 ×	(23b), i	then (24)	c) = (23b); otherv	ventilatic wise (24	c) = (22t	o) m + 0.	.5 × (23b))				
d) If natural ventilation or whole house positive input ventilation from loft If (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m ² x 0.5] (24d)m = 0.54 0.54 0.53 0.53 0.53 0.52 0.52 0.53 0.53 0.53 0.54 (24d) Effective air change rate - enter (24a) or (24b) or (24c) or (24c) hox (25) 3. Heat losses and heat loss parameter: ELEMENT Gross Openings Net Area U-value A X U K kJ/m ² -K kJ/K Windows Type 1 2, 2.88 $x/[1/1(12) + 0.04] = 3.3$ (27) Windows Type 1 2, 2.88 $x/[1/1(12) + 0.04] = 2.13$ (27) Windows Type 1 2, 2.88 $x/[1/1(12) + 0.04] = 2.13$ (27) Walls 6.6 24.15 \times 0.18 $= 4.35$ (29) Total area of elements, m ² 30.75 (31) Party wall 53.34 \times 0 $=$ 0 (32) Party ceiling 51.1 (32a) Party ceiling 51.1 (32a) Party ceiling 51.1 (32a) For windows use effective window U-value calculated using formula 1/[1/U-value)+0.04] as given in paragraph 3.2 * include the areas on both sides of internal wells and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (11.9 (33)) Heat capacity Cm = S(A x k) (28)(30) + (32) + (32a)(32e) = (11.9 (33)) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 area to abacised of a detailed calculated using Appendix K (33) + (46) = (51.0 (37)) Ventilation heat loss calculated using Appendix K (33) + (46) = (50.4 (37)) Ventilation heat loss calculated monthly (38) = 0.05 x (31) Total fabric heat loss (26) The Cm + TFA) in kJ/m ² K indicative values of TMP in Table 11 and the set of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K (33) + (46) = (50.4 (37)) Ventilation heat loss calculated monthly (38)m = 0.33 x (25) m (5) Ventilation heat loss calculated monthly (38)m = 0.33 x (25) m (37) Ventilation heat loss 0.4 (34) <u>A Apr May Jun Jul Aug Sep Oct Nov Dec</u> (39)m = (37) + (39)m (39) 4 39.4 39.48 (39) 6 (39) 4 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39.04 39	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)	
	d) lf i	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	nole hous)m = (221	se positiv b)m othe	/e input erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]			-		
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25) (25) 0.54 0.54 0.53 0.53 0.52 0.52 0.53	(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(24d)	
$ \begin{array}{c c} (25)m^{2} & 0.54 & 0.54 & 0.54 & 0.53 & 0.53 & 0.52 & 0.52 & 0.52 & 0.53 & 0.53 & 0.53 & 0.54 \\ \hline \textbf{3. Heat losses and heat loss parameter:} \\ \hline \textbf{ELEMENT} & Gross \\ area (m^{2}) & Met Area \\ area (m^{2}) & Met Area \\ A, m^{2} & VI(11(12) + 0.04] = & 3.3 & (27) \\ \hline \textbf{Windows Type 1} & 2.88 & x1(11(12) + 0.04] = & 3.3 & (27) \\ \hline \textbf{Windows Type 2} & 1.86 & x1(11(12) + 0.04] = & 2.13 & (27) \\ \hline \textbf{Windows Type 2} & 1.86 & x1(11(12) + 0.04] = & 2.13 & (27) \\ \hline \textbf{Walls} & \hline \textbf{6.6} & 24.15 & x & 0.18 & = & 4.35 & (29) \\ \hline \textbf{Total area of elements, m^{2}} & 30.75 & (31) \\ \hline \textbf{Total area of elements, m^{2}} & 30.75 & (31) \\ \hline \textbf{Party wall} & 53.34 & x & 0 & = & 0 & (32) \\ \hline \textbf{Party wall} & 53.34 & x & 0 & = & 0 & (32) \\ \hline \textbf{Party wall} & 51.5 & (32) & (32) \\ \hline \textbf{Party wall} & 51.5 & (32) & (32) \\ \hline \textbf{Party ceiling} & 51.1 & (28)(30) + (32) = & (1.9 & (33) \\ \hline \textbf{Heat capacity Cm = S(A \times K) & (26)(30) + (32) = & (1.9 & (33) \\ \hline \textbf{Heat capacity Cm = S(A \times K) & (26)(30) + (32) = & (1.9 & (33) \\ \hline \textbf{For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 \\ \hline \textbf{Can be used instead of a detailed calculated using Appendix K & (33) + (36) = & (15.04 & (37) \\ \hline \textbf{Ventilation heat loss calculated monthly & (39)m = 0.33 \times (25)m \times (5) \\ \hline \textbf{Wentilation heat loss calculated monthly & (39)m = 0.33 \times (25)m \times (5) \\ \hline \textbf{Wentilation heat loss calculated monthly & (39)m = (37) + (38)m \\ \hline \textbf{(39)m} = & \frac{39.83 & 39.47 & 39.4 & 39.04 & 39.04 & 39.04 & 39.04 & 39.04 & 39.04 \\ \hline \textbf{(39)m} = & (39.98 & 39.9, 39.83 & 39.47 & 39.4 & 39.09 & 39.04 & 39.04 & 39.04 & 39.44 & 28.47 \\ \hline \textbf{(29)}$	Effe	ctive air	change	rate - ei	nter (24a	ı) or (24t	o) or (24	c) or (24	d) in boy	x (25)				4		
3. Heat losses and heat loss parameter: ELEMENT Gross area (m ²) Openings Met Area A, m ² U-value W/m2K A X U (W/K) K-value KJ/m ² -K A X k KJ/K Windows Type 1 2.88 x1/11/(12)*0.04] = 3.3 (27) Windows Type 2 1.86 x1/11/(12)*0.04] = 2.13 (27) Windows Type 2 1.86 x1/11/(12)*0.04] = 2.13 (27) Windows Type 2 1.86 x1/11/(12)*0.04] = 2.13 (27) Windows Type 2 1.86 x1/11/(12)*0.04] = 2.13 (27) Windows Type 2 1.86 x1/11/(12)*0.04] = 2.13 (27) Windows and read elements, m ² 30.75 (31) Party colspan="2" (32) Party colspan="2" 11/2 (32) (32) (32) <th col<="" td=""><td>(25)m=</td><td>0.54</td><td>0.54</td><td>0.54</td><td>0.53</td><td>0.53</td><td>0.52</td><td>0.52</td><td>0.52</td><td>0.53</td><td>0.53</td><td>0.53</td><td>0.54</td><td></td><td>(25)</td></th>	<td>(25)m=</td> <td>0.54</td> <td>0.54</td> <td>0.54</td> <td>0.53</td> <td>0.53</td> <td>0.52</td> <td>0.52</td> <td>0.52</td> <td>0.53</td> <td>0.53</td> <td>0.53</td> <td>0.54</td> <td></td> <td>(25)</td>	(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(25)
ELEMENTGross area (m²)Openings m²Net Area A,m²U-value W/m2KA X U (W/K)k-value kJ/m²-KA X k kJ/kWindows Type 12.88 2.88 x1f1(1(1.2)+0.04] =3.3 3.3(27)Windows Type 21.86 5.624.15 2.13(27)Walls6.624.15 2.13 0.18 2.13(27)Walls6.624.15 2.13(31)Party wall53.34 2.1500Party wall53.34 2.1100Party gloor51.50(32)Party floor51.50(32)* include the areas on both sides of internal walls and partitions(26)(30) + (32) =11.9Fabric heat loss, W/K = S (A x U)(26)(30) + (32) =11.9(33)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) =11.745.9(34)Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium250(35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.3.14(36)Thermal bridges : S (L X Y) calculated using Appendix K3.14(36)3.14(36)if details of thermal walls(31) + (32) =15.04(37)Ventilation heat loss(24.97)(24.9424.86(47.78)(36)(38)m = 0.33 × (25)m x (5)(36)m = (37) + (38)m(38)m = (37) + (38)m(38)m(39)m = 39.839.9.339.4.	3 He	at losse	s and he	eat loss	paramet	er:										
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Walls $\begin{array}{c c c c c c c c c c c c c c c c c c c $	Window	ws Type	2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)	
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* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 11.9 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 11745.9 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K (31) + (36) = 15.04 (37) Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5) Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5) (38)m = 24.94 24.86 24.78 24.43 24.36 24.05 24.05 23.99 24.17 24.36 24.49 24.64 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 39.98 39.9 39.83 39.47 39.4 39.09 39.09 39.04 39.21 39.4 39.54 39.68 Average = Sum(39), p/12 39.47 (39)	Party c	ceiling					51.1					[╡ 	(32b)	
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Heat capacity $Cm = S(A \times k)$ $((28)(30) + (32) + (32a)(32e) =$ 11745.9 (34) Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m²KIndicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1fcan be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K(33) + (36) =(15.04(37)Total fabric heat loss(38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (38) m = $0.33 \times (25)m \times (5)$ (39) m = $(37) + (38)m$ (39) m = $(37) + (38)m$ (39) m = $(39.4) \times (99.4) \times ($	Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				11.9	(33)	
Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium 250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K(33) + (36) =15.04(33) + (36) =15.04(33) + (36) =(15.04(33) + (36) =(15.04(33) + (36) =(15.04(33) + (36) =(15.04(37)Ventilation heat loss calculated monthly(38)m = $0.33 \times (25)m \times (5)$ (38)m = 24.94 (24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(24.94(39)m = (37) + (38)m(39)m = (39.91) (39.91)(29.94)(29.94)(29.94)(29.94)(29.94)(29.94)(29.94)(29.94) <td colspa<="" td=""><td>Heat c</td><td>apacity</td><td>Cm = S(</td><td>(Axk)</td><td></td><td></td><td></td><td></td><td></td><td>((28)</td><td>(30) + (32</td><td>2) + (32a).</td><td>(32e) =</td><td>11745.9</td><td>(34)</td></td>	<td>Heat c</td> <td>apacity</td> <td>Cm = S(</td> <td>(Axk)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>((28)</td> <td>(30) + (32</td> <td>2) + (32a).</td> <td>(32e) =</td> <td>11745.9</td> <td>(34)</td>	Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	11745.9	(34)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss (33) + (36) = (33) + (36) = (15.04) (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = 24.94 24.86 24.78 24.43 24.36 24.05 24.05 23.99 24.17 24.36 24.49 24.64 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = 39.98 39.9 39.83 39.47 39.4 39.09 39.09 39.04 39.21 39.4 39.54 39.68 Average = Sum(39), $\nu/12$ 39.47 (39)	Therm	al mass	parame	ter (TMI	P = Cm -	⊦ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)	
Thermal bridges : S (L x Y) calculated using Appendix K 3.14 (36) if details of thermal bridging are not known (36) = $0.05 \times (31)$ (33) + (36) = 15.04 (37) Total fabric heat loss (33) + (36) = (15.04 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = $0.33 \times (25)m \times (5)$ (38)m = (38)m = (37) (38)m= Z4.94 Z4.86 Z4.78 Z4.43 Z4.36 Z4.05 Z3.99 Z4.17 Z4.36 Z4.49 Z4.64 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (39.98) 39.9 39.47 39.4 39.09 39.04 39.21 39.4 39.54 39.68 Average = Sum(39), $12/(22)$ 39.47 (39)	For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the culation.	construct	ion are not	t known pr	recisely the	e indicative	e values of	TMP in T	able 1f			
if details of thermal bridging are not known $(36) = 0.05 \times (31)$ Total fabric heat loss Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = 24.94 24.86 24.78 24.43 24.36 24.05 24.05 23.99 24.17 24.36 24.49 24.64 (38)m = (37) + (38)m Heat transfer coefficient, W/K (39)m = 39.98 39.9 39.83 39.47 39.4 39.09 39.09 39.04 39.21 39.4 39.54 39.68 Average = Sum(39), $\frac{12}{12}$ 39.47 (39)	Therm	al bridge	es : S (L	x Y) cal	lculated	using Ap	pendix ł	<						3.14	(36)	
I otal fabric heat loss $(33) + (36) =$ 15.04 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 24.94 24.86 24.78 24.43 24.36 24.05 23.99 24.17 24.36 24.49 24.64 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (37) + (38)m (39)m = (37) + (38)m (39)m = (39.98 39.93 39.47 39.4 39.09 39.04 39.21 39.4 39.54 39.68	if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)									
Ventulation neat IOSS calculated monthly (38) m = $0.33 \times (25) \text{m x (5)}$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 24.94 24.86 24.78 24.43 24.36 24.05 23.99 24.17 24.36 24.49 24.64 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m= 39.98 39.9 39.47 39.4 39.09 39.04 39.21 39.4 39.54 39.68 Average = Sum(39) (39)		abric he	at Ioss	-111	al					(33) +	(36) =	(OF) (=		15.04	(37)	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Ventila	ition hea			d monthly	y L Maria	L	1.1	A	(38)m	= 0.33 × (25)m x (5)	1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(38)m-	Jan 24.04	+eb	Mar	Apr	May 24.36	Jun 24.05	JUI 24.05	Aug	24.17	24.36	NOV	24.64		(38)	
Theat transfer coefficient, VV/K $(39)m = (37) + (38)m$ (39)m= 39.98 39.9 39.47 39.4 39.09 39.04 39.21 39.4 39.54 39.68 Average = Sum(39), $12/12 = 39.47$		27.34	27.00		27.43	27.00	27.00	24.05	20.00	(00)	_ (07) : (27.43	27.04	l	(00)	
$\frac{(39)}{10} = \frac{39.50}{39.50} = \frac{39.63}{39.60} = \frac{39.47}{39.4} = \frac{39.09}{39.09} = \frac{39.04}{39.04} = \frac{39.21}{39.4} = \frac{39.54}{39.54} = \frac{39.66}{39.50} = \frac{39.47}{39.4} = \frac$				11, VV/K	30.47	20.4	30.00	30.00	30.04	(39)m	= (37) + (3	38)m	30.69	1		
	(39)11-	39.90	39.9	39.03	39.47	39.4	39.09	39.09	39.04	39.21	Average =	Sum(39)	12 /12=	39 47	(39)	

Heat lo	oss para	ımeter (I	HLP), W	/m²K					(40)m	= (39)m ÷	• (4)			
(40)m=	0.78	0.77	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.77	0.77	0.77		
Numb	er of day	ı /s in mo	nth (Tab	le 1a)		1	1	1	,	Average =	Sum(40)1	12 /12=	0.77	(40)
- turno	Jan	Feb	Mar	Apr	May	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														~ /
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned occu A > 13. A £ 13.	upancy, 9, N = 1 9, N = 1	N + 1.76 x	(1 - exp)(-0.0003	349 x (TF	⁻ A -13.9)2)] + 0.(0013 x (⁻	TFA -13.	1. .9)	73		(42)
Annua Reduce not mor	l averag the annua e that 125	je hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	75 f	5.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
Energy	content of	hot water	used - ca	lculated m	onthly = 4.	190 x Vd,ı	m x nm x [OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	904.68	(44)
(45)m=	122.98	107.56	110.99	96.77	92.85	80.12	74.24	85.2	86.21	100.47	109.68	119.1		
lf instan	taneous v	/ater heati	ng at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =		1186.18	(45)
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water	storage	loss:					1				·			
Storag	je volum	e (litres)) includir	ng any se	olar or W	WHRS	storage	within sa	ame ves	sel		180		(47)
If com	munity h	eating a	and no ta	ank in dw ar (this ir	velling, e	enter 110 netantar) litres in	i (47) ombi boil	ore) onto	ər '()' in <i>(</i>	(17)			
Water	storage	loss:	not wate	51 (1115 11	iciuues i	nstanta			ers) erit		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
a) If m	nanufact	urer's d	eclared l	oss fact	or is kno	wn (kWł	n/day):				1	.2		(48)
Tempe	erature f	actor fro	m Table	2b							0	.6		(49)
Energy	y lost fro	m wate	r storage	e, kWh/y	ear			(48) x (49)) =		0.	.72		(50)
b) If m	nanufact	urer's d	eclared	cylinder	loss fact	or is not	known:							
Hot wa	ater stor	age loss	actor fi	rom lab	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a	011 4.5								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Enera	v lost fro	om watei	r storage	. kWh/v	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (55)	, ,							0.	.72		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylind	er contain	s dedicate	d solar sto	rage, (57)	n = (56)m	x [(50) – (I [H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	lculated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				-	
(mo	dified by	tactor f	rom Fab	IE H5 if t	inere is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)	00.07	l	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	lculated	for eac	h month	(61)m =	(60) ÷	365 × (41)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	neating c	alculated	for e	ach month	(62)m	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	168.56	148.73	156.58	140.88	138.43	124.2	119.83	130.78	130.33	146.06	153.79	164.68		(62)
Solar DH	W input	calculated	using Ap	pendix G o	r Appendix	H (ne	ative quantit	y) (enter '	0' if no sola	ar contribu	tion to wate	er heating)	•	
(add ad	dditiona	I lines if	FGHRS	S and/or V	WWHRS	appli	es, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter		-		-	-		-	-		-	
(64)m=	168.56	148.73	156.58	140.88	138.43	124.2	23 119.83	130.78	130.33	146.06	153.79	164.68		
		-			-		-	Ou	tput from w	ater heate	er (annual)₁	12	1722.88	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [O.	85 × (45)m	ı + (61)ı	m] + 0.8 :	x [(46)m	ı + (57)m	+ (59)m]	
(65)m=	77.36	68.7	73.37	67.46	67.34	61.9	3 61.15	64.79	63.96	69.87	71.76	76.07		(65)
inclu	de (57)	m in calo	ulation	of (65)m	only if c	ylinde	r is in the	dwelling	, g or hot w	/ater is f	rom com	munity ł	' neating	
5. Int	ernal q	ains (see	Table	5 and 5a):	-		-				-	-	
Metabo	olic gair	ns (Table	5) Wa	utts	,									
motabl	Jan	Feb	Mar	Apr	May	Ju	n Jul	Aug	Sep	Oct	Nov	Dec]	
(66)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		(66)
Lightin	g gains	(calcula	ted in A		L. equati	ion L§) or L9a), a	lso see	Table 5	1			1	
(67)m=	14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15	1	(67)
Appliar	ices da	ins (calc	ulated i	n Appen	l dixlea	uatior	 1 13 or 1	i 3a) als	o see Ta	ble 5	<u> </u>		1	
(68)m=	151.13	152.7	148.74	140.33	129.71	119.7	/3 113.06	111.49	115.45	123.86	134.48	144.46]	(68)
Cookin	a aains	L (calcula	L Ited in A	L Appendix	L equat	ion L	15 or I 15a) also s	L See Table	ـــــــــــــــــــــــــــــــــــــ			1	
(69)m=	31.67	31.67	31.67	31.67	31.67	31.6	7 31.67	31.67	31.67	31.67	31.67	31.67	1	(69)
Pumps	and fa	l ne gaine	(Table	52)									I	
(70)m=					0	0	0	0	0	0	0	0	1	(70)
		l /anoratio		 ativo valu	les) (Tab	<u> </u>		, ,				Ĵ	1	
(71)m=	-69.37	-69 37	-69.37	-69.37	-69 37	-69.3	7 -69.37	-69.37	-69.37	-69.37	-69 37	-69.37	1	(71)
Wator	booting			00.07	00.07	00.0	00.07	00.07	00.07	00.07	00.07	00.07	l	(***)
	103.07			03.7	00.51	86.0	1 82.10	87.00	00.02	03.02	00.66	102.24	1	(72)
(72)III-	100.97	102.23	30.02	33.7	30.51	00.0	$66)m \pm (67)n$	07.03	+ (60)m +	(70)m + (1)	71)m + (72)	102.24	J	(12)
	210.06	gains =	207.02	201 11	275.26	250.0	00)III + (07)II				207.27	210.96	1	(73)
(73)III-	310.00	317.04	307.02	291.11	275.20	259.0	249.77	204.74	202.00	278.90	297.37	310.60		(13)
Solar d	ains are i	s. calculated	usina soli	ar flux from	Table 6a a	and as	sociated equa	ations to c	convert to th	ne applica	ble orientat	ion		
Orienta	ation:	Access F	actor	Area			-lux		a		FF		Gains	
onona	-	Table 6d	40101	m²		-	Table 6a		9_ Table 6b	٦	able 6c		(W)	
Southea	ast <u>o 9x</u>	0.77			88	×	36 79	1 x [0.63	┐ _×	0.7		32.38	7(77)
Southea	ast 0,9x	0.77	=	(1	86	×	36 79		0.63		0.7		41.83](77)
Southea	ast <u>o av</u> [0.77	(88		62.67		0.00		0.7		55 16](77)
Souther	ast n ov	0.77	\dashv		86	x L	62.67		0.03	╡ᆠ┟	0.7		71.25	ן (דדי
Souther	asto ov [0.77	╡(° ∟ √ ┌	95.75	」 ^ L 1 ↓ F	0.00	╡ᆠ┟	0.7		75.40	J('')](77)
000000		0.77	^	×	00	^	65.75		0.05	^	0.7		75.46	(11)

Southea	st 0.9x	0.77	x		1.86	x	8	5.75	×	0.63	x	0.7		=	97.49	(77)
Southea	st 0.9x	0.77	x		2.88	×	1	06.25	x	0.63	x	0.7		=	93.52	(77)
Southea	st <mark>0.9x</mark>	0.77	x	Γ	1.86	×	1	06.25	x	0.63	×	0.7		=	120.8	(77)
Southea	st 0.9x	0.77	x	Γ	2.88	×	1	19.01	x	0.63	×	0.7		=	104.75	(77)
Southea	st <mark>0.9x</mark>	0.77	x	Γ	1.86	×	1	19.01	x	0.63	×	0.7		=	135.3	(77)
Southea	st <mark>0.9x</mark>	0.77	x	Г	2.88	×	1	18.15	x	0.63	×	0.7		=	103.99	(77)
Southea	st 0.9x	0.77	x	Γ	1.86	×	1	18.15	x	0.63	×	0.7		=	134.32	(77)
Southea	st <mark>0.9x</mark>	0.77	x	Γ	2.88	×	1	13.91	x	0.63	×	0.7		=	100.26	(77)
Southea	st <mark>0.9x</mark>	0.77	x	Γ	1.86	×	1	13.91	x	0.63	×	0.7		=	129.5	(77)
Southea	st <mark>0.9x</mark>	0.77	×		2.88) ×	1	04.39	x	0.63	×	0.7		=	91.88	(77)
Southea	st <mark>0.9x</mark>	0.77	x		1.86	×	1	04.39	x	0.63	×	0.7		=	118.68	(77)
Southea	st 0.9x	0.77	x		2.88	×	9	2.85	x	0.63	x	0.7		=	81.73	(77)
Southea	st <mark>0.9x</mark>	0.77	x		1.86	×	9	2.85	x	0.63	x	0.7		=	105.56	(77)
Southea	st <mark>0.9x</mark>	0.77	x		2.88	×	6	9.27	x	0.63	x	0.7		=	60.97	(77)
Southea	st <mark>0.9x</mark>	0.77	x		1.86	×	6	9.27	x	0.63	x	0.7		=	78.75	(77)
Southea	st <mark>0.9x</mark>	0.77	x		2.88	×	4	4.07	x	0.63	x	0.7		=	38.79	(77)
Southea	st <mark>0.9x</mark>	0.77	x		1.86	×	4	4.07	x	0.63	x	0.7		=	50.1	(77)
Southea	st 0.9x	0.77	x		2.88	×	3	1.49	x	0.63	x	0.7		=	27.71	(77)
Southea	st <mark>0.9x</mark>	0.77	x		1.86	×	3	1.49	x	0.63	×	0.7		=	35.8	(77)
Solar o	aine in i	watte ca	lculater	1 for	r each mon	- th			(83)m	u = Sum(74)m	(82)r					
(83)m=	74.21	126.42	172.97	21	4.31 240.0	5 2	238.31	229.76	210	.56 187.29	139.	72 88.89	63.5	1		(83)
Total ga	ains – iı	nternal a	nd sola	r (84	4)m = (73)r	n + ((83)m	, watts	I	I	1		1			
(84)m=	393.07	443.45	479.99	50	5.42 515.3	1 4	98.16	479.53	465	5.3 450.16	418.	386.26	374.3	38		(84)
7. Mea	an inter	nal temp	erature	(he	ating seas	on)_					•	·	•			
			on all all of	(110	annig oodio											

Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	Itilisation factor for gains for living area, h1,m (see Table 9a)													•
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.94	0.85	0.69	0.5	0.36	0.39	0.59	0.87	0.97	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	llow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	20.45	20.59	20.75	20.91	20.98	21	21	21	20.99	20.91	20.66	20.42		(87)

Temp	emperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												_
(88)m=	20.27	20.28	20.28	20.28	20.28	20.29	20.29	20.29	20.29	20.28	20.28	20.28	(88)
Utilisa	tilisation factor for gains for rest of dwelling, h2,m (see Table 9a)												
(89)m=	0.99	0.97	0.93	0.82	0.64	0.45	0.3	0.33	0.54	0.83	0.97	0.99	(89)
					<u> </u>	το (• • • •	•			'

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 19.56 19.75 19.98 20.18 20.27 20.29 20.29 20.28 20.19 19.86 19.51 (90)

fLA = Living area ÷ (4) =	0.49	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

								``	,				
(92)m=	19.99	20.16	20.35	20.53	20.61	20.63	20.63	20.63	20.63	20.54	20.25	19.95	(92)

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

(93)m=	19.99	20.16	20.35	20.53	20.61	20.63	20.63	20.63	20.63	20.54	20.25	19.95		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set T the ut	i to the r tilisation	mean int factor fo	ernal tei or gains	mperatui using Ta	re obtain able 9a	ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.33	0.36	0.56	0.84	0.96	0.99		(94)
Usefu	ul gains,	hmGm	, W = (94	4)m x (84	4)m		_							
(95)m=	387.27	429.09	444.85	419.39	343.33	235.21	157.66	165.22	253.93	353.6	372.7	370.18		(95)
Montl	hly avera	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	627.34	608.75	551.71	459.12	351.18	235.83	157.7	165.29	255.98	391.55	519.76	625.08		(97)
Spac	e heatin	g require	ement fo	or each n	nonth, k\	Nh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m=	178.61	120.73	79.5	28.61	5.84	0	0	0	0	28.23	105.88	189.65		1
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	737.06	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								14.31	(99)
9b. En	ergy rec	uiremer	nts – Coi	mmunity	heating	scheme	;							
This pa	art is use	ed for sp	ace hea	ating, spa	ace cooli	ng or wa	ater hea	ting prov	ided by	a comm	unity sch	neme.		1
Fractic	on of spa	ace heat	from se	condary	/supplen	nentary I	heating	(Table 1'	1) '0' if n	one			0	(301)
Fractic	on of spa	ace heat	from co	mmunity	y system	1 – (30′	1) =						1	(302)
The con	nmunity so	cheme mag	y obtain he	eat from se	everal sour	rces. The p	procedure	allows for	CHP and u	up to four (other heat	sources; ti	he latter	
Fractic	on of hea	eat pumps at from C	s, geotheri Commun	nal and wa	aste heat f pump	rom powei	r stations.	See Apper	ndix C.				1	(303a)
Fractic	on of tota	al space	heat fro	m Comn	nunity he	eat pump	C			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	g method	(Table 4	4c(3)) fo	r commı	unity hea	iting syst	tem			1	(305)
Distrib	ution los	s factor	(Table 1	12c) for o	commun	ity heatii	ng syste	m					1.05	(306)
Space	heating	9											kWh/year	
Annua	l space	heating	requiren	nent									737.06]
Space	heat fro	om Comr	nunity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) :	=	773.91	(307a)
Efficie	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space	heating	require	ment fro	m secon	dary/su	oplemen	tary syst	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water Annua	heating	j neating r	equirem	ient									1722.88	1
If DHV Water	V from contract from heat from the second se	ommunit m Comn	ty schen nunity he	ne: eat pumi	0				(64) x (30)3a) x (30	5) x (306) :	=	1809.02] (310a)
Electri	city used	d for hea	t distrib	ution				0.01	× [(307a).	(307e) +	(310a)(310e)] =	25.83] (313)
Coolin	g Syster	n Enera	y Efficie	ncy Rati	0					()	,	- 74	0] (314)
Space	cooling	(if there	is a fixe	ed cooling	g systen	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electri	city for p	oumps a	nd fans	within dv	velling (1	Table 4f)	:					l		J 7
mecha	inical ve	ntilation	- balanc	ced, extra	act or po	sitive in	put from	outside					0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year		=(330a) + (330	b) + (330g) =		0	(331)
Energy for lighting (calculated in Appen-	dix L)				260.28	(332)
Total delivered energy for all uses (307)	+ (309) + (310) +	(312) + (315) + (331) + (33	32)(237b) =	Γ	2843.22	(338)
12b. CO2 Emissions – Community heat	ing scheme					
		Energy kWh/year	Emission factors kg CO2/kWh	or Eı kç	nissions g CO2/year	
CO2 from other sources of space and w Efficiency of heat source 1 (%)	vater heating (not C If there is CH	CHP) P using two fuels repeat (363) to	(366) for the second	fuel	401	(367a)
CO2 associated with heat source 1	[(3	307b)+(310b)] x 100 ÷ (367b) x	0.52	=	334.3	(367)
Electrical energy for heat distribution		[(313) x	0.52	=	13.41	(372)
Total CO2 associated with community s	ystems	(363)(366) + (368)(372	2)	=	347.71	(373)
CO2 associated with space heating (see	condary)	(309) x	0	=	0	(374)
CO2 associated with water from immers	sion heater or insta	ntaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and w	ater heating	(373) + (374) + (375) =			347.71	(376)
CO2 associated with electricity for pump	os and fans within o	dwelling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighti	ng	(332))) x	0.52	=	135.09	(379)
Total CO2, kg/year	sum of (376)(382) =	:			482.79	(383)
Dwelling CO2 Emission Rate					9.37	(384)
El rating (section 14)					93.3	(385)

User Details:		
Assessor Name:Stroma Number:Software Name:Stroma FSAP 2012Software Version:Versio	n: 1.0.5.59	
Property Address: Kingston Bridge 1BF TOP 52 AS	HP	
Address :		
1. Overall dwelling dimensions:		
Ground floor 51.5 (1a) x 2.7 (2a) =		3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ [51.5] (4)	139.05	<i>54)</i>
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = [130.05 ((5)
	(()
2. Ventilation rate: main secondary other total	m ³ per hour	
heating heating		
Number of chimneys 0 + 0 + 0 = 0 × 40 =	0 (6a)
Number of open flues 0 + 0 = 0 × 20 =	0 (6b)
Number of intermittent fans	10 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 ((7c)
Air ch	anges per hour	
Infiltration due to obimpove fluce and fore $= (62) \pm (6b) \pm (72) \pm (7b) \pm (7c) =$		
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) \div (5) =		
Number of storeys in the dwelling (ns)	0 ('	(9)
Additional infiltration [(9)-1]x0.1 =	0 ((10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 ((11)
if both types of wall are present, use the value corresponding to the greater wall area (after		
deducting areas of openings); it equal user 0.35	((12)
If no draught lobby, enter 0.05, else enter 0		(12) (13)
Percentage of windows 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, q50, expressed in cubic metres per hour per square metre of envelope area	4 ((17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.27 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides sheltered	2 ((19)
Shelter factor $(20) = 1 - [0.073 \times (19)] =$	0.85 (2	20)
Inflitration rate incorporating shelter factor $(21) = (10) \times (20) =$	0.23 (2	21)
Inflitration rate modified for monthly wind speed		
Jan Feb Mar Apr May Jun Jui Aug Sep Oct Nov Dec		
Monthly average wind speed from Table 7		
(22)11- 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7		
Wind Factor (22a)m = (22)m ÷ 4		
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18		

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-		-	-	-		
II IIIt			ucing App	ondix N (2	(2b) = (22c)		oquation (I		nvico (23h) - (23a)			0	(23a)
If bal	ancod with	boot roce			.55) – (256	or in uso f	actor (fron	n Table 4b) –) - (208)			0	(230)
) - .)]]h)ma (/)	00k) v [4 (22.5)	0	(23c)
a) IT								HR) (24a 1	a)m = (22)	20)m + (. 0	230) × [1 - (23C)) ÷ 100j]	(24a)
(24a)11-		U			0	0						0	J	(240)
D) IT	balance		anical ve			neat rec	covery (r	VIV) (240 T	o)m = (22	20)m + (2	23D)		1	(24b)
(240)m=		0								0	0	0	J	(240)
C) IT	if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), 1	then (24	c) = (23b); other	ventilatio wise (24	c) = (22b	p(tside) $m + 0.$	5 × (23b)	-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)n	ventilation n = 1, th	on or wh en (24d)	ole hous m = (221	se positiv o)m othe	ve input erwise (2	ventilatio 24d)m =	on from I 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in boy	k (25)	-	-		_	
(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54]	(25)
3 He	at losse	s and he	eat loss i	paramet	er.									
		Gros	SS	Openin	as	Net Ar	ea	U-valı	Je	AXU		k-value	e /	A X k
		area	(m²)	'n	9- 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K I	kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				6.6		24.15	5 X	0.18	=	4.35				(29)
Roof				0		51.5	x	0.13	= =	6.69	7 1		$\neg \square$	(30)
Total a	area of e	lements	, m²			82.25	5							(31)
Party v	wall					53.34	4 X	0	= [0				(32)
Party f	loor					51.5	=		I				\dashv	(32a)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	ns given ir	n paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				18.6	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	5867.59	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	⊦ TFA) ir	n kJ/m²K	,		Indica	tive Value	Medium		250	(35)
For desi can be u	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the ulation.	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix I	K						8.79	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			27.39	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y			<u> </u>	(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	24.94	24.86	24.78	24.43	24.36	24.05	24.05	23.99	24.17	24.36	24.49	24.64	J	(38)
Heat ti	ransfer o	coefficie	nt, W/K		-				(39)m	= (37) + (3	38)m			
(39)m=	52.33	52.25	52.17	51.82	51.75	51.44	51.44	51.38	51.56	51.75	51.88	52.03		
										Average =	Sum(39)	112 /12=	51.82	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.02	1.01	1.01	1.01	1	1	1	1	1	1	1.01	1.01		
Numbe	er of day	s in mo	nth (Tab	le 1a)	•		•	•		Average =	Sum(40)1	.12 /12=	1.01	(40)
- turno c	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			1			1		I						
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF	ed occu A > 13.9 A £ 13.9	upancy, I 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	o(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.(0013 x (⁻	TFA -13	1. ⁻ .9)	73		(42)
Annual Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = ^{designed} ld)	(25 x N) to achieve	+ 36 a water us	se target o	75. f	.39		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.93	79.91	76.9	73.88	70.87	67.85	67.85	70.87	73.88	76.9	79.91	82.93		
$Total = Sum(44)_{112} =$										- 10)	904.68	(44)		
Energy c	=nergy content of not water used - calculated monthly = 4.190 x Vd, m x nm x D I m / 3600 kWh/month (see Tables 1b, 1c, 1										c, 1a)	I		
(45)m=	n= 122.98 107.56 110.99 96.77 92.85 80.12 74.24 85.2 86.21 100.47 109.68 119.1										119.1	1100.10		
Total = $Sum(45)_{112}$ = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)												1186.18	(45)	
(46)m=	18.45	16.13	16.65	14.51	13.93	12.02	11.14	12.78	12.93	15.07	16.45	17.87		(46)
Water storage loss:														
Storage volume (litres) including any solar or WWHRS storage within same vessel													(47)	
If comr	nunity r vise if no	eating a	ind no ta	ink in dw ar (this ir	velling, e ocludes i	nter 110 nstantar) litres in	1 (47) Smbi boil	are) ante	ar '∩' in <i>(</i>	(47)			
Water	storage	loss:	not wate	51 (1115 11	iciuues i	nstantai			ers) erit		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
a) If m	anufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):				1.	.2		(48)
Tempe	rature f	actor fro	m Table	2b							0.	.6		(49)
Energy	lost fro	m water	• storage	, kWh/y	ear			(48) x (49)) =		0.	72		(50)
b) lf m	anufact	urer's de	eclared of	cylinder	loss fact	or is not	known:						I	
Hot wa	nunity h	age loss leating s	Tactor II	om Iab	ie z (kvv	n/litre/da	ay)				()		(51)
Volume	e factor	from Ta	ble 2a	011 4.0)		(52)
Tempe	rature f	actor fro	m Table	2b							())		(53)
Energy	lost fro	m water	· storage	, kWh/y	ear			(47) x (51)) x (52) x (53) =	()		(54)
Enter	(50) or ((54) in (5	55)								0.1	72		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3						(0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	there is s	solar wat	ter heati	ng and a	cylinde	r thermo	ostat)		I	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(61) m (62) (63)											
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)$ (62)m = 168.56 148.73 156.58 140.88 138.43 124.23 119.83 130.78 130.33 146.06 153.79 164.68 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 = 100 -	m (62) (63)											
(62)m= 168.56 148.73 156.58 140.88 138.43 124.23 119.83 130.78 130.33 146.06 153.79 164.68 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) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	(62) (63)											
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)											
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	(63)											
	(63)											
	(64)											
Output from water heater	(64)											
(64)m= 168.56 148.73 156.58 140.88 138.43 124.23 119.83 130.78 130.33 146.06 153.79 164.68	(64)											
Output from water heater (annual) ₁₁₂ 1722.88												
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= 77.36 68.7 73.37 67.46 67.34 61.93 61.15 64.79 63.96 69.87 71.76 76.07	(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= 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72 86.72	(66)											
ighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m= 14.74 13.09 10.65 8.06 6.02 5.09 5.5 7.14 9.59 12.17 14.21 15.15	(67)											
Appliances gains (calculated in Appendix L. equation L13 or L13a), also see Table 5												
(68)m= 151.13 152.7 148.74 140.33 129.71 119.73 113.06 111.49 115.45 123.86 134.48 144.46	(68)											
cooking gains (calculated in Appendix L. equation L15 or L15a), also see Table 5												
(69)m= 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67 31.67	(69)											
Pumps and fans gains (Table 5a)												
	(70)											
$(71)_{m=} -69.37 -69.27 -69.27 -69.27 -69.27 -69.27 -69.27 -69.$	(71)											
Water besting gains (Table 5)												
(72)m = 103 97 102 23 98 62 93 7 90 51 86 01 82 19 87 09 88 83 93 92 99 66 102 24	(72)											
$Tetel internal pains = \frac{(60)m + (67)m + (69)m + (69)m + (70)m + (71)m + (72)m}{(60)m + (67)m + (69)m + (69)m + (70)m + (71)m + (72)m}$	()											
(3) = 318 86 317 04 307 02 201 11 275 26 250 85 240 77 254 74 262 88 278 06 207 37 310 86	(73)											
(r3)iii- 316.60 317.04 307.02 291.11 275.20 259.05 249.17 254.14 202.00 276.90 297.57 310.60	(13)											
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.												
Orientation: Access Factor Area Flux q FF Gains												
Table 6d m^2 Table 6aTable 6bTable 6c(W)												
Southeast 0.9x 0.77 x 2.88 x 36.79 x 0.35 x 0.7 = 17.99	(77)											
Southeast $0.9x$ 0.77 x 1.86 x 36.79 x 0.35 x 0.77 = 23.24												
Southeast $0.9x$ 0.77 x 2.88 x 62.67 x 0.35 x 0.7 = 30.65	(77)											
Southeast $0.9x$ 0.77 x 1.86 x 62.67 x 0.35 x 0.77 = 39.58												
Southeast 0.9x 0.77 x 2.88 x 85.75 x 0.35 x 0.77 = 41.93												

51.96 (67.11 (58.19 (75.17 (57.77 (74.62 (55.7 ((77) (77) (77) (77) (77) (77)
67.11 (58.19 (75.17 (57.77 (74.62 (55.7 ((77) (77) (77) (77) (77)
58.19 (75.17 (57.77 (74.62 (55.7 ((77) (77) (77) (77) (77)
75.17 (57.77 (74.62 (55.7 ((77) (77) (77)
57.77 (74.62 (55.7 ((77) (77)
74.62 (77)
55.7 (1
、 、	77)
71.95 (77)
51.04 (77)
65.93 (77)
45.4 (77)
58.65 (77)
33.87 (77)
43.75 (77)
21.55 (77)
27.83 (77)
15.4 (77)
19.89 ((77)
(83)
()	84)
,	85)
	55.7 (71.95 (51.04 (65.93 (45.4 (58.65 (33.87 (43.75 (21.55 (19.89 (0 (21 (

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.97	0.91	0.77	0.59	0.62	0.84	0.96	0.99	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)				_	
(87)m=	20.04	20.15	20.33	20.57	20.79	20.95	20.99	20.99	20.91	20.64	20.29	20.01		(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)														
(88)m=	20.07	20.07	20.07	20.08	20.08	20.08	20.08	20.09	20.08	20.08	20.08	20.07		(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)														
(89)m=	0.99	0.99	0.98	0.95	0.87	0.68	0.47	0.5	0.77	0.95	0.99	1		(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)														
(90)m=	18.79	18.95	19.22	19.56	19.87	20.05	20.08	20.08	20.01	19.66	19.17	18.76		(90)
									f	LA = Livin	g area ÷ (4	+) =	0.49	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m= 19.4 19.53 19.76 20.05 20.32 20.48 20.52 20.52 20.44 20.13 19.72 19.36 (9											-	-		
	(92)m=	19.4	19.53	19.76	20.05	20.32	20.48	20.52	20.52	20.44	20.13	19.72	19.36	(92

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

(93)m=	19.4	19.53	19.76	20.05	20.32	20.48	20.52	20.52	20.44	20.13	19.72	19.36		(93)
8. Spa	ace hea	ting requ	uirement	t				•						
Set Ti the ut	i to the r ilisation	mean int factor fo	ernal ter or gains	mperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.98	0.95	0.88	0.72	0.53	0.56	0.8	0.95	0.99	0.99		(94)
Usefu	ıl gains,	hmGm ,	, W = (94	4)m x (84	4)m									
(95)m=	357.58	382.87	394.55	390.68	360.87	283.1	198.95	207.79	292.2	338.46	342.02	344.19		(95)
Month	nly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	77)m= 789.9 764.45 691.6 577.76 445.96 302.62 201.75 211.69 327.13 493.39 654.55 788.95												(97)	
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	321.65	256.42	221	134.7	63.3	0	0	0	0	115.27	225.02	330.9		
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	1668.26	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								32.39	(99)
9b. En	ergy rec	quiremer	nts – Cor	mmunity	heating	scheme	•							-
This pa	art is use	ed for sp	ace hea	ating, spa	ace cooli	ng or wa	ater heat	ting prov	ided by	a comm	unity sch	neme.	0	(301)
Fractio	n of spa		from co	mmunity	supplen	1 (30 ²	1) –		1) 0 11 1	one			0	
The community scheme may obtain heat from sourced sources. The procedure allows for CUD and up to four other back courses $\frac{1}{2}$											1	(002)		
includes	nmunity so boilers, h	cheme may leat pumps	y obtain he s. aeotheri	eat from se mal and wa	everal sour aste heat f	rces. The p rom power	rocedure	allows for See Appel	CHP and l ndix C.	up to four	other heat	sources; ti	he latter	
Fractio	n of hea	at from C	Commun	ity heat	pump			0007.pp0					1	(303a)
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump	D			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	l method	(Table 4	4c(3)) fo	r commi	unity hea	iting sys	tem			1	(305)
Distrib	ution los	ss factor	(Table 1	12c) for c	commun	ity heatir	ng syste	m					1.05	(306)
Space	heating	g											kWh/year	_
Annua	l space	heating	requiren	nent									1668.26	
Space	heat fro	om Comr	munity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) =	=	1751.68	(307a)
Efficier	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 -	+ (308) =		0	(309)
Water Annual	heating I water h) neating r	equirem	ient									1722.88	1
If DHW Water	/ from contract from heat from the structure of the struc	ommunit m Comn	ty schen nunity he	ne: eat pumr)				(64) x (30	03a) x (30	5) x (306) =	=	1809.02] (310a)
Electric	city used	d for hea	t distrib	ution				0.01	× [(307a).	(307e) +	(310a)(310e)] =	35.61	(313)
Cooline	g Syster	m Enera	y Efficie	ncy Ratio	C					/	. , , ,	· · · ·	0)`´´ (314)
Space	cooling	(if there	is a fixe	d cooling	g systen	n, if not e	enter 0)		= (107) ÷	· (314) =			0	(315)
Electric	city for p	oumps ai	nd fans v	within dv	velling (1	able 4f)	:					l		J
mecha	nical ve	ntilation	- balanc	ced, extra	act or po	sitive in	put from	outside					0	(330a)
warm air heating system fans					0	(330b)								
---	---------------------------------	--	------------------------------	-------------	------------------------	--------								
pump for solar water heating					0	(330g)								
Total electricity for the above, kWh/ye	ar	=(330a) + (330b	o) + (330g) =		0	(331)								
Energy for lighting (calculated in Appe	endix L)				260.28	(332)								
Total delivered energy for all uses (30	7) + (309) + (310) + (312) + (315) + (331) + (33	2)(237b) =		3820.98	(338)								
12b. CO2 Emissions – Community he	ating scheme													
		Energy kWh/year	Emission facto kg CO2/kWh	or Ei kç	missions g CO2/year									
CO2 from other sources of space and Efficiency of heat source 1 (%)	water heating (n If there is	ot CHP) s CHP using two fuels repeat (363) to ((366) for the second	fuel	401	(367a)								
CO2 associated with heat source 1		[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	460.85	(367)								
Electrical energy for heat distribution		[(313) x	0.52	=	18.48	(372)								
Total CO2 associated with community	systems	(363)(366) + (368)(372	?)	=	479.33	(373)								
CO2 associated with space heating (s	econdary)	(309) x	0	=	0	(374)								
CO2 associated with water from imme	ersion heater or ir	nstantaneous heater (312) x	0.52	=	0	(375)								
Total CO2 associated with space and	water heating	(373) + (374) + (375) =			479.33	(376)								
CO2 associated with electricity for put	mps and fans wit	nin dwelling (331)) x	0.52	=	0	(378)								
CO2 associated with electricity for ligh	nting	(332))) x	0.52	=	135.09	(379)								
Total CO2, kg/year	sum of (376)(3	82) =			614.42	(383)								
Dwelling CO2 Emission Rate					11.93	(384)								
El rating (section 14)					91.47	(385)								

		Use	r Details:						
Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Num are Ver	ber: sion:		Versio	n: 1.0.5.59	
		Proper	rty Address:	Kingsto	n Bridge	e 2BF GI	ND 65 A	SHP	
Address :									
1. Overall dwelling dime	nsions:	•	*** * (*** ²)		A. 11a	arla t (ma)			
Ground floor		A F		(1a) v	AV. He		(22) = 1	volume(m ^s)	7(32)
Total floor area $TEA = (1a)$	a)+(1b)+(1c)+(1d)+(1c))+ (1n)	65.2	(10) X	2		(20) -	170.04	
)'(111)	05.2	(4) (3a)+(3b))+(3c)+(3d)+(3e)+	(3n) =	170.04	٦(5)
Dweiling volume				(00) (00)	, (00) (00	, (00)	.(0)	176.04	
2. Ventilation rate:	main se	condary	other		total			m ³ per hour	
	heating h	eating			total				-
Number of chimneys	0 +	0 +	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	าร			Ē	2	x ^	10 =	20	(7a)
Number of passive vents					0	× ′	10 =	0	(7b)
Number of flueless gas fir	res				0	x 4	40 =	0	(7c)
							∆ir ch	anges per hou	
le filtre tiere due te delivere		-)(0.)(7)(7.							יי ר
Inflitration due to chimney	/s, flues and fans = (0)	$(0)^{+}(0)^{+}(7)^{+}(7)^{+}(7)$	7) otherwise (continue fr	$\frac{1}{2}$ (0) to ((16)	÷ (5) =		
Number of storevs in th	ne dwelling (ns)	a, proceed to (r	r), ourierwise c	onunue no	5111 (3) 10 (10)	1	0	7 (9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber f	rame or 0.35	for masonr	y constr	uction		-	0	- (11)
if both types of wall are pro	esent, use the value correspondences	ponding to the g	reater wall are	a (after			ľ		-
If suspended wooden fl	loor. enter 0.2 (unseal	ed) or 0.1 (se	aled), else	enter 0				0	7 (12)
If no draught lobby, ent	er 0.05, else enter 0		,,					0	(13)
Percentage of windows	and doors draught st	ripped					ĺ	0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =	İ	0	(16)
Air permeability value,	q50, expressed in cub	ic metres per	hour per se	quare m	etre of e	nvelope	area	4	(17)
If based on air permeabili	ty value, then (18) = [(1	7) ÷ 20]+(8), oth	erwise (18) = (16)				0.31	(18)
Air permeability value applies	s if a pressurisation test has	been done or a	degree air pei	rmeability	is being us	sed			-
Number of sides sheltered	d		(20) = 1 - 1	0 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	ing shelter factor		(20) (21) = (18)	(20) = (20) =	0)]		l	0.85	$\int_{(20)}^{(20)}$
Infiltration rate modified for	or monthly wind speed		() (10)	, x (20)			l	0.27	
	Mar Apr May	.lun .lu		Sen	Oct	Nov	Dec		
Monthly average wind an	and from Table 7		n / ag	000	000	1101	000		
$(22)m = \begin{bmatrix} 51 \\ 51 \end{bmatrix} \begin{bmatrix} 5 \\ 5 \end{bmatrix}$		38 39	37	4	43	45	47		
	····	0.0		т	1.0	T.0	T./		
Wind Factor (22a)m = (22	2)m ÷ 4	,					·		
(22a)m= 1.27 1.25 1	1.23 1.1 1.08	0.95 0.9	5 0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se	-	-		-	-		
II IIIt			ucing App	ondix N (2	(25) - (23c	$(a) \times Emy (a)$	oquation (I		nuico (23h) = (22a)			0	(23a)
lf bol	aust all fi				.50) – (258	i i i i i i i i i i	actor (fron	n = Table 4b) –) = (238)			0	(230)
) - .)]h)ma (/	00k) v I	·1 (00 a)	0	(23c)
a) IT	balance							HR) (24a T	i)m = (22	20)m + (. 	23D) × [(23c)) ÷ 100]]	(242)
(24a)11-			0		0		0					0		(244)
D) IT	balance		anical ve				covery (r	VIV) (240 T	o)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0			0					0	0	0		(240)
C) IT	whole r if (22b)r	iouse ex n < 0.5 ×	tract ver (23b), f	tilation (24)	c) = (23b)); otherv	ventilatio wise (24	c) = (22b)	outside b) m + 0.	5 × (23b)	-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	iole hous m = (22	se positiv b)m othe	ve input [.] erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(25)
3 He	at losse	s and he	eat loss	naramet	er.									
		Gros	s	Openin	as	Net Ar	ea	U-valı	le	AXU		k-value	e e	AXk
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K İ	kJ/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.2)+	0.04] =	6.6				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Floor						65.2	x	0.13	=	8.47599	9			(28)
Walls				9.48	3	34.64	ı x	0.18	i	6.24			\exists	(29)
Total a	area of e	elements	, m²			109.3	2							(31)
Party v	wall					44.12	2 x	0	=	0				(32)
Party of	ceilina					65.2							\dashv	(32b)
* for win	dows and	l roof wind	ows, use e	effective wi	indow U-va	alue calcul	 ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given ir	n paragraph	└ ı 3.2	()
** incluc	le the area	as on both	sides of in	nternal wal	ls and par	titions				, <u>-</u>	0	, , ,		
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				25.57	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	12604.26	(34)
Therm	al mass	parame	ter (TM	- = Cm +	⊦ TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi can be u	ign asses used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						7.98	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
I otal f	abric he	atioss							(33) +	(36) =			33.55	(37)
Ventila	ation hea	at loss ca	alculated	n monthl	y I			<u> </u>	(38)m	= 0.33 × (25)m x (5	i) 	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m=	32.4	32.27	32.14	31.54	31.43	30.91	30.91	30.81	31.11	31.43	31.66	31.9		(38)
Heat ti	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		1	
(39)m=	65.95	65.82	65.69	65.09	64.98	64.45	64.45	64.36	64.66	64.98	65.2	65.44		
										Average =	Sum(39)	112 /12=	65.09	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.01	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1		
Numbe	er of dav		nth (Tab	l <u> </u>		<u> </u>		!	,	Average =	Sum(40)1.	.12 /12=	1	(40)
Numbe	Jan	Feh	Mar	Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	12		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = ^{designed} ld)	(25 x N) to achieve	+ 36 a water us	se target o	, 84 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ii	n litres per	r day for ea T	ach month 1	Vd,m = fa	ctor from	Table 1c x	: (43) T		1			I	
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,ı	m x nm x L	OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1015.8	(44)
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
lf instan	taneous w	ater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46	;) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m=	20 71	18 12	18 69	16.3	15 64	13 49	12.5	14 35	14 52	16.92	18 47	20.06		(46)
Water	storage	loss:	10.00									20.00		
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)
If com	nunity h	eating a	and no ta	ank in dw	velling, e	nter 110) litres in	(47)						
Otherv	vise it no	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in ((47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1	2		(48)
Tempe	erature fa	actor fro	m Table	2b		,	,				0	6		(49)
Energy	/ lost fro	m water	⁻ storage	, kWh/ye	ear			(48) x (49) =		0.	72		(50)
b) If m	anufact	urer's de	eclared of	cylinder l	loss fact	or is not	known:							
Hot wa	ater stora	age loss	factor fr	rom Tabl	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a	011 4.5								n		(52)
Tempe	erature fa	actor fro	m Table	2b))		(53)
Energy	/ lost fro	m water	⁻ storage	e, kWh/ye	ear			(47) x (51) x (52) x (53) =)		(54)
Enter	(50) or ((54) in (5	55)								0.	72		(55)
Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
(moo	dified by	tactor f	rom lab	IE H5 if t	inere is s	solar wat	ter heati	ng and a	a cylinde	r thermo	ostat)	00.00		(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	loss ca	lculated	for eac	h n	nonth (61)m =	(60)) ÷ 36	65 × (41))m									
(61)m=	0	0	0		0	0		0	0	0		0	0		0	C)]	(61)
Total h	eat req	uired for	water l	hea	ating ca	lculated	l fo	r eacl	h month	(62)r	n =	0.85 × ((45)m	+	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	183.67	161.94	170.21		152.76	149.84	1:	34.08	128.95	141.	24	140.92	158.	4	167.26	179	.31		(62)
Solar DH	W input	calculated	using Ap	per	ndix G or	Appendix	н ((negati	ve quantity	/) (ente	er '0'	if no sola	r contri	bu	tion to wate	er hea	iting)		
(add a	dditiona	al lines if	FGHR	Sa	nd/or V	VWHRS	ap	plies	, see Ap	pend	ix G	3)							
(63)m=	0	0	0		0	0		0	0	0		0	0		0	C)]	(63)
Output	from w	ater hea	ter															-	
(64)m=	183.67	161.94	170.21		152.76	149.84	1:	34.08	128.95	141.	24	140.92	158.	4	167.26	179	.31		
			•								Outp	out from wa	ater he	ate	er (annual)	12		1868.57	(64)
Heat g	ains fro	m water	heating	g, k	wh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (6	1)m	n] + 0.8 x	(46))m	+ (57)m	+ (5	9)m]	
(65)m=	82.38	73.09	77.9	T	71.42	71.13	(- 65.2	64.18	68.2	27	67.48	73.9	8	76.24	80.	93	ĺ	(65)
inclu	de (57)	n in calo	ulation		[;] (65)m	onlv if c	vlir	nder i	s in the c	dwelli	na	or hot w	ater is	s f	rom com	mun	itv h	neating	
5 Int	ernal d	ains (see	Table	5 :	and 5a	· · ·	,										, , ,	g	
Vietek																			
wetabo	lan	IS (Table	8 5), VV8	<u>atts</u>	Anr	May		lun	lul	٨	I.G.	Sen	0	•+	Nov	П	00	1	
(66)m =	106 21	106.21	106.21	╈	Api 106.21	106.21	1(06 21	106 21	106	19 21	106 21	106 '	را 1	106.21	106	21		(66)
(00)11-		/ 100.21	100.21		100.21	100.21		00.21	100.21	100.	21		100.2	<u> </u>	100.21	100		J	(00)
Lightin	g gains			۱ ۱		_, equat	ion	L9 0	r L9a), a	ISO S	ee -	able 5		_				1	(07)
(67)m=	17.63	15.66	12.73		9.64	7.21	(5.08	6.57	8.5	5	11.47	14.5	6	1/	18.	12	J	(67)
Applia	nces ga	ins (calc	ulated	in /	Append	lix L, eq	uat	tion L	13 or L1	3a), a	also	see Ta	ble 5		1			1	
(68)m=	185.85	187.77	182.91		172.57	159.51	14	47.23	139.03	137.	11	141.97	152.3	31	165.37	177	.65]	(68)
Cookin	ig gains	calcula	ted in /	App	pendix	L, equat	ior	า L15	or L15a)	, also	o se	e Table	5						
(69)m=	33.62	33.62	33.62		33.62	33.62	3	3.62	33.62	33.6	62	33.62	33.6	2	33.62	33.	62		(69)
Pumps	and fa	ns gains	(Table	5a	a)														
(70)m=	0	0	0		0	0		0	0	0		0	0		0	C)		(70)
Losses	s e.g. ev	/aporatic	n (neg	ativ	/e valu	es) (Tab	le	5)										-	
(71)m=	-84.97	-84.97	-84.97	Τ	-84.97	-84.97	-8	34.97	-84.97	-84.	97	-84.97	-84.9	97	-84.97	-84	.97		(71)
Water	heating	gains (T	able 5)														1	
(72)m=	110.73	108.77	104.71	T	99.19	95.61	9	0.56	86.27	91.7	77	93.72	99.4	3	105.88	108	.78]	(72)
Total i	nternal	l dains =	I					(66)	L m + (67)m	ı + (68)m +	+ (69)m + ((70)m +	+ (7	 71)m + (72)	 m		1	
(73)m=	369.07	367.07	355.22		336.26	317.18	2	98.74	286.74	292.	, 28	302.02	321.	17	343.12	359	.41	1	(73)
6 Sol	ar gain	s.													1				• •
Solar g	ains are	calculated	using so	lar f	lux from	Table 6a a	and	associ	iated equa	tions t	о со	nvert to th	e appli	cal	ble orientat	ion.			
Orienta	ation:	Access F	actor		Area			Flu	x			q			FF			Gains	
	-	Table 6d			m²			Tal	ole 6a		Т	able 6b		Т	able 6c			(W)	
Northea	ast <mark>0.9x</mark>	0.77		×Г	5.7	6	x	1	1.28	x		0.3	٦ x	Г	0.7		=	9.46	(75)
Northea	ast _{0.9x} [0.77		х Г х	1.8	6	x		1 28	x		0.3	۲, ۲	F	0.7	=	_	6 11](75)
Northea	ast <u>o av</u> [0.77		, Г	5.7	6	x	' م	2 97	∣ ĭ L x [0.3			0.7	=	_	10.25	$\left \begin{array}{c} 1 \\ 7 \\ 7 \end{array} \right $
Northe	ast n av	0.77		ι Γ	1 0	<u> </u>	v	<u> </u>	2.07			0.3	╡Ĵ	F	0.7	=	=	12 / 2	$\frac{1}{75}$
Northes	ast o ov	0.77		Ĺ	1.0 				.2.91			0.0	╡ Û		0.7		_	12.43	$\int_{(7E)}^{(75)}$
NULLICO	JOL 0.9X	0.77		<u>^</u> [5.7	6	x	L 4	1.38	X		0.3	×	L	0.7		=	34.69	(10)

Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	4	1.38	x		0.3	×	0.7		=	22.4	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	6	7.96	x		0.3	×	0.7		=	56.96	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	6	7.96	x		0.3	×	0.7		=	36.79	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	1.35	x		0.3	×	0.7		=	76.57	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	1.35	x		0.3	×	0.7		=	49.45	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	7.38	x		0.3	×	0.7		=	81.63	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	7.38	x		0.3	×	0.7		=	52.72	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	91.1	x		0.3	×	0.7		=	76.37	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	91.1	x		0.3	x	0.7		=	49.32	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	7	2.63	x		0.3	×	0.7		=	60.88	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	7	2.63	x		0.3	×	0.7		=	39.32	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	5	0.42	x		0.3	×	0.7		=	42.27	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	5	0.42	x		0.3	×	0.7		=	27.3	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	2	8.07	x		0.3	×	0.7		=	23.53	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	2	8.07	x		0.3	×	0.7		=	15.19	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		14.2	x		0.3	×	0.7		=	11.9	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		14.2	x		0.3	×	0.7		=	7.69	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	9.21	x		0.3	×	0.7		=	7.72	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	9.21	x		0.3	×	0.7		=	4.99	(75)
Solar g	ains in	watts, ca	alcula	ted	for eac	n mont	h			(83)m	n = Su	m(74)m	.(82)m					
(83)m=	15.57	31.69	57.0	9	93.75	126.02	2 1	34.35	125.69	100	0.2	69.56	38.72	19.59	12	2.71		(83)
Total g	ains – i	nternal a	and so	lar	(84)m =	= (73)m	<u>ו + (</u>	83)m	, watts									
(84)m=	384.63	398.75	412.3	31	430.02	443.21	4	433.1	412.43	392	.48	371.58	359.89	362.7	37	2.12		(84)
7. Me	an inter	nal temp	peratu	re (heating	seaso	n)											
Temp	erature	during h	eating	g pe	eriods ir	n the liv	/ing	area	from Tal	ole 9	, Th1	(°C)					21	(85)
Utilisa	ation fac	tor for g	ains f	or li	ving are	ea, h1,	m (s	ее Та	ble 9a)					-				
	Jan	Feb	Ma	ar	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov		Dec		
(86)m=	1	1	0.99)	0.98	0.95		0.83	0.66	0.7	71	0.92	0.99	1		1		(86)
Mean	interna	l temper	ature	in li	iving ar	ea T1 (follo	ow ste	ps 3 to 7	7 in T	able	9c)						
(87)m=	19.94	20.02	20.2	2	20.46	20.73	2	20.92	20.98	20.	97	20.84	20.52	20.19	19	.92		(87)
Temp	erature	during h	eatin	g pe	eriods ir	n rest c	of dv	velling	from Ta	able 9	9, Th	2 (°C)						
(88)m=	20.07	20.08	20.0	8	20.08	20.09	2	20.09	20.09	20.	09	20.09	20.09	20.08	20	.08		(88)
Utilisa	ation fac	tor for a	ains f	or r	est of d	wellina	. h2	.m (se	e Table	9a)		I			•			
(89)m=	1	1	0.99)	0.98	0.92		0.75	0.54	0.5	59	0.87	0.98	1		1		(89)
Mean	interna	l temper	ature	in t	he rest	of dwe	llino	T2 (f	n Ulow eta	- - -	to 7	in Tabl	2 9c)	-!				
wear				111	101031		- in iy	1 - 2 (10		,ha n	, .0 /		5 00)					

(90)m=	18.65	18.77	19.03	19.42	19.79	20.03	20.09	20.08	19.95	19.51	19.03	18.63		(90)
									f	LA = Livin	g area ÷ (4	1) =	0.38	(91)
Mean	internal	l tempera	ature (fo	r the wh	ole dwel	lina) = fl	A × T1	+ (1 – fl	A) × T2					

wicun	interna	temper				inig) ii		· (i i i i i i i i i i i i i i i i i i					
(92)m=	19.15	19.25	19.48	19.82	20.15	20.37	20.43	20.42	20.29	19.9	19.48	19.13	(92)

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

(93)m=	19.15	19.25	19.48	19.82	20.15	20.37	20.43	20.42	20.29	19.9	19.48	19.13		(93)
8. Sp	ace hea	ting requ	uirement											
Set T the ut	i to the r tilisation	mean int factor fo	ernal ter or gains	mperatui using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	1	1	0.99	0.98	0.92	0.78	0.59	0.64	0.88	0.98	0.99	1		(94)
Usefu	ıl gains,	hmGm ,	, W = (94	4)m x (84	4)m									
(95)m=	383.35	396.88	408.62	419.64	409.6	337.4	241.3	250.17	326.92	351.83	360.48	371.1		(95)
Mont	nly avera	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	979.07	944.59	852.58	710.63	549.02	372.1	246.84	258.98	400.33	604.37	806.96	976.87		(97)
Spac	e heatin	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=	443.21	368.06	330.3	209.51	103.73	0	0	0	0	187.88	321.47	450.7		1
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	2414.86	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								37.04	(99)
9b. En	ergy rec	luiremer	nts – Coi	mmunity	heating	scheme								-
This pa	art is use	ed for sp	ace hea	iting, spa	ace cooli	ng or wa	ater hea	ting prov	ided by	a comm	unity sch	neme.		-
Fractic	on of spa	ace heat	from se	condary	/supplen	nentary l	neating	(Table 1	1) '0' if n	one			0	(301)
Fractio	on of spa	ace heat	from co	mmunity	system	1 – (301	1) =					[1	(302)
The con	nmunity so	cheme mag	y obtain he	eat from se	everal sour	ces. The p	procedure	allows for	CHP and u	up to four (other heat	sources; tl	he latter	
Fractic	boilers, h	eat pumps at from C	s, geotheri	nal and wa ity heat i	aste heat fi numn	rom powei	r stations.	See Apper	ndıx C.			1	1	(303a)
Fractic	on of tota	al space	heat fro	m Comn	nunitv he	eat pum)			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commi	unity hea	itina svs	tem		ŕ I	1	(305)
Distrib	ution los	s factor	(Table 1	l2c) for c	` commun	ity heatiı	ng syste	m	0 ,				1.05	(306)
Space	heating	a										I	kWh/vear	J
Annua	l space	heating	requiren	nent								[2414.86]
Space	heat fro	om Comr	munity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) =	=	2535.61	(307a)
Efficie	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 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 Annua	heating	j neating r	equirem	ent								I	1868.57	1
If DHV Water	/ from c	ommunii m Comn	ty schen	ne: eat pumr	h				(64) x (3()3a) x (30)	5) x (306) =	 = [1962] (310a)
Electri	city used	d for hea	at distrib	ution	-			0.01	× [(307a).	(307e) +	(310a)(310e)] =	44.98	(313)
Coolin	g Svster	n Enera	y Efficie	ncy Ratio	D				L().	()	(/1	0	(314)
Space	coolina	(if there	is a fixe	d cooline	g system	n, if not e	enter 0)		= (107) ÷	(314) =		l	0) (315)
Electri	city for p	oumps a	nd fans v	within dv	velling (1	able 4f)	:					l] ´
mecha	inical ve	ntilation	- balanc	ed, extra	act or po	sitive in	put from	outside					0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/ye	ear	=(330a) + (330b	o) + (330g) =		0	(331)
Energy for lighting (calculated in App	endix L)				311.36	(332)
Total delivered energy for all uses (30)7) + (309) + (310	0) + (312) + (315) + (331) + (33	2)(237b) =		4808.96	(338)
12b. CO2 Emissions – Community he	eating scheme					
		Energy kWh/year	Emission facto kg CO2/kWh	or Er kg	nissions J CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)	l water heating (r If there i	not CHP) s CHP using two fuels repeat (363) to ((366) for the second	fuel	401	(367a)
CO2 associated with heat source 1		[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	582.11	(367)
Electrical energy for heat distribution		[(313) x	0.52	=	23.34	(372)
Total CO2 associated with community	y systems	(363)(366) + (368)(372)	=	605.45	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from imm	ersion heater or i	nstantaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and	water heating	(373) + (374) + (375) =			605.45	(376)
CO2 associated with electricity for pu	mps and fans wit	hin dwelling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for lig	hting	(332))) x	0.52	=	161.59	(379)
Total CO2, kg/year	sum of (376)(3	182) =			767.04	(383)
Dwelling CO2 Emission Rate					11.76	(384)
El rating (section 14)					90.67	(385)

		User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa	a Num ire Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property /	Address:	Kingsto	n Bridge	e 2BF M	ID 65 AS	SHP	
Address :									
1. Overall dwelling dimer	ISIONS:	A	- (ma 2)		A. 11a			\/elume(m3)	
Ground floor		Area	a(m²)	(1a) x			(2a) =	176.04	– (3a)
Total floor area TFA = $(1a)$)+(1b)+(1c)+(1d)+(1e)+	(1n)	5.2	(14)			(20)	170.04	
Dwelling volume)*(10)*(10)*(10)*(10)*		55.2	(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	176.04	7(5)
				. , . ,		, , ,	` ´	170.04	
2. Ventilation rate:	main second	darv	other		total			m ³ per hour	
	heating heatin	<u>ig</u>		ı _ r-			10 -		-
Number of chimneys	0 + 0	+	0		0	X 2	+0 =	0	(6a)
Number of open flues	0 + 0	+	0	=	0	x 2	20 =	0	(6b)
Number of intermittent fan	S				2	x ^	10 =	20	(7a)
Number of passive vents				Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fire	es				0	× 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to obimpour	a flues and fame - (6a)+(6b))+(7c)+(7b)+(70) -	F					а. П
Ininitiation due to chimney	s, nues and rans = $(0a)+(0b)$	$(70)^{+}(70)$	nt) – otherwise c	ontinue fri	om (9) to ((16)	÷ (5) =		
Number of storeys in the	e dwelling (ns)				5111 (0) 10 (10)		0	(9)
Additional infiltration	U (<i>i</i>)					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel or timber frame	e or 0.35 for	masonr	y constr	uction		·	0	(11)
if both types of wall are pre	sent, use the value correspondin	g to the great	er wall area	a (after					_
deducting areas of opening	<i>js); if equal user 0.35</i> oor enter 0.2 (unsealed) o	r () 1 (seale	d) else	onter ()			I	0	7(12)
If no draught lobby, ente	er 0.05. else enter 0		, cioc					0	(12)
Percentage of windows	and doors draught strippe	d						0	$\left \begin{array}{c} (10) \\ (14) \end{array} \right $
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =		-	0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, o	50, expressed in cubic me	etres per ho	our per so	uare m	etre of e	nvelope	area	4	(17)
If based on air permeabilit	y value, then (18) = [(17) ÷ 20)]+(8), otherwi	se (18) = (16)				0.31	(18)
Air permeability value applies	if a pressurisation test has been	done or a deg	gree air per	meability	is being us	sed			_
Number of sides sheltered	1		(20) = 1 - [0 075 v (1	0)1 =			2	(19)
Sileller lacior	na oboltor footor		(20) = 1 - [v (20) -	5)] -			0.85	
Influence incorporation	r monthly wind aroud		(21) - (10)	x (20) -				0.27	(21)
			A	San	Oct	Nov	Dee		
		n Jui	Aug	Sep	Oci	INOV	Dec		
Monthly average wind spe		2.0	27	4	4.2	4.5	47	l	
(22)111= 0.1 0 4	H.9 4.4 4.3 3.8	3.8	J.1	4	4.3	4.5	4./		
Wind Factor (22a)m = (22)m ÷ 4								
(22a)m= 1.27 1.25 1	.23 1.1 1.08 0.95	5 0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calcul	ate effe	ctive air	change	rate for t	the appli	cable ca	se	-				-		
II IIIt			ucing App	ondix N (2	(22h) = (22c)		oquation (I		nuico (23h) = (23a)			0	(23a)
If bol		eat pump			(200) = (200)	i) ~ i iiv (e	Squation (i	n = Table 4b) –) = (238)			0	(230)
) -	2 a)	006)	4 (00 -)	0	(23c)
a) ir	balance							HR) (24a T	a)m = (22	20)m + (230) × [1 - (23C)) ÷ 100]]	(242)
(24a)11-			0		0							0		(244)
D) IT	balance		anical ve			neat rec	covery (r	VIV) (240 T	5)m = (22	2b)m + (2 	23D)		1	(24b)
(240)m=		0			 					0	0	0		(240)
C) If	whole h if (22b)r	iouse ex n < 0.5 ×	tract ver (23b), f	then (24	or positiv c) = (23b); other	ventilatio wise (24	c) = (22b	outside b) m + 0.	5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a	i) or (24t	o) or (24	c) or (24	d) in boy	x (25)	-	-	-		
(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55		(25)
3 He	at losse	s and he	at loss	naramet	er.								-	
		Gros	35	Openin		Net Ar	rea	U-valı	lie	ΑΧΠ		k-value	ر د	4 X k
		area	(m²)	n	190 1 ²	A ,r	n²	W/m2	2K	(W/I	K)	kJ/m²·l	K I	kJ/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.2)+	0.04] =	6.6				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				9.48	3	34.64	1 X	0.18	=	6.24				(29)
Total a	area of e	elements	, m²			44.12	2							(31)
Party v	wall					44.12	2 X	0	=	0				(32)
Party f	loor					65.2	=				i		\exists	(32a)
Party of	ceiling					65.2					[\dashv	(32b)
* for win ** includ	dows and le the area	l roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Ils and pari	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	n paragraph	1 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)) + (32) =				17.09	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	12930.26	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm +	÷ TFA) ir	ו kJ/m²K	,		Indica	tive Value	: Medium		250	(35)
For desi can be ι	ign asses: Jsed inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	e construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	K						3.89	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	:1)								
Total fa	abric he	at loss							(33) +	(36) =			20.98	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y			,	(38)m	= 0.33 × (25)m x (5)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.4	32.27	32.14	31.54	31.43	30.91	30.91	30.81	31.11	31.43	31.66	31.9		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	53.39	53.26	53.13	52.53	52.42	51.89	51.89	51.8	52.09	52.42	52.64	52.88		
										Average =	Sum(39)	112 /12=	52.53	(39)

Heat lo	ss para	imeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.82	0.82	0.81	0.81	0.8	0.8	0.8	0.79	0.8	0.8	0.81	0.81		
Numbo	r of dou		I			1	1		1	Average =	Sum(40) ₁ .	12 /12=	0.81	(40)
	l ol uay	Eob	Mar		May	lun	<u> </u>	Δυσ	Son	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31 31	30	31	30	31		(41)
(41)11-	51	20			01			51	00		50	51		()
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF. if TF.	ed occu A > 13.9 A £ 13.9	upancy, I 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	349 x (TI	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	12		(42)
Annual Reduce not more	averag the annua that 125	le hot wa al average litres per l	ater usag hot water person pe	ge in litre usage by s r day (all w	es per da 5% if the c vater use, l	ay Vd,av lwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	64 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per I	r day for ea I	ach month I	Vd,m = fa I	ctor from	Table 1c x T	(43) T	1				I	
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12	1015.0	
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,ı	m x nm x [OTm / 3600) kWh/mor	total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1015.8	(44)
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
lf instant	aneous w	vater heati	na at poini	t of use (no	hot wate	r storage).	enter 0 in	boxes (46	;) to (61)	Total = Su	m(45) ₁₁₂ =		1331.88	(45)
(46)m=	20.71	18 12	18 69	16.3	15.64	13.49	12.5	14 35	14 52	16.92	18.47	20.06		(46)
Water	storage	loss:	10.03	10.5	15.04	10.49	12.5	14.00	14.52	10.32	10.47	20.00		(10)
Storage	e volum	e (litres)) includir	ng any so	olar or W	WHRS	storage	within sa	ame ves	sel		180		(47)
If comr	nunity h	neating a	ind no ta	ank in dw	velling, e	enter 110) litres in	(47)						
Otherw	ise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in ((47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1	.2		(48)
Tempe	rature f	actor fro	m Table	2b		,	3,				0	.6		(49)
Energy	lost fro	om water	storage	e, kWh/ye	ear			(48) x (49) =		0.	72		(50)
b) If m	anufact	urer's de	eclared	cylinder l	oss fact	or is not	known:							
Hot wa	ter stora	age loss	tactor fi	rom labl	e 2 (kW	h/litre/da	ay)					0		(51)
Volume	e factor	from Ta	ble 2a	011 - 1.0								0		(52)
Tempe	rature f	actor fro	m Table	2b								0		(53)
Energy	lost fro	m water	storage	e, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)								0.	72		(55)
Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)i	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m =	(58) ÷ 36	65 × (41))m	• 4 • • • • • •				
(moc (50)						solar wai		ing and a				22.26	l	(50)
(59)m=	23.20	21.01	23.20	22.31	23.20	22.01	23.20	23.20	22.31	23.20	22.31	23.20		(33)

Combi	loss ca	lculated	for eac	ch r	month ((61)m =	(60)) ÷ 36	65 × (41)m								
(61)m=	0	0	0		0	0		0	0	0		0	0	0		0]	(61)
Total h	eat req	uired for	water	hea	ating ca	alculated	d fo	or eacl	h month	(62)r	n =	0.85 × ((45)m	+ (46)n	n + (57)m +	(59)m + (61)m	
(62)m=	183.67	161.94	170.2	1	152.76	149.84	1	34.08	128.95	141.	24	140.92	158.4	167.	.26	179.31]	(62)
Solar DH	W input	calculated	using A	ope	ndix G or	Appendi	κΗ	(negati	ve quantity	/) (ente	er '0'	if no sola	r contrib	ution to	water	heating)	-	
(add a	dditiona	I lines if	FGHR	S a	and/or V	WWHRS	s ap	plies	, see Ap	pend	ix G	G)						
(63)m=	0	0	0		0	0		0	0	0		0	0	0		0]	(63)
Output	from w	ater hea	ter						-						_		-	
(64)m=	183.67	161.94	170.2	1	152.76	149.84	1	34.08	128.95	141.	24	140.92	158.4	167.	.26	179.31		
		•	•							. (Dutp	out from wa	ater hea	ter (anni		12	1868.57	(64)
Heat g	ains fro	m water	heatin	g, I	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	ı + (6	1)m	ı] + 0.8 x	((46)r	n + (57	⁄)m ⊦	+ (59)m	1]	
(65)m=	82.38	73.09	77.9	T	71.42	71.13		65.2	64.18	68.2	27	67.48	73.98	76.2	24	80.93]	(65)
inclu	de (57)	n in calo	culation	י ו סו	f (65)m	only if c	ı İv	nder i	s in the o	dwelli	ng	or hot w	ater is	from c	omn	nunity ł	neating	
5 Int	ernal o	ains (see	Table	5	and 5a).	,				Ū					,	Ũ	
Motob				otte		/•												
Melabo	Jiic gaii Jan	Feb	<u>, 0), w</u>	-	Anr	May		.lun	Jul	Δι	IU	Sen	Oct	N	ov I	Dec]	
(66)m=	106.21	106.21	106.2		106.21	106.21	1	06.21	106.21	106.	21	106.21	106.2	1 106	.21	106.21	-	(66)
Lightin	a apine	(calcula	ted in	∆nr	hendix		ion		r I () a) a			Table 5		1			J	
(67)m=	9 94113 17 63	15.66	12 73		9.64	7 21		6.08	6 57	85	50	11 47	14 56	17	,	18 12	1	(67)
(07)III-	17.00				0.04 A mm a ma				12 or 11	20.0						10.12	J	(0.)
Appilar				in . . T	Append		ua T 1			3a), a				1 105	27	177.65	1	(68)
(68)m=	185.85	187.77	182.9	<u></u>	1/2.5/	159.51		47.23	139.03	137.	11	141.97	- 152.3	1 105.	.37	177.05]	(00)
Cookin	ig gains		ated in	Ap	pendix	L, equa	tior	1 L15	or L15a)), also) SE	e lable	5				1	(00)
(69)m=	33.62	33.62	33.62		33.62	33.62	3	33.62	33.62	33.6	52	33.62	33.62	33.6	52	33.62	J	(69)
Pumps	and fa	ns gains	(Table	58	a)		-										1	
(70)m=	0	0	0		0	0		0	0	0		0	0	0		0		(70)
Losses	s e.g. e\	/aporatic	on (neg	ativ	ve valu	es) (Tab	le	5)		-							-	
(71)m=	-84.97	-84.97	-84.97	'	-84.97	-84.97	-8	84.97	-84.97	-84.	97	-84.97	-84.97	7 -84.	97	-84.97		(71)
Water	heating	gains (T	able 5)						_							_	
(72)m=	110.73	108.77	104.7 ⁻	1	99.19	95.61	g	90.56	86.27	91.7	7	93.72	99.43	105.	.88	108.78		(72)
Total i	nternal	gains =						(66))m + (67)m	n + (68)m +	- (69)m + ((70)m +	(71)m +	(72)n	n		
(73)m=	369.07	367.07	355.22	2	336.26	317.18	2	98.74	286.74	292.	28	302.02	321.1	7 343.	.12	359.41		(73)
6. Sol	ar gain	s:																
Solar g	ains are	calculated	using sc	lar	flux from	Table 6a	and	lassoci	iated equa	itions t	о со	nvert to th	e applic	able orie	entatio	on.		
Orienta	ation: /	Access F	actor		Area			Flu	x		-	g_		FF	=		Gains	
	_	able 60			m ^			Tat	ole 6a			able 6b		lable	bC		(VV)	_
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	1	1.28	x		0.63	x	0	.7	=	19.86	(75)
Northea	ast <mark>0.9x</mark> [0.77		×	1.8	86	x	1	1.28	x [0.63	×	0	.7	=	12.83	(75)
Northea	ast <mark>0.9x</mark>	0.77		x [5.7	'6	x	2	2.97	x		0.63	x	0	.7	=	40.43	(75)
Northea	ast <mark>0.9x</mark>	0.77		x [1.8	86	x	2	22.97	x [0.63	×	0	.7	=	26.11	(75)
Northea	ast <mark>0.9x</mark>	0.77		× [5.7	6	x	4	1.38	x [0.63	×	0	.7	=	72.84	(75)

Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	4	1.38	x		0.63	x	0.7		=	47.04	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	6	7.96	x		0.63	۲ ×	0.7		= [119.62	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	6	7.96	x		0.63	× ٦	0.7		=	77.26	(75)
Northea	ast 0.9x	0.77		x	5.7	6	x	9	1.35	x		0.63	۲ × ۲	0.7		=	160.8	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	1.35	x		0.63	۲ ×	0.7		=	103.85	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	9	7.38	x		0.63	× ٦	0.7		=	171.43	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	9	7.38	x		0.63	×	0.7		=	110.71	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		91.1	x		0.63	×	0.7		= [160.37	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		91.1	x		0.63	×	0.7		=	103.57	(75)
Northea	ast 0.9x	0.77		x	5.7	6	x	7	2.63	x		0.63	×	0.7		= [127.85	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	7	2.63	x		0.63	× ٦	0.7		=	82.57	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	5	0.42	x		0.63	×	0.7		= [88.76	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	5	0.42	×		0.63	×	0.7		=	57.32	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x	2	8.07	x		0.63	×	0.7		= [49.41	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	2	8.07	x		0.63	×	0.7		= [31.91	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		14.2	İ x		0.63	×	0.7		= [24.99	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x	· ·	14.2	x		0.63	×	0.7		= [16.14	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	5.7	6	x		9.21	x		0.63	×	0.7		= [16.22	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	1.8	6	x		9.21] ×		0.63	×	0.7		=	10.48	(75)
	_									-						_		
Solar g	ains in	watts, ca	alculat	ed	for eacl	n mont	h		i	(83)m	1 = SI	um(74)m .	<mark>(82)</mark> m					
(83)m=	32.69	66.54	119.8	8	196.88	264.65	5 2	82.14	263.94	210	.42	146.08	81.32	2 41.13	26	6.7		(83)
Total g	ains – i	nternal a	and so	lar	(84)m =	: (73)m	ı + (83)m	, watts						-			
(84)m=	401.75	433.61	475.1	1	533.14	581.83	5 5	80.88	550.68	502	2.7	448.1	402.4	9 384.25	38	6.1		(84)
7. Me	an inter	nal temp	peratu	те (heating	seaso	n)											
Temp	erature	during h	neating	j pe	eriods ir	the liv	/ing	area	from Tab	ole 9	, Th	1 (°C)				[21	(85)
Utilisa	ation fac	tor for g	ains fo	or li	ving are	a, h1,ı	n (s	ее Та	ble 9a)							L		
	Jan	Feb	Ма	r	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	t Nov	D)ec		
(86)m=	1	0.99	0.98		0.93	0.78	T	0.57	0.41	0.4	47	0.76	0.96	0.99		1		(86)
Mean	interna	l temper	ature	in li	iving are	ea T1 (follo	ow ste	ps 3 to 7	7 in T	able	e 9c)						

(87)m= 20.25 20.35 20.54 20.79 20.95 21 21 21 20.97 20.76 20.46 20.23 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) 20.24 20.26 (88) (88)m= 20.24 20.24 20.25 20.25 20.26 20.26 20.25 20.25 20.25 20.24 Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89) 0.69 1 (89)m= 1 0.99 0.98 0.91 0.74 0.5 0.34 0.4 0.95 0.99

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) 19.23 (90) (90)m= 19.37 19.65 20 20.2 20.25 20.26 20.26 20.23 19.97 19.55 19.2 $fLA = Living area \div (4) =$ (91) 0.38

Mean internal temperature (for the whole dwelling) = $f(A \times T1 + (1 - f(A) \times T2))$

Incall	interna	i temper				iiiiig) – ii		· (<u>, , , , , , , , , , , , , , , , , , , </u>			
(92)m=	19.62	19.75	19.99	20.3	20.49	20.54	20.54	20.54	20.51	20.27	19.9	19.6

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

(93)m=	19.62	19.75	19.99	20.3	20.49	20.54	20.54	20.54	20.51	20.27	19.9	19.6		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	mperatur using Ta	re obtain Ible 9a	ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.98	0.92	0.75	0.53	0.37	0.43	0.72	0.95	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	399.94	430	464.37	488.21	437.07	306.21	204.39	214.17	321.28	381.56	380.43	384.74		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	817.73	790.59	716.53	599.05	460.76	308.14	204.54	214.53	334.17	506.96	673.72	814.1		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	310.84	242.31	187.61	79.81	17.62	0	0	0	0	93.29	211.16	319.44		1
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1462.09	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								22.42	(99)
9b. En	ergy rec	luiremer	nts – Cor	mmunity	heating	scheme)							
This pa	art is use	ed for sp	ace hea	iting, spa	ace cooli	ing or wa	ater hea	ting prov	ided by	a comm	unity sch	neme.		-
Fractio	n of spa	ice heat	from se	condary	/supplen	nentary l	heating	(Table 1	1) '0' if n	one			0	(301)
Fractio	n of spa	ice heat	from co	mmunity	' system	1 – (301	1) =						1	(302)
The com	nmunity so	heme mag	y obtain he	eat from se	everal sour	rces. The p	procedure	allows for	CHP and i	up to four o	other heat	sources; tl	he latter	
Fractio	n of hea	at from C	ommun	ity heat	pump	rom powei	r stations.	See Appel	naix C.			[1	(303a)
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump	C			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commi	unity hea	ating sys	tem		ĺ	1	(305)
Distrib	ution los	s factor	(Table 1	l2c) for c	commun	ity heatii	ng syste	m					1.05	(306)
Space	heating	a											kWh/year	1
Annual	space	heating	requiren	nent								[1462.09]
Space	heat fro	m Comr	nunity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) =	-	1535.2	(307a)
Efficier	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	require	ment fro	m secon	dary/sup	oplemen	tary sys	tem	(98) x (30	01) x 100 -	+ (308) =	[0	(309)
Water Annual	heating I water h	l neating r	equirem	ent								I	1868.57	1
If DHW	/ from c	ommunit	ty schem	ne:								l]
Water	heat fro	m Comn	nunity he	eat pump	0				(64) x (30	03a) x (30	5) x (306) =	=	1962	(310a)
		tor hea			<u> </u>			0.01	× [(307a).	(307e) +	(310a)(310e)] =	34.97	$\left \begin{pmatrix} 313 \\ 214 \end{pmatrix} \right $
Space		ii ⊏iieig			U a evetor	, if not a	antor 0		= (107) ·	(314) -		l	0	(314) (315)
Space	cooning		is a lixe		y systell	i, ii 1101 €			-(107) -	(314) -		l	U	(313)
Electric mecha	city for p nical ve	oumps aintilation	nd fans v - balanc	within dw ced, extra	velling (1 act or po	able 4f) sitive in	: put from	outside				[0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating				Γ	0	(330g)
Total electricity for the above, kWh/ye	ear	=(330a) + (330b) + (330g) =	Ē	0	(331)
Energy for lighting (calculated in App	endix L)			Ē	311.36	(332)
Total delivered energy for all uses (3	07) + (309) + (310	0) + (312) + (315) + (331) + (332	2)(237b) =	Γ	3808.55	(338)
12b. CO2 Emissions – Community he	eating scheme					
		Energy kWh/year	Emission facto kg CO2/kWh	or Ei kç	missions g CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)	d water heating (r If there i	not CHP) is CHP using two fuels repeat (363) to (366) for the second	fuel	401	(367a)
CO2 associated with heat source 1		[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	452.63	(367)
Electrical energy for heat distribution		[(313) x	0.52	=	18.15	(372)
Total CO2 associated with communit	y systems	(363)(366) + (368)(372))	=	470.78	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from imm	ersion heater or i	nstantaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and	water heating	(373) + (374) + (375) =			470.78	(376)
CO2 associated with electricity for pu	imps and fans wit	thin dwelling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for lig	hting	(332))) x	0.52	=	161.59	(379)
Total CO2, kg/year	sum of (376)(3	382) =			632.37	(383)
Dwelling CO2 Emission Rate					9.7	(384)
El rating (section 14)					92.31	(385)

		User E	Details:						
Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Num re Ver	ber: sion:		Versio	n: 1.0.5.59	
		Property	Address:	Kingsto	n Bridge	e 2BF TC	DP 65 AS	SHP	
Address :									
1. Overall dwelling dime	insions:	A	e (me 2)			arla 4 (ma)			
Ground floor		Are	a(m-)	(1a) x			(2a) =	176.04] (3a)
Total floor area TFA = (1)	a)+(1b)+(1c)+(1d)+(1e)+(1n)	65.2	(4)	2	1	(20)	170.04](00)
Dwelling volume		,,	00.2	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	176.04] (5)
2 Ventilation rate:							l], ,
2. Ventilation rate:	main se	econdary eating	other		total			m ³ per hour	
Number of chimneys		0 +	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins			, <u> </u>	2	x 1	0 =	20	(7a)
Number of passive vents	i			Γ	0	x 1	0 =	0	(7b)
Number of flueless gas fi	res				0	x 4	40 =	0	(7c)
							Air ch	anges per hou	- ır
Infiltration due to chimney	va fluce and fana - (6)	2)+(6b)+(7a)+(7b)+	70) -	F					יי ר
If a pressurisation test has b	ys, nues and fans – (00	d, proceed to (17).	otherwise c	ontinue fro	om (9) to ((16)	+ (5) =		
Number of storeys in th	he dwelling (ns)	a, proceed to (11),			, (0) 10 (10)	[0](9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber f	rame or 0.35 fo	r masonr	constru	uction		İ	0	(11)
if both types of wall are pl	resent, use the value correspondent of the second	conding to the grea	ter wall area	a (after					
If suspended wooden f	floor, enter 0.2 (unseal)	ed) or 0.1 (seale	ed), else (enter 0			[0	7(12)
If no draught lobby, en	ter 0.05, else enter 0		,					0	(13)
Percentage of windows	s and doors draught str	ripped						0	(14)
Window infiltration	-		0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate			(8) + (10) +	• (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cub	ic metres per ho	our per so	juare me	etre of e	nvelope	area	4	(17)
If based on air permeabil	ity value, then (18) = [(17	7) ÷ 20]+(8), otherw	ise (18) = (1	6)				0.31	(18)
Air permeability value applie	s if a pressurisation test has	been done or a de	gree air per	meability i	is being us	sed			-
Number of sides sheltere	;d		(20) = 1 - [) 075 v (1	9)1 =			2	(19)
Infiltration rate incorporat	ting chalter factor		(20) + [(21) = (18)	x(20) =	0)]		l	0.85] ⁽²⁰⁾] ₍₂₄₎
Infiltration rate modified f	ing sheller lactor		(21) (10)	x (20)			l	0.27	J ⁽²¹⁾
Jan Feb	Mar Apr Mav	Jun Jul	Aua	Sep	Oct	Nov	Dec		
Monthly average wind sp	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		
		I	<u> </u>			1			
vvind = actor (22a)m = (22a)m = (22a)m = 1.27 = 1.25	$2 \text{ Jin} \div 4$ 1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
						L <u>-</u>			

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
<u> </u>	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calcul If me	ate etteo echanica	ctive air al ventila	change	rate for t	he appli	cable ca	ise						0	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)) . othei	rwise (23b) = (23a)			0	(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,			0	(23c)
a) If	balance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a) m = (22	2b)m + ()	23b) × [1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	L Covery (N	MV) (24b)m = (22	1 2b)m + (2	23b)	1	1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	r positiv	ve input v	ventilatio	on from c	outside				1	
	if (22b)n	n < 0.5 ×	(23b), t	then (24)	c) = (23b); other	wise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft	0 51				
(24d)m=	17 (22D)n	n = 1, th	en (24a)	m = (22)		$\frac{1}{0.53}$	(40)m =	0.5 + [(2	20)m ² x	0.5]	0.54	0.55	1	(24d)
Effo				10.04	0.04	0.00	0.00	d) in hoy	(25)	0.54	0.34	0.55		(240)
(25)m=		0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55	1	(25)
(20)	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00]	()
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	lgs 1²	Net Ar A ,r	rea m²	U-valı W/m2	le K	A X U (W/I	()	k-value kJ/m²·l	e A K k	λХk (J/K
Windo	ws Type	e 1				5.76	x1	/[1/(1.2)+	0.04] =	6.6				(27)
Windo	ws Type	e 2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				9.48	3	34.64	4 X	0.18	= [6.24	ı آ			(29)
Roof				0		65.2	x	0.13		8.48	= i		\dashv	(30)
Total a	area of e	lements	, m²			109.3	2		I		L			(31)
Party v	wall					44.12	<u>2</u> X	0	= [0				(32)
Party f	loor					65.2			เ				\dashv	(32a)
* for win ** includ	dows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1,	/[(1/U-valu	e)+0.04] a	L Is given in	n paragraph	3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				25.57	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	6997.06	(34)
Therm	al mass	parame	ter (TMI	> = Cm ÷	⊦ TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi	ign assess	sments wh	ere the de	tails of the	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al brida	ad or a de	x Y) cal	culated i	usina Ar	nendix l	к						2 90	(36)
if details	s of therma	al bridaina	are not kr	own (36) =	= 0.05 x (3	1)							3.09	(30)
Total f	abric he	at loss		(- /			(33) +	(36) =			29.46	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.4	32.27	32.14	31.54	31.43	30.91	30.91	30.81	31.11	31.43	31.66	31.9		(38)
Heat tr	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	61.86	61.73	61.6	61	60.89	60.37	60.37	60.27	60.57	60.89	61.12	61.36		
										Average =	Sum(39)1	12 /12=	61	(39)

Heat lo	oss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.92	0.93	0.93	0.94	0.94		
Numbe	ar of day	re in mo	nth (Tab	le 1a)	1		1	1	,	Average =	Sum(40)1.	12 /12=	0.94	(40)
Numbe	lan	Feb	Mar	Δnr	May	lun	1.1	Δυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	1VIA y	30	31	Auy 31	30	31	30	31		(41)
(+1)11-	51	20	51	30	51	50	51	51	50	51	50	51		(++)
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13. A £ 13.	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	⁻ A -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. 9)	12		(42)
Annua Reduce not more	l averag the annua e that 125	je hot wa al average litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	84 f	.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)		-				
(44)m=	93.12	89.73	86.34	82.96	79.57	76.19	76.19	79.57	82.96	86.34	89.73	93.12		
Energy o	content of	^t hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	m x nm x L)))))))))))))))))))) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1015.8	(44)
(45)m=	138.09	120.77	124.63	108.65	104.25	89.96	83.36	95.66	96.8	112.82	123.15	133.73		
		1	1	1	1			1		Total = Su	m(45) ₁₁₂ =	-	1331.88	(45)
lf instant	taneous v	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)				I	
(46)m= Water	20.71 storage	18.12	18.69	16.3	15.64	13.49	12.5	14.35	14.52	16.92	18.47	20.06		(46)
Storag	e volum	ne (litres) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)
If comr	nunity ł	neating a	and no ta	ank in dw	velling, e	nter 110) litres in	(47)			L			. ,
Otherw	vise if n	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:		<i>.</i> .			<i>.</i>						I	
a) If m _	anufaci	turer's d	eclared I	oss facto	or is kno	wn (kvvi	n/day):				1	.2		(48)
Tempe	erature f	actor fro	m lable	20							0	.6		(49)
Energy	/ lost fro	om water	storage	e, KVVh/ye cylinder	ear loss fact	or is not	known:	(48) x (49) =		0.	72		(50)
Hot wa	iter stor	age loss	factor fi	rom Tabl	le 2 (kW	h/litre/da	ay)					0		(51)
If comr	munity ł	neating s	ee secti	on 4.3										
Volum	e factor	from Ta	ble 2a	01-								0		(52)
Tempe	erature t	actor fro	m Table	20								0		(53)
Energy	/ lost fro (50) or	m watei (54) in (#	storage	e, kvvh/ye	ear			(47) x (51) x (52) x (53) =	0	0		(54) (55)
Water	storage	loss cal	culated ·	for each	month			((56)m = (55) × (41)	m	0.	12		(00)
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	()
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	v circuit	loss (ar	nual) fr	u m Tabla	<u>،</u> ع	1		!		1		0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m		L		I	
(moo	dified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		I	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	lculated	for eac	h mon	h (61)m =	(60	0) ÷ 30	65 × (41))m							
(61)m=	0	0	0	0	0		0	0	0		0	0	0	0]	(61)
Total h	leat req	uired for	water I	neating	calculate	d fo	or eac	h month	(62)m	า = (0.85 × ((45)m ·	+ (46)m +	(57)m +	- (59)m + (61)m	
(62)m=	183.67	161.94	170.21	152.7	6 149.84	1	34.08	128.95	141.2	24	140.92	158.4	167.26	179.31]	(62)
Solar Dł	-IW input	calculated	using Ap	pendix (or Append	хH	(negati	ve quantity	/) (ente	r '0' i	if no solai	r contrib	ution to wate	er heating)	
(add a	dditiona	al lines if	FGHR	S and/o	r WWHR	S a	pplies	, see Ap	pendi	x G)					
(63)m=	0	0	0	0	0		0	0	0		0	0	0	0]	(63)
Output	from w	ater hea	ter		-									-	-	
(64)m=	183.67	161.94	170.21	152.7	6 149.84	1	34.08	128.95	141.2	24	140.92	158.4	167.26	179.31]	
		•							C)utpu	ut from wa	ater hea	er (annual)	112	1868.57	(64)
Heat g	ains fro	m water	heating	g, kWh	month 0.2	25 ´	[0.85	× (45)m	ı + (61)m]	+ 0.8 x	((46)r	n + (57)m	+ (59)n	ן ו	
(65)m=	82.38	73.09	77.9	71.4	2 71.13	Т	65.2	64.18	68.2	7	67.48	73.98	76.24	80.93	ſ	(65)
inclu	ude (57)	m in calo	ulation	of (65)m only if	cvli	nder i	s in the o	dwellir	na o	or hot w	ater is	from com	munity	_ heating	
5. Inf	ernal g	ains (see	e Table	5 and	5a):	,				U				,	5	
Motab	olic gair	ne (Table	5) Wa	otte												
Melab	Jan	Feb	<u>, 0), wa</u> Mar		r Mav	Т	Jun	Jul	Au	a	Sep	Oct	Nov	Dec	1	
(66)m=	106.21	106.21	106.21	106.2	1 106.21	1	06.21	106.21	106.2	21	106.21	106.2	106.21	106.21	-	(66)
Lightin	n nains	l (calcula	L ted in A	I	ix Lequa	tion	190	l rl9a)a	l Iso se	E T	able 5	I			1	
(67)m=	17 63	15 66	12 73	9.64	7 21	T	6.08	6 57	8 55		11 47	14 56	17	18 12	1	(67)
Applia							tion	12 or 1 1	30) 0		200 Tol]	
	195.95					Jua T₁		13 UI LI	3a), a		141 07		165.37	177.65	Г	(68)
(00)III-				\		'	~ 1 4 F	071450				F	103.37	111.00]	(00)
COOKI	ig gains				IX L, equa		n L15), aiso	see		5	00.00	00.00	1	(60)
(69)11-	33.02	. 33.02	(33.0	2 33.02	<u> </u>	33.02	33.02	33.0	2	33.02	33.02	33.02	33.02		(09)
Pumps	and fa	ns gains	(Table	5a)		-		<u> </u>		-1	-		1.		-	(70)
(70)m=	0	0	0	0	0		0	0	0		0	0	0	0		(70)
Losses	s e.g. ev	vaporatio	on (nega	ative va	alues) (Ta	ble	5)	•					-		7	
(71)m=	-84.97	-84.97	-84.97	-84.9	7 -84.97	-	84.97	-84.97	-84.9	7	-84.97	-84.97	-84.97	-84.97		(71)
Water	heating	gains (T	able 5)	-							-	-		-	
(72)m=	110.73	108.77	104.71	99.1	9 95.61	9	90.56	86.27	91.7	7	93.72	99.43	105.88	108.78		(72)
Total i	nterna	gains =					(66))m + (67)m	n + (68)	m +	(69)m + ((70)m +	(71)m + (72)m	_	
(73)m=	369.07	367.07	355.22	336.2	6 317.18	2	298.74	286.74	292.2	28	302.02	321.17	343.12	359.41		(73)
6. So	lar gain	s:														
Solar g	ains are	calculated	using sol	ar flux fr	om Table 6a	anc	d assoc	iated equa	itions to	o con	vert to th	e applic	able orienta	tion.		
Orienta	ation:	Access F	actor	Ar	ea		Flu			т	g_		FF		Gains	
	-	Table 60		n 	I-			ble ba		Ta			Table oc		(VV)	_
Northea	ast <mark>0.9x</mark>	0.77	1	×	5.76	x	1	1.28	×		0.35	x	0.7	=	11.03	(75)
Northea	ast <mark>0.9x</mark>	0.77		<	1.86	x	1	1.28	×		0.35	×	0.7	=	7.13	(75)
Northea	ast <mark>0.9x</mark>	0.77		<	5.76	x	2	22.97	×		0.35	×	0.7	=	22.46	(75)
Northea	ast <mark>0.9x</mark>	0.77		ĸ	1.86	x	2	22.97	x		0.35	×	0.7	=	14.51	(75)
Northea	ast <mark>0.9x</mark>	0.77	1	K	5.76	x	4	1.38	x		0.35	x	0.7	=	40.47	(75)

Northeast	0.9x	0.77		x	1.8	6	x	4	1.38	x	C).35	x	0.7] = [26.13	(75)
Northeast	0.9x	0.77		x	5.7	6	×	6	67.96	x	C).35	×	0.7] = [66.46	(75)
Northeast	0.9x	0.77		x	1.8	6	×	6	67.96	x	C).35	×	0.7] = [42.92	(75)
Northeast	0.9x	0.77		x	5.7	6	×	g	91.35	×	C).35	×	0.7		=	89.33	(75)
Northeast	0.9x	0.77		x	1.8	6	x	g	91.35	x	C).35	×	0.7		=	57.69	(75)
Northeast	0.9x	0.77		x	5.7	6	×	g	97.38	×	C).35	×	0.7		=	95.24	(75)
Northeast	0.9x	0.77		x	1.8	6	×	9	97.38	x	C).35	×	0.7] = [61.51	(75)
Northeast	0.9x	0.77		x	5.7	6	×		91.1	x	C).35	×	0.7		=	89.09	(75)
Northeast	0.9x	0.77		x	1.8	6	x		91.1	x	C).35	×	0.7		=	57.54	(75)
Northeast	0.9x	0.77		x	5.7	6	x	7	2.63	x	C).35	×	0.7] = [71.03	(75)
Northeast	0.9x	0.77		x	1.8	6	×	7	2.63	x	C).35	×	0.7		=	45.87	(75)
Northeast	0.9x	0.77		x	5.7	6	×	5	50.42	x	C).35	×	0.7] =	49.31	(75)
Northeast	0.9x	0.77		x	1.8	6	x	5	50.42	x	C).35	×	0.7] = [31.85	(75)
Northeast	0.9x	0.77		x	5.7	6	×	2	28.07	x	C).35	×	0.7		=	27.45	(75)
Northeast	0.9x	0.77		x	1.8	6	×	2	28.07	x	C).35	×	0.7] = [17.73	(75)
Northeast	0.9x	0.77		x	5.7	6	×		14.2	×	C).35	×	0.7		=	13.88	(75)
Northeast	0.9x	0.77		x	1.8	6	×		14.2	x	C).35	×	0.7] =	8.97	(75)
Northeast	0.9x	0.77		x	5.7	6	x		9.21	x	C).35	×	0.7		=	9.01	(75)
Northeast	0.9x	0.77		x	1.8	6	×		9.21	x	C).35	x	0.7] = [5.82	(75)
Solar gai	ns in	watts, ca	alcula	ted	for each	n mont	th			(83)m	n = Sum	n(74)m	.(82)m				1	
(83)m= 1	18.16	36.97	66.	6	109.38	147.03	3 1	56.75	146.63	116	6.9	81.16	45.18	22.85	14	1.83		(83)
Total gai	ns – i	nternal a	ind so	olar	(84)m =	: (73)n	1 + (83)m	, watts								1	
(84)m= 3	87.23	404.03	421.	82	445.64	464.2	1 4	55.49	433.37	409	.18 3	883.17	366.35	365.97	37	4.24		(84)
7. Mean	n inter	nal temp	oeratu	ure (heating	seasc	on)											
Temper	ature	during h	eatin	ig pe	eriods in	the liv	ving	area	from Tab	ole 9	, Th1 ((°C)					21	(85)
Utilisatio	on fac	tor for ga	ains f	for li	ving are	a, h1,	m (s	ее Та	ıble 9a)									

					, ,	`	/							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.93	0.78	0.6	0.66	0.89	0.98	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	20.03	20.12	20.29	20.55	20.8	20.95	20.99	20.99	20.89	20.59	20.27	20.02		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ible 9, Ti	n2 (°C)					
(88)m=	20.13	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.97	0.9	0.7	0.49	0.54	0.84	0.98	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	ps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.83	18.95	19.21	19.58	19.92	20.11	20.14	20.14	20.04	19.65	19.19	18.81		(90)
									f	LA = Livin	g area ÷ (4	l) =	0.38	(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m= 19.29 19.4 19.62 19.95 20.26 20.43 20.47 20.46 20.37 20.01 19.6 19.27 (92)							• /							_
	(92)m=	19.29	19.4	19.62	19.95	20.26	20.43	20.47	20.46	20.37	20.01	19.6	19.27	(92)

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

(93)m=	19.29	19.4	19.62	19.95	20.26	20.43	20.47	20.46	20.37	20.01	19.6	19.27		(93)
8. Sp	ace hea	ting requ	uirement					•						
Set T the ut	i to the r ilisation	mean int factor fo	ernal ter or gains	nperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:										
(94)m=	1	0.99	0.99	0.97	0.9	0.73	0.53	0.59	0.85	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m=	385.89	401.98	417.43	432.01	418.15	331.72	230.82	240.35	326.72	356.72	363.55	373.18		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	927.31	894.93	808.35	674.27	521.11	352.15	233.49	244.99	379.53	572.95	764.16	924.7		(97)
Space	e heating	g require	ement fo	r each m	nonth, k\	Wh/mont	th = 0.02	24 x [(97])m – (95)m] x (4 ⁻	1)m			
(98)m=	402.81	331.26	290.85	174.43	76.6	0	0	0	0	160.88	288.45	410.33		1
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	2135.61	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								32.75	(99)
9b. En	b. Energy requirements – Community heating scheme his part is used for space heating, space cooling or water heating provided by a community scheme.													
This pa	art is use	ed for sp	ace hea	ting, spa	ace cooli	ng or wa	ater heat	ting prov	ided by	a comm	unity sch	neme.		
Fractio	on of spa	ace heat	from se	condary/	supplen	nentary l	neating ((Table 1 ⁻	1) '0' if n	one			0	(301)
Fractio	Fraction of space heat from community system 1 – (301) = 1 (302) The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter 1													
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.														
Includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community heat pump Fraction of total space heat from Community heat pump (202) x (2022) = (202) x (202) = (202) x (202)														(303a)
Fractio	on of tota	al space	heat fro	m Comm	nunity he	eat pump	0			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commı	unity hea	iting sys	tem		ĺ	1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	commun	ity heatir	ng syste	m					1.05	(306)
Space	heating	9										-	kWh/year	•
Annua	l space	heating	requirem	nent									2135.61]
Space	heat fro	om Comr	nunity h	eat pum	ρ				(98) x (30	04a) x (30	5) x (306) =	-	2242.39	(307a)
Efficier	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	require	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 -	+ (308) =		0	(309)
Water Annua	heating I water h	j neating r	equirem	ent								I	1868.57	1
If DHW Water	/ from co	ommunii m Comn	ty schem	ne:	N				(64) x (3(13a) x (30)	5) x (306) :	ا = ا	1962]](310a)
Flectri		d for boo	t dietrib	ution	,			0.01	x [(307a)	(3070) +	(310a)	3100)1 -	1302	(313)
	a Sveter	n Enera	v Efficier	ncv Rati	h			0.01	∽ [(JU/a).	(3078) +	(JIUA)(<u>510e)]</u> =	42.04 0	(314)
Space	coolina	(if there	is a fixe	d cooline	- a system	n, if not e	enter 0)		= (107) ÷	(314) =		l	0	(315)
Flectri	city for n		nd fane v	within du	elling (7	ahlo (f)			. /			l	-]` ′
mecha	nical ve	ntilation	- balanc	ed, extra	act or po	sitive in	put from	outside					0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/yea	r	=(330a) + (330	b) + (330g) =	Γ	0	(331)
Energy for lighting (calculated in Apper	dix L)			Ē	311.36	(332)
Total delivered energy for all uses (307) + (309) + (310) +	· (312) + (315) + (331) + (33	32)(237b) =	Γ	4515.74	(338)
12b. CO2 Emissions – Community hea	ting scheme					
		Energy kWh/year	Emission facto kg CO2/kWh	or Eı kç	nissions g CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)	vater heating (not If there is Cl	CHP) HP using two fuels repeat (363) to	(366) for the second	fuel	401	(367a)
CO2 associated with heat source 1	I	(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	544.16	(367)
Electrical energy for heat distribution		[(313) x	0.52	=	21.82	(372)
Total CO2 associated with community	systems	(363)(366) + (368)(372	2)	=	565.98	(373)
CO2 associated with space heating (se	condary)	(309) x	0	=	0	(374)
CO2 associated with water from immer	sion heater or inst	antaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and v	vater heating	(373) + (374) + (375) =			565.98	(376)
CO2 associated with electricity for pum	ps and fans within	dwelling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for light	ing	(332))) x	0.52	=	161.59	(379)
Total CO2, kg/year	sum of (376)(382)	=			727.57	(383)
Dwelling CO2 Emission Rate					11.16	(384)
El rating (section 14)					91.15	(385)

Assessor Name: Stroma FSAP 2012 Software Version: Version: 1.0.5.59 Property Address: Kingston Bridge 3BF GND 83 ASHP Address : 1. Overall dwelling dimensions: Ground floor Area (TA)+(1b)+(1c)+(1d)+(1e)+,(1n) Area(m ²), Av. Height(m) Volume(m ³), 2.7 (2a) = 224.1 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+,(1n) Area(m ²), Av. Height(m) (3a)+(3a)+(3a)+(3a)+(3a)+(3a)+(3a)+(3a)+		User Details:														
Property Address: Kingston Brage 3BF GND 83 ASHP Address: I. Overall dwelling dimensions: Area(m ²) Av. Height(m) Volume(m ²) Ground floor Area(m ²) Av. Height(m) Volume(m ²) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 83 (1a) x 2.7 (2a) = C224.1 (3a) Dowelling volume Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colsp	Assessor Name: Software Name:	Stroma FSAP 201	2	Stroma Softwa	a Numi ire Ver	ber: sion:		Versio	n: 1.0.5.59							
Address : 1. Overall dwelling dimensions: Ground floor Ground floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 83 (1a) x 2.7 (2a) = 224.1 (3a) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 224.1 (5) 2. Ventilation rate: main secondary other total m³ per hour Number of chimneys 0 + 0 = 0 x40 = 0 (6a) Number of open flues 0 + 0 = 0 x40 = 0 (6b) Number of passive vents 0 x10 = 20 (7a) Number of flueless gas fires 0 x40 = 0 (7c) Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = + (5) =			Property	Address:	Kingsto	n Bridge	e 3BF GI	ND 83 A	SHP							
Area(m ²) Ave. Height(m) Volume(m ³) Ground floor 83 (1a) x 2.7 (2a) = 224.1 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 83 (4) (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 224.1 (6) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 224.1 (6) Image: the secondary interval of the secondary interv	Address :	ncione:														
Area (iii)Voltarie (iii)Ground floor83(1a) x2.7(2a) =224.1(3a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)83(4)Dwelling volume(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =224.1(5) 2. Ventilation rate: (3a)+(3b)+(3c)+(3d)+(3e)+(3n) =224.1(5)Number of chimneys0+0=0x40 =0(6a)Number of open flues0+0=0x20 =0(6b)Number of intermittent fans2x10 =20(7a)Number of flueless gas fires0x40 =0(7c)Number of flueless gas fires0x40 =0(7c)Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =+ (6) =(6b)Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =+ (6) =(9)Infiltration(10)(10)(10)Structural infiltration:0.25 for steel or timber frame or 0.35 for masonry construction(10)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35(12)If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00(12)If no draught lobby, enter 0.05, else enter 00(13)		1510115.	Arc	a(m²)			iaht(m)		Volume(m ³)							
ConstructionConstructionConstructionTotal floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)83(4)Development of the set o	Ground floor			83	(1a) x		911(11) 7	(2a) =	224 1](3a)						
Total hold alled TYTE (16) (16) (16) (16) (16) (16) (16) (16)	Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	2)+ (1n)	02	(4)											
2. Ventilation rate:main heating 0secondary heating +other 0totalm³ per hour 0Number of chimneys 0 + 0 + 0 = 0 x40 = 0 (6a)Number of open flues 0 + 0 + 0 = 0 x20 = 0 (6b)Number of intermittent fans 2 x10 = 20 (7a)Number of passive vents 0 x10 = 0 (7c)Number of flueless gas fires 0 x40 = 0 (7c)Number of flueless gas fires 0 x40 = 0 (7c)Number of storeys in the dwelling (ns) $Additional infiltration(9)-1]x0.1 =0(10)Additional infiltration:0.25 for steel or timber frame or 0.35 for masonry constructionif both types of wall are present, use the value corresponding to the greater wall area (afterdeducting areas of openings); if equal user 0.3500(12)If no draught lobby, enter 0.05, else enter 00(12)0(12)If no draught lobby, enter 0.05, else enter 00(13)$			<i>,</i>),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	03	(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	224.1							
2. Ventilation rate: main heating secondary heating other total m³ per hour Number of chimneys 0 $+$ 0 $+$ 0 $=$ 0 $x40 =$ 0 (6a) Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $x40 =$ 0 (6a) Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $x20 =$ 0 (6b) Number of intermittent fans 2 $x10 =$ 2 $x10 =$ 0 (7b) Number of passive vents 0 $x10 =$ 0 (7c) Number of flueless gas fires 0 $x40 =$ 0 (7c) Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) = $+$ $+$ 0 0 (7c) Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $+$ $+$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0					(, (,		., (,		224.1							
Interting heatingChickChickChickImportanceNumber of chimneys 0 $+$ 0 $+$ 0 $=$ 0 $x40 =$ 0 (6a)Number of open flues 0 $+$ 0 $=$ 0 $x20 =$ 0 (6b)Number of intermittent fans 2 $x10 =$ 20 (7a)Number of passive vents 0 $x10 =$ 0 (7c)Number of flueless gas fires 0 $x40 =$ 0 (7c)Number of flueless gas fires 0 $x40 =$ 0 (7c)Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) =$ $+$ $(5) =$ (6) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) (9) (9) Additional infiltration (9) (11) 0 (11) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (9) (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 (12) 0 (12) If no draught lobby, enter 0.05 , else enter 0 0 (12) 0 (13)	2. Ventilation rate:	main s	econdary	other		total			m ³ per hour							
Number of chimneys 0 $+$ 0 $+$ 0 $=$ 0 $x40$ $=$ 0 $6a$ Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $x40$ $=$ 0 $6a$ Number of intermittent fans 2 $x10$ $=$ 20 $(7a)$ Number of passive vents 0 $x10$ $=$ 0 $(7c)$ Number of flueless gas fires 0 $x40$ $=$ 0 $(7c)$ Number of flueless gas fires 0 $x40$ $=$ 0 $(7c)$ Number of storeys, flues and fans = $(6a)+(6b)+(7a)+(7c)$ $+$ (5) $=$ If a pressurisation test has been carried out or is intended, proceed to (17) , otherwise continue from (9) to (16) a a Number of storeys in the dwelling (ns) a a a a a Additional infiltration (9) (10) (10) (11) a (11) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11) (11) (11) i 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 (12) (13) If no draught lobby, enter 0.05 , else enter 0 0 (13)		heating h	neating	ounor	. –	totai				-						
Number of open flues 0 $+$ 0 $+$ 0 $=$ 0 $\times 20$ $=$ 0 $(6b)$ Number of intermittent fans 2 $\times 10$ $=$ 20 $(7a)$ Number of passive vents 0 $\times 10$ 0 $(7b)$ Number of flueless gas fires 0 $\times 40$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c)$ $+$ $+$ (5) $=$ If a pressurisation test has been carried out or is intended, proceed to (17) , otherwise continue from (9) to (16) 0 (9) Number of storeys in the dwelling (ns) 0 (9) (9) (10) Additional infiltration (9) (10) (11) (10) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11) (11) <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user $0.35$$0$$(12)$If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter $0$$0$$(12)$If no draught lobby, enter 0.05, else enter $0$$0$$(12)$If no draught lobby, enter 0.05, else enter $0$$0$$(13)$</i>	Number of chimneys	0 +	0 +	0		0	X 4	40 =	0	(6a)						
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Number of passive vents 0 $x 10 =$ 0 $(7b)$ Number of flueless gas fires 0 $x 40 =$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) =$ $+ (5) =$ $+ (5) =$ $+ (5) =$ If a pressurisation test has been carried out or is intended, proceed to (17) , otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) 0 (9) Additional infiltration $(9)-1]x0.1 =$ 0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 0 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05 , else enter 0 0 (13)	Number of intermittent far	าร				2	x ^	10 =	20	(7a)						
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<th column="" of="" second="" second<="" td="" the=""><td></td><td colspan="14">Air changes per hour</td></th>	<td></td> <td colspan="14">Air changes per hour</td>		Air changes per hour													
Infiltration due to chimneys, flues and fans = $(6a)^{+}(6b)^{+}(7a)^{+}(7b)^{+}(7c)^{-1}$ + (5) = <i>If a pressurisation test has been carried out or is intended, proceed to</i> (17), <i>otherwise continue from</i> (9) <i>to</i> (16) Number of storeys in the dwelling (ns) Additional infiltration [(9)-1]x0.1 = 0 (10) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); <i>if equal user 0.35</i> If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 <i>f</i> no draught lobby, enter 0.05, else enter 0 0 (12) <i>f</i> no draught lobby, enter 0.05, else enter 0</i>	le f ille e tiere de la biere e		·-) · (0h) · (7-) · (7h) ·	(7-) -	_				anges per no							
If a pressure allow each of its intended, proceed to (17), otherwise contribute from (9) to (10)Number of storeys in the dwelling (ns)Additional infiltrationStructural infiltration: 0.25 for steel or timber frame or 0.35 for masonry constructionif both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00011013	Inflitration due to chimney	/s, flues and fans = (0)	$(00)^+(70)^+(70)^+(70)^+$	(70) =	ontinuo fr	$\frac{1}{2}$	(16)	÷ (5) =								
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13)	Structural infiltration: 0.	25 for steel or timber	frame or 0.35 fo	or masonr	y constru	uction			0	– (11)						
deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 0 (13)	if both types of wall are pro	esent, use the value corres	ponding to the grea	ter wall area	a (after			ľ		_						
If no draught lobby, enter 0.05, else enter 0 0 (13)	If suspended wooden fl	gs); if equal user 0.35	led) or 0 1 (seal	ed) else (onter ()				0	7(12)						
	If no draught lobby, ent	er 0.05, else enter 0							0	$\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$						
Percentage of windows and doors draught stripped	Percentage of windows	and doors draught st	tripped						0							
Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)	Window infiltration	Ū		0.25 - [0.2	x (14) ÷ 1	00] =			0](15)						
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)	Infiltration rate			(8) + (10) +	- (11) + (1	2) + (13) -	+ (15) =		0	(16)						
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17)	Air permeability value,	q50, expressed in cub	pic metres per h	our per so	juare me	etre of e	nvelope	area	4	(17)						
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$ 0.29 (18)	If based on air permeabili	ty value, then (18) = [(1	7) ÷ 20]+(8), otherw	/ise (18) = (*	16)				0.29	(18)						
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	Air permeability value applies	s if a pressurisation test has	s been done or a de	gree air per	meability i	is being u	sed			_						
Number of sides sheltered 2 (19) Chalter factor (20) = 1 (0.075 x (10)) =	Number of sides sheltered	d		(20) - 1	0 075 v (1	0)1 -			2	(19)						
Sheller factor $(20) = 1 - [0.073 \times (19)] = 0.85$ (20)	Sheller lactor	na chaltar factor		(20) = 1 - [1]	y (20) -	9)] –			0.85	_(20)						
Infiltration rate modified for monthly wind encod	Infiltration rate modified for	ng sheller lactor	J	(21) - (10)	x (20) -				0.25	(21)						
Inflitration rate modified for monthly wind speed		Mar Apr May			Son	Oct	Nov	Dee								
Jan Feb Mai Api May Jun Ju Aug Sep Oct Nov Dec			Jun Jui	Aug	Sep	Oci	INOV	Dec								
Nonthly average wind speed from Table /	wonthly average wind spe		20 00			4.2	A E	A 7								
	(22)111- 0.1 0	4.3 4.4 4.3	3.0 3.8	3.1	4	4.3	4.3	4./								
Wind Factor (22a)m = (22)m ÷ 4	Wind Factor (22a)m = (22	2)m ÷ 4														
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18	(22a)m= 1.27 1.25 1	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18								

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
Calculate effective air change rate for the applicable case 0 (23a) If mechanical ventilation: if exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23a) a) If balanced mechanical ventilation with heat recovery (MVHR) (24a) m = (22b)m + (23b) × [1 - (23c) + 100] 0		0.31	0.31	0.3	0.27	0.26	0.23	0.23	0.23	0.25	0.26	0.28	0.29		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	lf exh	aust air h	eat numn	using Ann	endix N (2	(23a) = (23a	a) × Fmv (e	equation (1	N5)) other	rwise (23h) = (23a)			0	
$ \begin{array}{c c} 1 \text{ (2b)} \\ \hline \text{(24)} \text{(24)} \\ \hline \text{(24)} \text{(25)} \\ \hline \text{(24)} \\ \hline \text{(24)} \\ \hline \text{(25)} \\ \hline \text{(24)} \\ \hline \text{(25)} \\ \hline \text{(26)} \\ \hline \text{(27)} \\ \hline \text{(28)} \\ \hline \text{(27)} \\ \hline \text{(28)} \\ \hline \text{(27)} \\ \hline \text{(28)} \\ \hline \text{(29)} \\ \hline \text{(21)} \\ \hline \text{(20)} \\ \hline \text$	lf bala	anced with	heat reco	overv: effic	ciency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(230)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	a) If	halance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	a)m = (22)	2h)m + (23h) x [1 - (23c)	÷ 1001	(200)
b) if balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24a)m=	0	0			0	0		0	0	0		0]	(24a)
$\begin{array}{c c} \label{eq:constraint} \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	b) If	balance	d mech	ı anical ve	L entilation	ı without	i heat rec	L Coverv (N	I //V) (24b))m = (22	1 2b)m + (;	1 23b)		1	
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)	c) If	whole h	use ex	tract ver	ntilation of	r positiv	input v	ventilatio	on from c	outside		1		1	
	í	if (22b)n	n < 0.5 >	‹ (23b) , †	then (24	c) = (23b); other	wise (24	c) = (22b	o) m + 0.	5 × (23b))			
d) if natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m ² x 0.5] (24d)m = 0.55 0.55 0.54 0.53 0.53 0.53 0.53 0.53 0.53 0.54 0.54 (24d) Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25)m = 0.55 0.55 0.55 0.54 0.53 0.53 0.53 0.53 0.53 0.53 0.54 0.54 (25) 3. Heat losses and heat loss parameter: ELEMENT Gross area (m ²) Openings Net Area U-value A X U K K-value K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/m ² -K K, J/K K, J/K V//K K, J/K K, J/K V//K K, J/M ² -K K, J/K K, J/K V//K K, J/K K, J/K V//K K, J/K K, J/K K, J/K V//K K, J/K K, J/K K, J/K K, J/K V//K K, J/K K, J/K V//K K, J/K K,	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
$ \begin{array}{c} (22b)m = 1, \ then (24d)m = (22b)m \ otherwise (24d)m = 0.5 + [(22b)m^2 \times 0.5] \\ (24d)m = 0.55 & 0.55 & 0.55 & 0.54 & 0.53 & 0.53 & 0.53 & 0.53 & 0.53 & 0.54 & 0.54 \\ \hline \\ Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) \\ (25)m = 0.55 & 0.55 & 0.54 & 0.53 & 0.53 & 0.53 & 0.53 & 0.53 & 0.54 & 0.54 \\ \hline \\ 3. Heat losses and heat loss parameter: \\ \hline \\ ELEMENT & Gross \\ area (m^2) & m^2 & A, m^2 & U-value \\ A, m^2 & W/m2K & (W/K) & K-value \\ A, m^2 & W/m2K & (W/K) & K-value \\ W/m0 ws Type 1 & 2.88 & x1f1/t (1.2) + 0.04] = 3.3 \\ \hline \\ Windows Type 2 & 1.36 & x1f1/t (1.2) + 0.04] = 2.13 \\ \hline \\ Windows Type 2 & 1.36 & x \ 0.13 & = 10.79 \\ \hline \\ Walls & 19.62 & 30.6 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.13 & = 10.79 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & 83 & x \ 0.18 & = 5.51 \\ \hline \\ Other & Waldws and rod windows, use effective window U-value calculated using formula 1/(1/U-value)+0.04] as given in paragraph 3.2 \\ ^{*} include the areas on both sides of internal walls and partitions \\ ^{*} Fabric heat loss, W/K = S (A \times U) \\ (26)(30) + (32) = \\ \hline \\ For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1! \\ con design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1! \\ cont details of thermal bridging are not known (36) = 0.05 x (31) \\ \hline Other Heat loss calculated monthly \\ \hline \\ Ventilation heat loss calculated monthly \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (39)m \\ \hline \\ \hline \\ Windews Type = (37) + (38)m \\ \hline $	d) lf	natural	ventilatio	on or wh	ole hous	se positiv	ve input	ventilatio	on from I	oft					
(240)m 0.53 0.53 0.53 0.53 0.53 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.55	(0.4.1)	if (22b)n	n = 1, th	en (24d))m = (22	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]	0.54	0.54	1	(244)
Effective air change rate - enter (24a) or (24c) or (24c) or (24d) in box (25) (25)m= 0.55 0.55 0.55 0.54 0.53 0.53 0.53 0.53 0.53 0.53 0.53 0.54 0.54 0.54 0.54 0.54 0.54 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.57 0.55	(240)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	J	(24u)
(2))// (2) (3.3)	Effe			rate - ei	1 ter (24a)	1) or (24t)	0) or (24)	c) or (24		(25)	0.52	0.54	0.54	1	(25)
3. Heat loss parameter: ELEMENT Gross area (m ²) Openings Met Area A.m ² U-value A X U (W/K) K-value kJ/m ² -K kJ/K Windows Type 1 2.88 x1(11(1.2)+0.04] = 3.3 (27) Windows Type 2 186 x1(11(1.2)+0.04] = 2.13 (27) Floor 83 x 0.13 = 10.79 (28) Windows Type 2 (28) x1(11(1.2)+0.04] = 2.13 (27) Floor 83 x 0.13 = 10.79 (28) Vindiagram of elements, m ² 133.22 (31) Party celling (32) 10 are of elements, m ² 0 (32) r/or windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ** * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (28)(30) + (32) = (33).76 (33)	(25)11-	0.55	0.55	0.55	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.54	J	(23)
ELEMENT Gross area (m ²) Openings m ² Net Area A, m ² U-value W/m2K A X U k-value kJ/m ² ·K A X k k/K Windows Type 1 2.88 x1/[1/(1.2)+0.04] = 3.3 (27) Windows Type 2 1.86 x1/[1/(1.2)+0.04] = 2.13 (27) Floor 83 x 0.13 = 10.79 (28) Walls 19.62 30.6 x 0.18 = 5.51 (29) Total area of elements, m ² 133.22 (31) (32) (32) Party wall 57.08 x 0 = 0 (32) (32) ** include the areas on both sides of internal walls and partitions 83 (26)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) = 38.76 (33) For design assessments where the dails of the construction are not known precisely the indicative values of TMP in Table 11 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative values of TMP in Table 11 (35) For design assessments where the dails of the construction are not known precisely the indicative values of TMP in Table 11 <t< td=""><td>3. He</td><td>at losse</td><td>s and he</td><td>eat loss</td><td>paramet</td><td>er:</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	3. He	at losse	s and he	eat loss	paramet	er:									
Windows Type 1 2.88 $x1[11/(1.2) + 0.04] = 3.3$ (27) Windows Type 2 1.86 $x1[11/(1.2) + 0.04] = 2.13$ (27) Floor 83 $x 0.13 = 10.79$ (28) Walls 19.62 30.6 $x 0.13 = 10.79$ (28) Walls 19.62 30.6 $x 0.13 = 5.51$ (29) Total area of elements, m ² 133.22 (31) (32) Party wall 57.08 $x 0 = 0$ (32) Party ceiling 83 (30) (32) (32) (32) (32) (33) (33) (26)(30) + (3	ELEN	IENT	Gros area	ss (m²)	Openin rr	igs າ²	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	<)	k-value kJ/m²·∣	e A K k	λXk ⟨J/Κ
Windows Type 2 1.86 $x1[1/(1.2) + 0.04] = 2.13$ (27) Floor 83 x 0.13 = 10.79 (28) Walls 19.62 30.6 x 0.18 = 5.51 (29) Total area of elements, m ² 133.22 (31) (31) Party wall 57.08 x 0 $=$ 0 (32) Party ceiling 83 0 $=$ 0 (32) (32) * include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = (33) (32) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32)(32) + (32)(32e) = 15941.96 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) can be used instead of a detailed calculated using Appendix K (9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = 0.33 x	Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Floor 83 x 0.13 = 10.79 (28) Walls 19.62 30.6 x 0.18 = 5.51 (29) Total area of elements, m ² 133.22 (31) (31) (32) (32) Party wall 57.08 x 0 = 0 (32) Party ceiling 83 (32) (32) (32) (32) * for windows and roof windows, use effective window U-value calculated using formula 1/(1/U-value)+0.04] as given in paragraph 3.2 ** ** * include the areas on both sides of internal walls and partitions (26)(30) + (32) = (38.76 (33) Heat capacity Cm = S(A x k) (26)(30) + (32) = (38.76 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (34) Thermal bridges : S (L x Y) calculated using Appendix K (9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) (33) + (36) = (48.03 (37) Ventilation heat loss calculated monthly<	Windo	ws Type	2				1.86	x1	/[1/(1.2)+	0.04] =	2.13				(27)
Walls19.62 30.6 x 0.18 = 5.51 (29)Total area of elements, m2133.22(31)Party wall 57.08 x 0 =(32)Party ceiling 83 (32)* for windows and roof windows, use effective window U-value calculated using formula $1/(1/U-value)+0.04$ as given in paragraph 3.2(32)** include the areas on both sides of internal walls and partitions(26)(30) + (32) = 38.76 Fabric heat loss, W/K = S (A x U)(26)(30) + (32) = 38.76 (33)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) = 15941.96 (34)Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium 250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f 250 (35)can be used instead of a detailed calculation. 9.26 (36)Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ $(33) + (36) =$ 48.03 (37)Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ $(38)m = 0.33 \times (25)m \times (5)$ $(38)m = (37) + (38)m$ (39)m= 88.64 88.49 88.66 87.71 87.59 87.02 86.91 87.24 87.59 87.71 (39)m= 88.64 88.49 88.66 87.71 87.59 87.02 86.91 87.24 87.59 87.71 (730) <td>Floor</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>83</td> <td>x</td> <td>0.13</td> <td>=</td> <td>10.79</td> <td></td> <td></td> <td></td> <td>(28)</td>	Floor						83	x	0.13	=	10.79				(28)
Total area of elements, m ² Total area of elements, m ² Party wall Party wall 33.22 32.2 33.22 32.2 33.22 32.2 33.22 32.2 33.22 32.2 33.22 33.22 32.2 33.22 32.2 33.22 32.2 33.22 32.2 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 33.22 32.2	Walls				19.6	2	30.6	x	0.18	=	5.51				(29)
Party wall 57.08 x 0 $=$ 0 (32) Party ceiling 83 $(32b)$ * for windows and roof windows, use effective window U-value calculated using formula $1/(1/U-value)+0.04$] as given in paragraph 3.2** include the areas on both sides of internal walls and partitionsFabric heat loss, $W/K = S (A \times U)$ $(26)(30) + (32) =$ 38.76 (33) Heat capacity Cm = $S(A \times k)$ $((28)(30) + (32) + (32a)(32e) =$ 15941.96 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² KIndicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1fcan be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36) (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly $(33) + (36) =$ 48.03 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ (38)m 40.61 40.47 40.33 39.68 39.56 38.99 38.89 39.21 39.56 39.89 (38) Heat transfer coefficient, W/K(39)m $(37) + (38)m$ (39)m $(39)m = (37) + (38)m$ (39)m $(39)m = (37) + (38)m$	Total a	rea of e	lements	, m²			133.2	2							(31)
Party ceiling83(32b)* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2(32b)** include the areas on both sides of internal walls and partitionsFabric heat loss, W/K = S (A x U)(26)(30) + (32) =38.76(33)Heat capacity Cm = S(A x k)((28)(30) + (32) + (32a)(32e) =15941.96(34)Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium250(35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.9.26(36)Thermal bridges : S (L x Y) calculated using Appendix K9.26(36)if details of thermal bridging are not known (36) = 0.05 x (31)(33) + (36) =48.03(37)Ventilation heat loss calculated monthly(38)m = 0.33 x (25)m x (5)(38)(38)m =40.6140.4740.3339.6839.5638.9938.9938.9339.2139.5639.8140.06(38)Heat transfer coefficient, W/K(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (32)m	Party v	vall					57.08	3 X	0	=	0				(32)
* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 15941.96 (34) Thermal mass parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5) (38)m = $40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38)$ Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = $88.64 88.49 88.36 87.71 87.59 87.02 87.02 86.91 87.24 87.59 87.83 88.09$	Party o	ceiling					83							\neg	(32b)
Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 38.76 (33) Heat capacity Cm = S(A x k) ((28)(30) + (32) + (32a)(32e) = 15941.96 (34) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35) For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f (36) can be used instead of a detailed calculation. 9.26 (36) Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36) if details of thermal bridging are not known (36) = 0.05 x (31) 9.26 (36) Total fabric heat loss (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ (38)m = (39)m = $(37) + (38)m$ (39)m = (38)m= 40.61 40.47 40.33 39.68 39.56 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m = (37) (39)m = (37) (39)m = (37) (38)	* for win ** inclua	dows and le the area	roof wind as on both	ows, use e sides of ii	effective wi nternal wal	indow U-va Is and part	alue calcul titions	lated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	ns given ir	n paragrapł	1 3.2	
Heat capacity $Cm = S(A \times k)$ ((28)(30) + (32) + (32a)(32e) = 15941.96 (34)Thermal mass parameter (TMP = $Cm + TFA$) in kJ/m²KIndicative Value: Medium250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1fcan be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K9.26 (36)f details of thermal bridging are not known (36) = 0.05 x (31)Total fabric heat loss(33) + (36) =Ventilation heat loss calculated monthly(38)m = 0.33 × (25)m x (5)(38)m = $0.33 \times (25)m x (5)$ (38)m = $0.44.47 + 40.33 + 39.68 + 39.56 + 38.99 + 38.99 + 38.89 + 39.21 + 39.56 + 39.81 + 40.06(38)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)m$	Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				38.76	(33)
Thermal mass parameter (TMP = Cm + TFA) in kJ/m²KIndicative Value: Medium 250 (35)For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.Thermal bridges : S (L x Y) calculated using Appendix K9.26 (36)if details of thermal bridging are not known (36) = 0.05 x (31)Total fabric heat loss(33) + (36) =(38)m = 0.33 × (25)m x (5)Ventilation heat loss calculated monthly(38)m = 0.33 × (25)m x (5)(38)m = (37) + (38)m(38)m = (37) + (38)m(39)m = (37) + (38)m(39)m = (37) + (38)mAverage = Sum(30), p (12= 10, 0, 12)Apr May Br. 10 St. 10	Heat c	apacity	Cm = S	(Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	15941.96	(34)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation. Thermal bridges : S (L x Y) calculated using Appendix K if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = $40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06$ Heat transfer coefficient, W/K (39)m = $88.64 88.49 88.36 87.71 87.59 87.02 87.02 86.91 87.24 87.59 87.83 88.09$ Average = Sum(39), w (12 = 197.71 (39))	Therm	al mass	parame	eter (TMI	P = Cm +	+ TFA) ir	ו kJ/m²K			Indica	tive Value	Medium		250	(35)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.29 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = $(37) + (38)m$ (39)m = $(36.4 + 88.49 + 88.36 + 87.71 + 87.59 + 87.02 + 87$	For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
if details of thermal bridging are not known $(36) = 0.05 \times (31)$ Total fabric heat loss $(33) + (36) =$ 48.03 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ $(38)m = 0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec $(38)m =$ 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K	Therm	al bridg	es : S (L	x Y) ca	culated	using Ap	pendix I	K						9.26	(36)
I otal fabric heat loss (33) + (36) = 48.03 (37) Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m = 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m<	if details	of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								
Ventilation neat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 40.61 40.47 40.33 39.68 39.56 38.99 38.99 38.89 39.21 39.56 39.81 40.06 (38) Heat transfer coefficient, W/K (39)m = $(37) + (38)m$ (39)m= 88.64 88.49 88.36 87.71 87.59 87.02 87.02 86.91 87.24 87.59 87.83 88.09	I otal fa	abric he	at loss							(33) +	(36) =	05)		48.03	(37)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ventila	tion hea				у	1	1.1	Δ	(38)m	= 0.33 × (25)m x (5		1	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(20)	Jan 40.61		Mar	Apr	May 20.56	Jun		Aug	Sep	UCt	NOV		4	(38)
Heat transfer coefficient, W/K $(39)m = (37) + (38)m$ $(39)m = 88.64$ 88.49 88.36 87.71 87.59 87.02 86.91 87.24 87.59 87.83 88.09 Average = Sum(30), r_{1} (12) 87.71 87.71 87.9 87.71 (39)	(30)11=	40.01	40.47	40.33	39.00	39.50	30.99	30.99	30.69	39.21	39.50	39.01	40.00	J	(30)
$(39)^{\text{III}=} \boxed{00.04 \ 80.49 \ 80.30 \ 81.71 \ 81.39 \ 81.02 \ 81.02 \ 81.02 \ 80.91 \ 81.24 \ 81.59 \ 81.83 \ 88.09}$	Heat tr	anster o		nt, W/K	07 74	07 50	07.00	07.00	00.01	(39)m	= (37) + (3	38)m	00.00	1	
	(39)m=	00.04	00.49	00.30	07.71	07.59	07.02	07.02	00.91	07.24	07.59 Average =	5um(30)	00.09	87 71	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.07	1.07	1.06	1.06	1.06	1.05	1.05	1.05	1.05	1.06	1.06	1.06		
Numbe	er of day	s in mo	nth (Tab	le 1a)		1				Average =	Sum(40)1.	.12 /12=	1.06	(40)
Numbe	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	52		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ii	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		-
Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x [OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1127.84	(44)
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.56	106.21	107.48	125.26	136.73	148.48		
lf instan	Total = Sum(45) ₁₁₂ = f instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
						storage),		15 00		40.70	00.54	00.07		(46)
Water	²³ storage	loss:	20.76	18.1	17.30	14.98	13.88	15.93	10.12	18.79	20.51	22.21		(40)
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)
If com	munity h	eating a	ind no ta	ank in dw	velling, e	nter 110 nstantar) litres in	(47) mbi boil	ers) ente	ər 'O' in <i>(</i>	(47)			
Water	storage	loss:	not wate			notantai				51 0 111	,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1	.2		(48)
Tempe	erature fa	actor fro	m Table	2b							0	.6		(49)
Energy	/ lost fro	m water	storage	e, kWh/ye	ear			(48) x (49)) =		0.	72		(50)
Hot wa	anufact	urer s ae aae loss	factor fr	rom Tabl	loss fact	or is not h/litre/da	KNOWN: av)					n l		(51)
If com	munity h	eating s	ee secti	on 4.3	- (<i>J</i> /							
Volum	e factor	from Ta	ble 2a								(D		(52)
Tempe	erature fa	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	storage	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) Or ((54) III (5	oulated :	for oach	month			((56)m = (55) x (41)	m	0.	72		(55)
(FO)						01.0	00.00				01.0	00.00		(56)
(56)m=	22.32 er contains	20.16 s dedicate	d solar sto	21.6 prage, (57)	22.32 m = (56)m	21.6 x [(50) – (22.32 H11)] ÷ (5	22.32 0), else (5	21.6 7)m = (56)	22.32 m where (21.6 (H11) is fro	22.32 m Append	ix H	(96)
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	v circuit	loss (ar	nual) fro	om Table))		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	ostat)			(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	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 h	neat rec	uired for	water l	hea	ating ca	alculated	d fo	r eac	h month	(62)m	= 0.85 =	× (4	45)m +	(46)m +	(57)m	+ (59)m + (61)m	
(62)m=	198.9	175.26	183.95		164.75	161.33		144	138.14	151.7) 151.5	9	170.84	180.84	194.06	7	(62)
Solar DI	-IW input	calculated	using Ap	pe	ndix G or	Appendi	κΗ	(negati	ve quantity	/) (enter	'0' if no so	olar	contribut	ion to wate	er heating	1)	
(add a	dditiona	al lines if	FGHR	Sa	and/or V	WWHRS	s ap	oplies	, see Ap	pendix	G)						
(63)m=	0	0	0		0	0		0	0	0	0		0	0	0		(63)
Output	t from w	ater hea	iter											-		_	
(64)m=	198.9	175.26	183.95		164.75	161.33		144	138.14	151.7) 151.5	9	170.84	180.84	194.06	7	
		•	•							0	utput from	wa	iter heate	r (annual)₁	12	2015.47	(64)
Heat g	ains fro	m water	heating	g, ł	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (61	m] + 0.8	8 x	[(46)m	+ (57)m	+ (59)r	n]	
(65)m=	87.44	77.52	82.47	T	75.4	74.95		68.5	67.24	71.78	71.03	3	78.11	80.75	85.84	7	(65)
inclu	ude (57)m in cal	ulation	l of	f (65)m	only if c	vlir	nder i	s in the c	dwellin	g or hot	wa	ater is fi	rom com	munity	heating	
5. Inf	ternal o	ains (see	e Table	5 :	and 5a):	,				•				-	U U	
Metab	olicazi	ne (Table	5) Wa	atte	-	/-											
Metab	Jan	Feb	Mar	T	Apr	Mav	Γ	Jun	Jul	Auc	Ser	5	Oct	Nov	Dec	7	
(66)m=	125.87	125.87	125.87		125.87	125.87	1	25.87	125.87	125.8	7 125.8	7	125.87	125.87	125.87	1	(66)
Lightin		. (calcula	L ted in A	- Anr	pendix	L equat	ion	190	riga)a	l Iso sei	Table	5			1		
(67)m=	20 11	17 86	14 53	T	11	8 22		6 94	7.5	9 75	13.08	3	16 61	19 39	20.67	7	(67)
Applia	$\frac{20.11}{19.39} = \frac{20.11}{19.39} = \frac{14.53}{19.39} = \frac{11}{100} = \frac{8.22}{10.94} = \frac{7.5}{1.5} = \frac{13.08}{13.08} = \frac{10.51}{19.39} = \frac{20.07}{20.07} = \frac{10.51}{19.39} = \frac{10.51}{19.39} = \frac{10.51}{19.39} = \frac{10.51}{100} $																
	225.6	1000000000000000000000000000000000000		T	200 /8			1011 L	168 77	166 A		3		200 74	215.64	7	(68)
Cookir	Cooking gains (calculated in Appendix L. equation 15 or 15a), also see Table 5																
				T	25 50	L, equa		1 L 13	01 L 15a,), aiso			D 25 50	25 50	25 50	7	(60)
(09)11-	35.59		(7 11		\$5.59	30.09		55.59	35.59	35.58	35.58	,	35.59	30.09	35.59		(03)
Pumps	s and fa	ins gains	(Table	58	a)		-					_				-	(70)
(70)m=	0	0	0		0	0		0	0	0	0		0	0	0		(70)
Losses	s e.g. e	vaporatio	on (neg	ativ	ve valu	es) (Tab	ole T	5)								7	
(71)m=	-100.69	-100.69	-100.69) ·	-100.69	-100.69	-1	00.69	-100.69	-100.6	9 -100.6	9	-100.69	-100.69	-100.69	<u>'</u>	(71)
Water	heating	gains (T	Table 5)			-									-	
(72)m=	117.53	115.36	110.85		104.72	100.74	9	95.14	90.38	96.48	98.65	5	104.99	112.16	115.37		(72)
Total i	nterna	l gains =	:					(66)	m + (67)m	n + (68)r	n + (69)m	+ (70)m + (7	1)m + (72))m	-	
(73)m=	424	421.92	408.18		385.96	363.35	3	41.57	327.41	333.4	2 344.8	2	367.26	393.05	412.44		(73)
6. So	lar gain	s:															
Solar g	ains are	calculated	using so	lar f	flux from	Table 6a	and	assoc	iated equa	tions to	convert to	o the	e applicat	ole orientat	ion.		
Orienta	ation:	Access F Table 6d	actor		Area			Flu	X No 6a		g_ Table 6	h	т	FF		Gains	
.	. 1			r				- Tai		. –			, , ,			(**)	-
Southw	/est <mark>0.9x</mark>	0.77		×	2.8	8	x	3	6.79	ļĽ	0.3			0.7	=	15.42	(79)
Southw	/est <mark>0.9x</mark>	0.77		×	1.8	86	x	3	6.79	ļĹ	0.3		_ × L	0.7	=	89.64	(79)
Southw	/est <mark>0.9x</mark>	0.77		×	2.8	8	x	6	2.67	ļĹ	0.3		_ × [0.7	=	26.27	(79)
Southw	/est <mark>0.9x</mark>	0.77		× [1.8	86	x	6	2.67		0.3		×	0.7	=	152.68	(79)
Southw	/est <mark>0.9x</mark>	0.77		× [2.8	88	x	8	5.75		0.3		x	0.7	=	35.94	(79)

Southw	est <mark>0.9x</mark>	0.77	x	1.	36	x	8	5.75]		0.3	×	0.7		= [208.91	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	1	06.25	ĺ		0.3	_ × [0.7		= [44.53	(79)
Southw	est <mark>o.9x</mark>	0.77	x	1.8	36	x	1	06.25]		0.3	×	0.7		=	258.85	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	1	19.01]		0.3	×	0.7		= [49.88	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.5	36	x	1	19.01]		0.3	x	0.7		= [289.93	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	1	18.15]		0.3	×	0.7		= [49.52	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.5	36	x	1	18.15]		0.3	×	0.7		= [287.83	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	1	13.91]		0.3	x	0.7		= [47.74	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.	36	x	1	13.91			0.3	x	0.7		= [277.5	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	1	04.39]		0.3	×	0.7		= [43.75	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.8	36	x	1	04.39]		0.3	×	0.7		= [254.31	(79)
Southw	est <mark>o.9x</mark>	0.77	x	2.	38	x	9	92.85]		0.3	×	0.7		=	38.92	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.5	36	x	9	92.85]		0.3	×	0.7		= [226.2	(79)
Southw	est <mark>o.9x</mark>	0.77	x	2.	38	x	6	9.27]		0.3	×	0.7		= [29.03	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.8	36	x	6	9.27]		0.3	×	0.7		= [168.75	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	4	4.07]		0.3	×	0.7		= [18.47	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.8	36	x	4	4.07]		0.3	×	0.7		= [107.36	(79)
Southw	est <mark>0.9x</mark>	0.77	x	2.	38	x	3	31.49]		0.3	×	0.7		= [13.2	(79)
Southw	est <mark>0.9x</mark>	0.77	x	1.	36	x	3	31.49	1		0.3	_ x [0.7		= [76.71	(79)
	-								-						_		
Solar g	ains in	watts, ca	alculated	d for eac	h mont	h			(83)m	ו = Su	m(74)m .	(<mark>82</mark>)m					
(83)m=	105.06	178.95	244.85	303.38	339.81	3	37.35	325.24	298	.07	265.12	197.78	125.83	89.	91		(83)
Total g	iains – i	nternal a	ind sola	r (84)m : -	= (73)m	+ (83)m	, watts									
(84)m=	529.06	600.87	653.03	689.34	703.16	6	578.92	652.66	631	.49	609.94	565.03	518.88	502	.35		(84)
7. Me	an inte	rnal temp	erature	(heating	j seaso	n)											
Temp	erature	during h	eating p	periods i	n the liv	ring	area	from Tab	ole 9	, Th1	(°C)					21	(85)
Utilisa	ation fac	ctor for g	ains for	living ar	ea, h1,r	n (s	вее Та	ble 9a)									
	Jan	Feb	Mar	Apr	May	'	Jun	Jul	A	ug	Sep	Oct	Nov	D	ес		
(86)m=	1	0.99	0.99	0.96	0.9		0.75	0.57	0.6	61	0.84	0.97	0.99	1			(86)
Mean	interna	al temper	ature in	living ar	ea T1 (follo	ow ste	ps 3 to 7	7 in T	able	9c)						
(87)m=	19.91	20.05	20.27	20.54	20.79		20.95	20.99	20.	99	20.9	20.58	20.19	19.	87		(87)
Temp	erature	during h	eating p	beriods i	n rest o	f dv	velling	from Ta	able 9	9, Th	2 (°C)						
(88)m=	20.03	20.03	20.03	20.04	20.04		20.04	20.04	20.	.04	20.04	20.04	20.04	20.	03		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina	h2	m (se	e Table	9a)		Į		-1				
(89)m=	1	0.99	0.98	0.95	0.86	<u> </u>	0.66	0.46	0.	5	0.77	0.96	0.99	1			(89)
Mean	interno	l tompor	ature in	the rest		llino	1 T2 (f	l ollow sta		to 7	in Tabl		1	I			
(90)m=	18.57	18.78	19.1	19.49	19.82		20	20.04	20	04	19.96	19.55	18.99	18	53		(90)
()=/				1					L	<u> </u>	f	LA = Liv	ing area ÷ (4	1 4) =		0.3) (91)
															L		

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

|--|

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

(93)m=	18.97	19.16	19.45	19.81	20.12	20.29	20.33	20.32	20.24	19.86	19.35	18.93		(93)
8. Spa	ace hea	ting requ	uirement					•						
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	mperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:										
(94)m=	1	0.99	0.98	0.95	0.86	0.69	0.49	0.53	0.78	0.95	0.99	1		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	526.46	594.84	638.66	651.68	606.54	467.08	320.45	335.31	478.37	537.92	513.5	500.45		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8		1		-				
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m	x [(93)m·	– (96)m	044.05	4075.00	4007.04		(07)
(97)m=	1300.42	1262.07	1144.17	956.81	737.05	494.98	324.18	340.98	535.6	811.35	1075.89	1297.81		(97)
	575.83		376 1	210.60	101111, K	0	$\ln = 0.02$	24 X [(97])m – (95 0)[1] X (4	1)[[]	503.24		
(30)11-	575.05	440.00	570.1	219.09	57.1	0	0	Tota		(k)//b///02r	+0+.52	9) –	2018 60	
Space	e heatin	a reauire	ement in	kWh/m²	/vear			TOLA	i per year	(KVVII/yeai) – Sum(9	0)15,912 -	35.16	(99)
Ob En	oray roo	uiromon	te Cor	nmunity	hosting	schomo						l]` ´´
This na	art ie uer	ad for sn	ace hea	ting ena		ng or wa	ator hoai	ting prov	ided by	a comm	unity sch	ama		
Fractio	n of spa	ace heat	from se	condary/	supplen	nentary l	neating ((Table 1	1) '0' if n	one	unity SCI		0	(301)
Fractio	n of spa	ace heat	from co	mmunity	system	1 – (301	1) =					[1	(302)
The com	he 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.													
Fractio	ncludes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. -raction of heat from Community heat pump 1 (
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump	D			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commu	unity hea	ting sys	tem			1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	commun	ity heatir	ng syste	m					1.05	(306)
Space	heating	9											kWh/year	_
Annual	space	heating	requiren	nent									2918.69	
Space	heat fro	m Comr	nunity h	eat pum	р				(98) x (30	04a) x (308	5) x (306) =	=	3064.62	(307a)
Efficier	ncy of se	econdary	/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 ÷	+ (308) =		0	(309)
Water Annual	heating water h	j neating r	eauirem	ent								I	2015.47	1
lf DHW Water	/ from co	ommunit m Comn	ty schen	ie:	`				(64) x (3(13a) x (30 ⁱ	5) x (306) :	ا = ا	2116.24]](310a)
Flectric		d for hea	it distrib	ution				0.01	× [(307a)	(307e) +	(310a) (310e)] =	51 81	(313)
Cooline	g Svster	n Enera	v Efficie	ncv Ratio	C			0.01	L(0074).	(0070) 1	(0.00)(0,000/]	0	(314)
Space	coolina	(if there	is a fixe	d cooline	- a svstem	n, if not e	enter 0)		= (107) ÷	· (314) =		l	0	(315)
Electric	city for p	oumps ai	nd fans v	within dv	vellina (1	able 4f)	:					l	-]` ′
mecha	nical ve	ntilation	- balanc	ed, extra	act or po	sitive in	out from	outside					0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/y	ear	=(330a) + (330b	o) + (330g) =		0	(331)
Energy for lighting (calculated in App	endix L)			Г	355.19	(332)
Total delivered energy for all uses (3	07) + (309) + (31	0) + (312) + (315) + (331) + (33	2)(237b) =	Γ	5536.05	(338)
12b. CO2 Emissions – Community h	eating scheme					
		Energy kWh/year	Emission facto kg CO2/kWh	or Eı kç	missions g CO2/year	
CO2 from other sources of space an Efficiency of heat source 1 (%)	d water heating (If there	not CHP) is CHP using two fuels repeat (363) to ((366) for the second	fuel	401	(367a)
CO2 associated with heat source 1		[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	670.54	(367)
Electrical energy for heat distribution		[(313) x	0.52	=	26.89	(372)
Total CO2 associated with communit	ty systems	(363)(366) + (368)(372)	=	697.43	(373)
CO2 associated with space heating ((secondary)	(309) x	0	=	0	(374)
CO2 associated with water from imm	nersion heater or	instantaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and	d water heating	(373) + (374) + (375) =			697.43	(376)
CO2 associated with electricity for pu	umps and fans wi	thin dwelling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for lig	phting	(332))) x	0.52	=	184.34	(379)
Total CO2, kg/year	sum of (376)(382) =			881.77	(383)
Dwelling CO2 Emission Rate	•				10.62	(384)
El rating (section 14)					90.77	(385)

	User Details:													
Assessor Name: Software Name:	Stroma FSAP 20	12	Strom Softwa	a Num are Ver	ber: rsion:		Versio	n: 1.0.5.59						
A		Proper	ty Address	: Kingsto	on Bridge	e 3BF M	ID 83 AS	SHP						
Address :	onsions:													
		Δ			Δ.Υ. Ηο	iaht(m)		Volume(m ³)						
Ground floor			83	(1a) x		9 7	(2a) =	224 1						
Total floor area TFA = $(1$	la)+(1b)+(1c)+(1d)+(1		83	(4)]()	227.1						
Dwelling volume			00	(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	224.1						
					, , , , ,	, , ,		224.1						
2. Ventilation rate:	main s	econdary	other		total			m ³ per hour	, ,					
	heating	heating			totai				-					
Number of chimneys	0 +	0 +	0	=	0	X 4	40 =	0	(6a)					
Number of open flues	0 +	0 +	0] = [0	x 2	20 =	0	(6b)					
Number of intermittent fa	ans				2	x ′	10 =	20	(7a)					
Number of passive vents	3			Γ	0	x ?	10 =	0	(7b)					
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)					
	Air changes per hour													
Infiltration due to objects		So) ((() (7 o) (7 b)	$\left(\frac{1}{2} \right)$	Г					- -					
Inflitration due to chimne	ess, flues and fans = ($(00)^{+}(00)^{+}(7a)^{+}(7b)$	(70) =	continuo fr	rom(0) to	(16)	÷ (5) =							
Number of storevs in t	the dwelling (ns)), ourier wise (continue in	0111 (9) 10 (10)		0	၂ (9)					
Additional infiltration						[(9)	-1]x0.1 =	0	(10)					
Structural infiltration: ().25 for steel or timber	frame or 0.35	for mason	ry constr	uction		-	0						
if both types of wall are p	present, use the value corres	sponding to the gr	eater wall are	a (after					_					
If suspended wooden	floor, enter 0.2 (unsea	led) or 0.1 (se	aled), else	enter 0				0	7(12)					
If no draught lobby, er	nter 0.05. else enter 0		,,					0	-1(12)					
Percentage of window	vs and doors draught s	tripped						0	$= \frac{1}{(14)}$					
Window infiltration		0.25 - [0.2	2 x (14) ÷ 1	00] =			0	$= (15)^{(15)}$					
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)					
Air permeability value	, q50, expressed in cu	bic metres per	hour per s	quare m	etre of e	envelope	area	4	(17)					
If based on air permeabi	lity value, then (18) = [(17) ÷ 20]+(8), othe	erwise (18) = ((16)				0.29	(18)					
Air permeability value appli	es if a pressurisation test ha	is been done or a	degree air pe	rmeability	is being u	sed			_					
Number of sides shelter	ed							2	(19)					
Shelter factor			(20) = 1 -	[0.075 x (1	[9)] =			0.85	(20)					
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.25	(21)					
Infiltration rate modified	for monthly wind spee	d			ı —		r	I						
Jan Feb	Mar Apr May	Jun Ju	Aug	Sep	Oct	Nov	Dec							
Monthly average wind sp	peed 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 = (2	22)m ÷ 4													
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 0.95	5 0.92	1	1.08	1.12	1.18							

Adjust	ed infiltr	ation rat	e (allow	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m					
<u> </u>	0.31	0.31	0.3	0.27	0.26	0.23	0.23	0.23	0.25	0.26	0.28	0.29		
Calcul If me	ate etter echanica	ctive air al ventila	change	rate for t	ne appli	cable ca	ISE						0	(23a)
lf exh	aust air h	eat pump	usina App	endix N. (2	(23a) = (23a	ı) × Fmv (e	equation (I	N5)) . othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	heat reco	overv: effic	iencv in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, (,			0	(23c)
a) If	balance	d mech	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	, a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	covery (I	u MV) (24b)m = (22	1 2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	e input v	ventilatio	n from c	outside			!	1	
	if (22b)n	n < 0.5 ×	(23b), t	then (24	c) = (23b); other	wise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from I	oft	0.51				
(24d)m=	0.55	n = 1, m	en (240)	m = (22)			40 m = 0.53	$0.5 + [(2)]_{0.53}$	20)III- X	0.5]	0.54	0.54	1	(24d)
Effo		change		$\int_{-0.04}^{0.04}$	1 or (24k)	0.00	(-0.00)		(25)	0.00	0.54	0.04		(213)
(25)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54]	(25)
()	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.01]	(- /
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	lgs 1²	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	K)	k-value kJ/m²·l	e / K l	A X k kJ/K
Windo	ws Type	e 1				2.88	x1	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	2				1.86		/[1/(1.2)+	0.04] =	2.13				(27)
Walls				19.6	2	30.6	x	0.18	=	5.51				(29)
Total a	area of e	lements	, m²			50.22	2							(31)
Party v	wall					57.08	3 X	0	=	0				(32)
Party f	loor					83]		\exists	(32a)
Party o	ceiling					83	=				[(32b)
* for win ** inclua	idows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] â	as given in	paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				27.97	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	16356.96	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi	ign assess	sments wh	ere the de	etails of the	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al brida	es : S (L	x Y) cal	culated i	usina Ap	pendix I	ĸ						4 21	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)							7.21	(00)
Total f	abric he	at loss							(33) +	(36) =			32.18	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y		i		(38)m	= 0.33 × (25)m x (5)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	40.61	40.47	40.33	39.68	39.56	38.99	38.99	38.89	39.21	39.56	39.81	40.06		(38)
Heat tr	ransfer o	coefficie	nt, W/K		-				(39)m	= (37) + (38)m			
(39)m=	72.79	72.65	72.51	71.86	71.74	71.17	71.17	71.07	71.39	71.74	71.98	72.24		
										Average =	Sum(39)1	12 /12=	71.86	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	0.88	0.88	0.87	0.87	0.86	0.86	0.86	0.86	0.86	0.86	0.87	0.87		
Numb	er of day		nth (Tab	le 12)		I		!	,	Average =	Sum(40)1.	12 /12=	0.87	(40)
Numbe	.lan	Feb	Mar	Anr	May	Jun	Jul	Αυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
. ,								<u> </u>						
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	2. .9)	52		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usaq hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = ^{designed} ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39		_
Energy	content of	hot water	used - cal	culated me	onthly $= 4$.	190 x Vd,r	m x nm x L	OTm / 3600) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1127.84	(44)
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.56	106.21	107.48	125.26	136.73	148.48		
										Total = Su	m(45) ₁₁₂ =		1478.77	(45)
lf instan	taneous w	ater heati	ng at point I	t of use (no	o hot water	r storage),	enter 0 in	boxes (46)) to (61)		1			
(46)m= Water	23 storage	20.11	20.76	18.1	17.36	14.98	13.88	15.93	16.12	18.79	20.51	22.27		(46)
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)
If com	munity h	eating a	and no ta	ank in dw	velling, e	nter 110	litres in	(47)						
Otherv	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If m	storage	ioss: urer's de	eclared I	oss facto	or is kno	wn (kWł	ı/dav) [.]				1	2		(48)
Tempe	erature f	actor fro	m Table	2b			"day).					6		(49)
Energy	y lost fro	m water	storage	e, kWh/ye	ear			(48) x (49)) =		0.	72		(50)
b) lf n	nanufact	urer's de	eclared of	cylinder	loss fact	or is not	known:							
Hot wa	ater stora	age loss	factor fr	rom Tabl	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a	011 4.5								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	y lost fro	m water	⁻ storage	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)								0.	72		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m	u 4la - u	oto ¹			
(mo						22 E1		ing and a				22.26		(50)
(59)11=	23.20	21.01	23.20	22.31	23.20	22.01	23.20	23.20	22.01	23.20	22.01	23.20		(00)

Combi	loss ca	lculated	for ea	ch	month ((61)m =	(60)) ÷ 36	65 × (41))m							
(61)m=	0	0	0		0	0		0	0	0	0		0	0	0		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	l fo	r each	h month	(62)m	= 0.85	i × ((45)m +	(46)m +	(57)m	+ (59)m + (61)m	
(62)m=	198.9	175.26	183.9	5	164.75	161.33		144	138.14	151.7	9 151.	59	170.84	180.84	194.06	3	(62)
Solar Dł	IW input	calculated	using A	ppe	endix G or	· Appendix	(H)	(negativ	ve quantity	/) (enter	'0' if no :	sola	r contribu	tion to wate	er heating	g)	
(add a	dditiona	al lines if	FGHR	S a	and/or \	WWHRS	i ap	oplies,	, see Ap	pendix	(G)						
(63)m=	0	0	0		0	0		0	0	0	0		0	0	0		(63)
Output	from w	ater hea	ter			-					-				-		
(64)m=	198.9	175.26	183.9	5	164.75	161.33		144	138.14	151.7	9 151.	59	170.84	180.84	194.06	3	
							•			0	utput from	n wa	ater heat	er (annual)	12	2015.47	(64)
Heat g	ains fro	m water	heatin	ıg,	kWh/m	onth 0.2	5 ′	[0.85	× (45)m	+ (61)m] + 0	.8 x	(46)m	ı + (57)m	+ (59)	m]	
(65)m=	87.44	77.52	82.47	,	75.4	74.95	(68.5	67.24	71.78	71.0)3	78.11	80.75	85.84	7	(65)
inclu	de (57)	m in calo	culatio	n o	f (65)m	only if c	ylir	nder is	s in the c	dwellin	g or ho	ot w	ater is t	rom com	munity	 heating	
5. Int	ernal g	ains (see	e Table	2.5	and 5a):	,				0				,	Ŭ	
Motab	olio goir	as (Table	5) W	att	0	/-											
Melab	Jiic gaii Jan	Feb	<u>, 5), w</u> Ma	r l	S Anr	May		.lun	.lul	Au	1 Se	'n	Oct	Nov	Dec		
(66)m=	125.87	125.87	125.8	7	125.87	125.87	1	25.87	125.87	125.8	7 125.	87	125.87	125.87	125.87	· ·	(66)
Lightin	a agine		tod in	<u>^</u>	nondiv		ion					5					
(67)m=	9 9anis	17.86	14 53			2, Equal		6 94	13a), a	0 75	130	18	16.61	10 30	20.67	7	(67)
(07)III-	20.11			/					12 and 1	20) 0	10.0	ло Та		10.00	20.07		(0.)
Appila	nces ga	lins (caic		in 7	Append				13 OF L1	3a), ai	so see	Ta		000 74	045.04		(69)
(68)m=	225.6	227.94	222.0	4	209.48	193.63		/8./3	168.77	166.4	3 172.	33	184.89	200.74	215.64	·	(00)
Cookir	ig gains	s (calcula	ated in	Ар	pendix	L, equa	tior	า L15	or L15a)), also	see Ta	ble	5			-	(22)
(69)m=	35.59	35.59	35.59	,	35.59	35.59	3	85.59	35.59	35.59	35.5	59	35.59	35.59	35.59		(69)
Pumps	and fa	ns gains	(Table	e 5a	a)											-	
(70)m=	0	0	0		0	0		0	0	0	0		0	0	0		(70)
Losses	s e.g. ev	/aporatic	on (neg	gati	ve valu	es) (Tab	le	5)								_	
(71)m=	-100.69	-100.69	-100.6	9	-100.69	-100.69	-1	00.69	-100.69	-100.6	9 -100.	.69	-100.69	-100.69	-100.69	Ð	(71)
Water	heating	gains (T	able 5	5)		-							-		-		
(72)m=	117.53	115.36	110.8	5	104.72	100.74	g	95.14	90.38	96.48	98.6	65	104.99	112.16	115.37	,	(72)
Total i	nterna	gains =	:					(66)	m + (67)m	ı + (68)r	n + (69)n	n + ((70)m + (71)m + (72))m		
(73)m=	424	421.92	408.1	8	385.96	363.35	3	41.57	327.41	333.4	2 344.	82	367.26	393.05	412.44	•	(73)
6. So	lar gain	s:															
Solar g	ains are	calculated	using so	olar	flux from	Table 6a	and	associ	ated equa	tions to	convert	to th	e applica	ble orientat	tion.		
Orienta	ation:	Access F	actor		Area			Flu	x		_ <u>g_</u>		_	FF		Gains	
		l able 6d			m²			lat	ole 6a		lable	6b		able 6c		(VV)	
Southw	est <mark>0.9x</mark>	0.77		x	2.8	38	x	3	6.79		0.63		×	0.7	=	32.38	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	36	x	3	6.79		0.63		x	0.7	=	188.24	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	38	x	6	2.67	Ī	0.63		×	0.7	=	55.16	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	36	x	6	2.67	ĪĒ	0.63		×	0.7	=	320.64	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	38	x	8	5.75	Ī	0.63		_ × [0.7	=	75.48	(79)

Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	6	5.75]		0.63	×	0.7		= [438.71	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25	j		0.63	_ × [0.7		= [93.52	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25]		0.63	×	0.7		=	543.58	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	19.01]		0.63	×	0.7		=	104.75	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01	Ī		0.63	_ × [0.7		=	608.85	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15	Ī		0.63	×	0.7		=	103.99	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15]		0.63	_ × [0.7		=	604.45	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91]		0.63	_ × [0.7		= [100.26	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.63	×	0.7		=	582.76	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39]		0.63	x	0.7		=	91.88	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39]		0.63	_ × [0.7		= [534.06	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	g	2.85	Ī		0.63	×	0.7		=	81.73	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	g	92.85]		0.63	×	0.7		=	475.03	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27	Ī		0.63	×	0.7		=	60.97	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27]		0.63	×	0.7		=	354.37	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07]		0.63	_ × [0.7		= [38.79	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07]		0.63	_ x [0.7		=	225.46	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	3	31.49	j		0.63	_ × [0.7		= [27.71	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49	Ī		0.63	_ × [0.7		=	161.09	(79)
	-									•								
Solar g	gains in	watts, ca	alculate	ed	for each	n month	1		-	(83)n	n = S	um(74)m .	(82)m		-			
(83)m=	220.62	375.8	514.18	3	637.1	713.6	7	708.44	683.01	625	.94	556.75	415.34	264.25	188	.81		(83)
Total g	jains – i	nternal a	nd sol	ar	(84)m =	(73)m	+ ((83)m	, watts									
(84)m=	644.62	797.72	922.36	5	1023.06	1076.95	1	050.01	1010.42	959	.36	901.58	782.59	657.3	601	.25		(84)
7. Me	an inter	nal temp	beratur	e (heating	seasor	า)											
Temp	perature	during h	eating	ре	eriods in	the livi	ng	area	from Tab	ole 9	, Th	1 (°C)				[21	(85)
Utilisa	ation fac	tor for g	ains fo	r li	ving are	a, h1,n	<u>ו (פ</u>	see Ta	ble 9a)									
	Jan	Feb	Mar		Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	D	ес		
(86)m=	0.99	0.97	0.91		0.78	0.61		0.43	0.31	0.3	34	0.54	0.84	0.97	0.9	99		(86)
Mean	interna	l temper	ature i	n li	ving are	ea T1 (f	olle	ow ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	20.31	20.53	20.75		20.92	20.99		21	21	2	1	20.99	20.9	20.57	20.	27		(87)
Temp	erature	during h	eating	ре	eriods in	rest of	d٧	velling	from Ta	able	9, Tł	ר2 (°C)						
(88)m=	20.19	20.19	20.19		20.2	20.2		20.2	20.2	20	.2	20.2	20.2	20.2	20.	19		(88)
Utilisa	ation fac	tor for a	ains fo	r re	est of dv	vellina.	h2	2.m (se	e Table	9a)				-				
(89)m=	0.99	0.96	0.89	Τ	0.75	0.56	Γ	0.38	0.25	0.2	28	0.48	0.8	0.97	0.9	99		(89)
Mean	interna	I temper	ature i	י ז tl	he rest o	of dwel	ind	a T2 (f	ollow ste	eps 3	to 7	7 in Tabl	e 9c)		•			
(90)m=	19.28	19.59	19.89	T	20.11	20.19	Τ	20.2	20.2	20	.2	20.2	20.09	19.66	19.	22		(90)
	L	I	I	-	I		-					f	LA = Liv	ing area ÷ (4	4) =		0.3	(91)
																		1

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

													-
(92)m=	19.59	19.87	20.15	20.36	20.43	20.44	20.44	20.44	20.44	20.33	19.93	19.53	(92)

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

(93)m=	19.59	19.87	20.15	20.36	20.43	20.44	20.44	20.44	20.44	20.33	19.93	19.53		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	e obtain ble 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:										
(94)m=	0.99	0.96	0.89	0.76	0.57	0.4	0.27	0.3	0.5	0.81	0.96	0.99		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	635.67	763.94	822.31	772.52	617.52	415.16	273.51	287.33	449.67	634.12	633.41	595.4		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m	x [(93)m·	– (96)m]				(0-)
(97)m=	1113.13	1087.67	989.92	823.31	626.01	415.83	273.56	287.42	452.45	698.37	923.81	1107.67		(97)
Space	e heating	g require	ement fo	r each m	nonth, k\	Wh/mont	h = 0.02	24 x [(97])m – (95)m] x (4 	1)m			
(98)m=	355.23	217.55	124.7	36.56	6.32	0	0	0	0	47.8	209.09	381.13		1
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1378.4	(98)
Space	e heating	g require	ement in	kWh/m²	/year								16.61	(99)
9b. En	ergy req	uiremer	nts – Cor	mmunity	heating	scheme								
This pa	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	(301)	
Fraction of space heat from community system 1 – (301) =												1	(302)	
The com	munity so	heme may	y obtain he	eat from se	veral sour	ces. The p	procedure	allows for	CHP and i	up to four (other heat	sources; tl	ne latter	
Fractio	n of hea	at from C	ommun	ity heat p	oump	rom powei	stations.	See Apper	naix C.			[1	(303a)
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump)			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commi	unity hea	ating sys	tem		ĺ	1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	commun	ity heatir	ng syste	m					1.05	(306)
Space	heating	3										•	kWh/year	•
Annual	space	heating	requiren	nent									1378.4]
Space	heat fro	m Comr	nunity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) :	-	1447.32	(307a)
Efficier	ncy of se	econdary	/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	plemen	tary sys [.]	tem	(98) x (30	01) x 100 -	+ (308) =		0	(309)
Water Annual	heating water h	l neating r	equirem	ent								I	2015.47	1
If DHW	/ from co	ommunit	ty schem	ie:	`				(64) x (3)	13a) x (30)	5) x (306) :	- -	2116.24](310a)
Electric	city user	for hea	t distrib	ution	,			0.01	× [(307a)	(307e) +	(310a) (310e)] =	.35.64	(313)
Cooline	g Svster	n Enera	y Efficie	ncy Ratio	C			5.01	L(0010).		(= : •••)···(0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0) $= (107) \div (314) =$											0	(315)		
Electric	city for p	umps ai	nd fans v	within dw	velling (1	able 4f)	: out from	outoido				1	0](220-2)
mecha	nical ve	nuiau011	- naidii0		aut of po	SILVE III	JULIIOII	outside					U	(3308)

warm air heating system fans					0	(330b)			
pump for solar water heating					0	(330g)			
Total electricity for the above, kWh/year		=(330a) + (330)b) + (330g) =		0	(331)			
Energy for lighting (calculated in Append	ix L)			Ē	355.19	(332)			
Total delivered energy for all uses (307)	+ (309) + (310) + (31	2) + (315) + (331) + (33	32)(237b) =	Γ	3918.74	(338)			
12b. CO2 Emissions – Community heati	ng scheme								
		Energy kWh/year	Emission factors kg CO2/kWh	or E kį	missions g CO2/year				
CO2 from other sources of space and wa Efficiency of heat source 1 (%)	ater heating (not CHF If there is CHP us) ing two fuels repeat (363) to	(366) for the second	fuel	401	(367a)			
CO2 associated with heat source 1	[(307b	o)+(310b)] x 100 ÷ (367b) x	0.52	=	461.22	(367)			
Electrical energy for heat distribution		[(313) x	0.52	=	18.49	(372)			
Total CO2 associated with community sy	rstems	(363)(366) + (368)(372	2)	=	479.71	(373)			
CO2 associated with space heating (sec	ondary)	(309) x	0	=	0	(374)			
CO2 associated with water from immersi	on heater or instanta	neous heater (312) x	0.52	=	0	(375)			
Total CO2 associated with space and wa	ater heating	(373) + (374) + (375) =			479.71	(376)			
CO2 associated with electricity for pump	s and fans within dwe	elling (331)) x	0.52	=	0	(378)			
CO2 associated with electricity for lightin	g	(332))) x	0.52	=	184.34	(379)			
Total CO2, kg/year	sum of (376)(382) =				664.05	(383)			
Dwelling CO2 Emission Rate					8	(384)			
El rating (section 14)					93.05	(385)			
		Us	er Details:						
--	--------------------------------	------------------	--------------------	------------------	----------------	------------------	-----------	-------------------------	----------------------
Assessor Name: Software Name:	Stroma FSAP 201	Versio	n: 1.0.5.59						
		Prope	erty Address:	Kingsto	n Bridge	e 3BF T(DP 83 A8	SHP	
Address :									
T. Overall dwelling dimer	ISIONS.		$\Lambda roc(m^2)$			iaht(m)		Volumo(m ³)	
Ground floor		, L		(1a) x		<u>ignu(iii)</u>	(2a) =	224.1] (3a)
Total floor area TEA $-$ (1a)	(1+(1+1)+(1-)+(1+1)+(1+1))		00	(10)			(20)	224.1	
		;)'(III)	83	(4) (3a)+(3b)	+(3c)+(3d	1)+(30)+	(3n) =		
Dweiling volume				(00)*(00)		(00)*	.(011)	224.1	_(5)
2. Ventilation rate:	main s	ocondary	other		total			m ³ per bour	
	heating h	neating			lotai				_
Number of chimneys	0 +	0 +	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0] = [0	× 2	20 =	0	(6b)
Number of intermittent far	<u> </u>			Ē	2	x ^	10 =	20	(7a)
Number of passive vents				Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fir	0	(7c)							
							Air ch	anges per bo	_
				_				anges per no	ui
Infiltration due to chimney	rs, flues and fans = (6)	a)+(6b)+(7a)+(7	(17) + (70) =			(4.0)	÷ (5) =		
Number of storevs in th	e dwelling (ns)	ea, proceea lo (17), otrierwise c	onunue inc) (1) (9) IO (10)	I	0	
Additional infiltration	e arreinig (ne)					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or 0.3	5 for masonr	y constru	uction			0	
if both types of wall are pro	esent, use the value corres	ponding to the	greater wall area	a (after			I		_
If suspended wooden fl	oor. enter 0.2 (unseal	led) or 0.1 (s	ealed), else (enter 0				0] (12)
If no draught lobby, ent	er 0.05, else enter 0							0	(13)
Percentage of windows	and doors draught st	ripped						0	
Window infiltration	-		0.25 - [0.2	x (14) ÷ 1	= [00		Ì	0	(15)
Infiltration rate			(8) + (10) +	- (11) + (1	2) + (13) -	+ (15) =	İ	0	(16)
Air permeability value, o	q50, expressed in cub	oic metres pe	er hour per so	luare me	etre of e	nvelope	area	4	(17)
If based on air permeabili	ty value, then (18) = [(1	7) ÷ 20]+(8), ot	herwise (18) = (*	16)				0.29	(18)
Air permeability value applies	s if a pressurisation test has	s been done or	a degree air per	meability i	s being us	sed			-
Number of sides sheltered			(20) = 1 - [0 075 x (1	9)] =			2	(19)
Infiltration rate incorporati	na shelter factor		(21) = (18)	x(20) =	0)]		l	0.85	$\int_{(21)}^{(20)}$
Infiltration rate modified for	r monthly wind speed	4	(21) (10)	x (20)			l	0.25	
	Mar Apr May			Sen	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7			υσρ					
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3	.8 3.7	4	4.3	4.5	4.7		
			I			1			
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4		<u></u>	. 1					
(22a)m= 1.27 1.25 1	1.23 1.1 1.08	0.95 0.1	95 0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.31	0.31	0.3	0.27	0.26	0.23	0.23	0.23	0.25	0.26	0.28	0.29		
Calcul	ate effe	ctive air	change	rate for t	he appli	cable ca	se		-	-	-	-		
II IIIt			ucing App	ondix N (2	3h) - (23a) x Emy (c	ocuation (N	NE)) othou	nuico (23h) - (23a)			0	(238)
If bal	ancod with	boot roce			.50) – (258	or in uso f	actor (from	$\mathbf{x}_{\mathbf{x}}$) –) - (208)			0	(230)
) - .) (0(]]h)ma (/)	00k) v r	4 (22.5)	0	(23c)
a) IT								HR) (24a T	i)m = (22	20)m + (. 0	230) × [1 - (23C)) ÷ 100]]	(24a)
(24a)III-						U	()					0		(244)
D) IT					without	neat rec		VIV) (240 T	o)m = (22	20)m + (. 	230)		1	(24b)
(240)11-					0					0	0	0		(240)
C) IT	if (22b)n	ouse ex n < 0.5 ×	tract ver (23b), 1	then (240	c) = (23b); otherv	ventilatio wise (24	c) = (22b	outside b) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural if (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	e positiv o)m othe	ve input [.] erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)			•		
(25)m=	0.55	0.55	0.55	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54		(25)
3 40	atlossa	s and he	at loss i	naramet	or.								•	
		Groe	201 1055	Onenin	л. Л	Nρt Δr	·ea	l I-valı	IA	ΔΧΠ		k-value	<u></u>	AXk
		area	(m²)	m	90 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K	kJ/K
Windo	ws Type	e 1				2.88	x1.	/[1/(1.2)+	0.04] =	3.3				(27)
Windo	ws Type	e 2				1.86	x1.	/[1/(1.2)+	0.04] =	2.13				(27)
Walls				19.6	2	30.6	x	0.18] = [5.51				(29)
Roof				0		83	x	0.13	 = [10.79	i F		\exists	(30)
Total a	area of e	lements	, m²			133.2	2							(31)
Party v	wall					57.08	3 X	0	= [0				(32)
Party f	floor					83			เ		i		\dashv	(32a)
* for win ** incluc	ndows and le the area	roof wind	ows, use e sides of ir	effective wi	ndow U-va Is and part	alue calcul titions	ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	s given in	n paragraph	I 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				38.76	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	8803.96	(34)
Therm	al mass	parame	ter (TM	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	(35)
For desi can be i	ign assess used inste	sments wh ad of a de	ere the de tailed calc	tails of the	constructi	ion are not	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al brida	es : S (L	x Y) cal	culated u	usina Ap	pendix ł	<						10.77	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)							10.11	(00)
Total f	abric he	at loss							(33) +	(36) =			49.53	(37)
Ventila	ation hea	at loss ca	alculated	monthl	ý			_	(38)m	= 0.33 × (25)m x (5)	_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	40.61	40.47	40.33	39.68	39.56	38.99	38.99	38.89	39.21	39.56	39.81	40.06		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	90.14	90	89.86	89.21	89.09	88.52	88.52	88.42	88.74	89.09	89.34	89.59		
								-		Average =	Sum(39)	112 /12=	89.21	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.09	1.08	1.08	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.08	1.08		
Numb			nth (Tab						,	Average =	Sum(40)1.	12 /12=	1.07	(40)
NUITIDE		Eob	Mar		Мау	lup	1.1	Δυσ	Son	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
()	01	20								01		01		(/
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13	2. .9)	52		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	93 f	.99		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month 1	Vd,m = fa	ctor from T	Table 1c x	(43)	1	r	1		I	
(44)m=	103.39	99.63	95.87	92.11	88.35	84.59	84.59	88.35	92.11	95.87	99.63	103.39	4407.04	
Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	m x nm x L	OTm / 3600) kWh/mor	total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1127.84	(44)
(45)m=	153.32	134.09	138.37	120.64	115.75	99.89	92.56	106.21	107.48	125.26	136.73	148.48		
lf instan	taneous w	ator hoati	na at point	t of use (n		r storage)	ontor 0 in	hoves (16) to (61)	Total = Su	m(45) ₁₁₂ =		1478.77	(45)
(46)22=		20.11		10/ 430 (7)	17.26	14.00	12 00	15 02	16 12	10 70	20.51	22.27	l	(46)
Water	storage	loss:	20.70	10.1	17.50	14.90	13.00	15.95	10.12	10.79	20.51	22.21		(40)
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		180		(47)
If com	munity h	eating a	and no ta	ank in dw	velling, e	nter 110	litres in	(47)						
Otherv Water	vise it no storage	o stored	hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in ((47)			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1	.2		(48)
Tempe	erature f	actor fro	m Table	2b							0	.6		(49)
Energy	/ lost fro	m water	⁻ storage	, kWh/ye	ear			(48) x (49) =		0.	72		(50)
b) If m	nanufact	urer's d	eclared of	cylinder	loss fact	or is not	known:							
HOT Wa	ater stora munity h	age loss leating s	ee secti	om I abi	ie 2 (kvv	n/litre/da	iy)					0		(51)
Volum	e factor	from Ta	ble 2a	011 1.0								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	⁻ storage	e, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (8	55)								0.	72		(55)
Water	storage	loss cal	culated	for each	month	-	-	((56)m = (55) × (41)	m				
(56)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	22.32	20.16	22.32	21.6	22.32	21.6	22.32	22.32	21.6	22.32	21.6	22.32		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m Noviimato	r thar	atat)			
(moo												22.25	l	(50)
(59)11=	23.20	21.01	23.20	22.31	23.20	22.01	23.20	23.20	22.01	23.20	22.01	23.20		(00)

Combi	loss ca	lculated	for eac	ch i	month ((61)m =	(60)) ÷ 36	65 × (41))m								
(61)m=	0	0	0		0	0		0	0	0		0	0	0		0		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	d fo	or eac	h month	(62)m	า =	0.85 × ((45)m ·	+ (46)m +	- (57))m +	(59)m + (61)m	
(62)m=	198.9	175.26	183.9	5	164.75	161.33		144	138.14	151.7	'9	151.59	170.84	180.84	194	4.06		(62)
Solar DH	W input	calculated	using A	ope	ndix G or	Appendi	κΗ	(negati	ve quantity	/) (ente	r '0'	if no sola	r contrib	ution to wat	ter hea	ating)		
(add ad	dditiona	al lines if	FGHR	Sa	and/or V	WWHRS	s ap	oplies	, see Ap	pendi	x G	6)						
(63)m=	0	0	0		0	0		0	0	0		0	0	0		0		(63)
Output	from w	ater hea	ter															
(64)m=	198.9	175.26	183.9	5	164.75	161.33		144	138.14	151.7	'9	151.59	170.84	180.84	194	4.06		
I			•							С	outpu	ut from wa	ater hea	er (annual)	112		2015.47	(64)
Heat g	ains fro	m water	heatin	g, l	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (61)m] + 0.8 x	(46)r	n + (57)m	า + (ร	59)m]	
(65)m=	87.44	77.52	82.47	T	75.4	74.95		68.5	67.24	71.7	8	71.03	78.11	80.75	85	.84	Ī	(65)
inclu	de (57)	m in calo	culation	י ו סו	f (65)m	only if c	ı İv	nder i	s in the c	dwellir	na c	or hot w	ater is	from con	nmur	nity h	leating	
5 Int	ernal o	ains (see	Table	5	and 5a).	,				U					,	J. J. J. J. J. J. J. J. J. J. J. J. J. J	
Motabo		an (Table	5) M	otte														
Melabo	Jiic gaii Jan	Feb	<u>, vi</u> Mai	-	S Anr	May	Γ	.lun	Jul	Au	a	Sen	Oct	Nov	Тг)ec		
(66)m=	125.87	125.87	125.87	_	125.87	125.87	1	25.87	125.87	125.8	9 87	125.87	125.87	125.87	12	5.87		(66)
Lightin	a apine		tod in	 Apr	oondix				r 0a) a		<u> </u>	able 5					l	
(67)m=	20 11							6 9/	7 5 T	0 75		13.08	16.61	10.30	20	67	1	(67)
(07)III-	20.11					0.22		0.34	10 and 1		<u></u>	10.00		19.59	20		l	(01)
Appliar	nces ga	lins (caic		in . . T	Append		ua L		13 OF L1	3a), a	iso	see Ta				- 04	1	(69)
(68)m=	225.6	227.94	222.04	+	209.48	193.63	1	78.73	168.77	166.4	3	172.33	184.8	200.74	21	5.64	l	(66)
Cookin	ig gains	s (calcula	ated in	Ар	pendix	L, equa	tior	n L15	or L15a)), also	se	e Table	5		<u> </u>	-	1	(00)
(69)m=	35.59	35.59	35.59		35.59	35.59	3	35.59	35.59	35.5	9	35.59	35.59	35.59	35	5.59	l	(69)
Pumps	and fa	ns gains	(Table	e 5a	a)		-							-1			1	
(70)m=	0	0	0		0	0		0	0	0		0	0	0		0	j	(70)
Losses	s e.g. ev	aporatic	on (neg	ati	ve valu	es) (Tab	le	5)	-						_			
(71)m=	-100.69	-100.69	-100.6	э .	-100.69	-100.69	-1	00.69	-100.69	-100.6	69	-100.69	-100.6	9 -100.69	-10	0.69		(71)
Water	heating	gains (T	able 5)						-							_	
(72)m=	117.53	115.36	110.8	5	104.72	100.74	9	95.14	90.38	96.4	8	98.65	104.99	112.16	11	5.37		(72)
Total i	nternal	gains =	:					(66))m + (67)m	n + (68)	m +	(69)m + ((70)m +	(71)m + (72	2)m			
(73)m=	424	421.92	408.18	3	385.96	363.35	3	41.57	327.41	333.4	2	344.82	367.26	393.05	41	2.44		(73)
6. Sol	ar gain	s:								-								
Solar g	ains are	calculated	using sc	lar	flux from	Table 6a	and	assoc	iated equa	tions to	o cor	nvert to th	e applic	able orienta	ation.			
Orienta	ation: /	Access F	actor		Area			Flu	x		_	g		FF			Gains	
		Table 6d			m²			Tal	ble 6a		Τa	able 6b		Table 6c			(W)	
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	3	86.79] [0.35	x	0.7		=	17.99	(79)
Southw	est <mark>0.9x</mark>	0.77		x	1.8	86	x	3	86.79			0.35	x	0.7		=	104.58	(79)
Southw	est <mark>o.9x</mark>	0.77		x	2.8	8	x	6	2.67] [0.35	x	0.7		=	30.65	(79)
Southw	est <mark>o.9x</mark>	0.77		x	1.8	6	x	6	62.67	ĪĪ		0.35	x	0.7		=	178.13	(79)
Southw	est <mark>0.9x</mark>	0.77		x	2.8	8	x	8	35.75	ΪĪ		0.35	×	0.7		=	41.93	(79)

Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	8	35.75]		0.35	×	0.7		= [243.73	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	06.25]		0.35	x	0.7		= [51.96	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	06.25]		0.35	x	0.7		= [301.99	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	19.01]		0.35	x	0.7		= [58.19	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	19.01]		0.35	x	0.7		= [338.25	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	18.15]		0.35	x	0.7		= [57.77	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	18.15]		0.35	x	0.7		= [335.81	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	13.91]		0.35	x	0.7		= [55.7	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	13.91]		0.35	x	0.7		= [323.75	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	1	04.39]		0.35	x	0.7		= [51.04	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	1	04.39]		0.35	x	0.7		= [296.7	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	g	92.85]		0.35	x	0.7		= [45.4	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	g	92.85]		0.35	x	0.7		= [263.9	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	6	9.27]		0.35	x	0.7		= [33.87	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	6	9.27]		0.35	×	0.7		= [196.87	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	4	4.07]		0.35	×	0.7		= [21.55	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	4	4.07]		0.35	×	0.7		= [125.26	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	2.8	8	x	3	31.49	Ī		0.35	×	0.7		= [15.4	(79)
Southw	/est <mark>0.9x</mark>	0.77		x	1.8	6	x	3	31.49]		0.35	x	0.7		= [89.49	(79)
Solar ((83)m=	ains in 122.57	watts, ca 208.78	alculat 285.6	ted 6	for eacl 353.94	n mont 396.45	h 5 3	93.58	379.45	<mark>(83)</mark> m 347	n = Su 7.74	ım(74)m. 309.31	<mark>(82)</mark> m 230.74	146.81	104	.89		(83)
Total g	jains – i	nternal a	ind so	lar	(84)m =	: (73)m	ı + (83)m	, watts					_				
(84)m=	546.57	630.7	693.8	84	739.9	759.8	7	35.15	706.86	681	.16	654.13	598	539.86	517	.33		(84)
7. Me	an inter	rnal temp	oeratu	re (heating	seaso	n)											
Temp	erature	during h	eating	g pe	eriods ir	the liv	/ing	area	from Tal	ole 9	, Th1	l (°C)				[21	(85)
Utilisa	ation fac	ctor for g	ains fo	or li	ving are	a, h1,ı	m (s	ее Та	ble 9a)					-	-			
	Jan	Feb	Ma	ır	Apr	Мау	/	Jun	Jul	A	ug	Sep	Oct	Nov	D	ес		
(86)m=	1	0.99	0.98	;	0.95	0.88		0.72	0.54	0.5	58	0.81	0.96	0.99	1			(86)
Mean	interna	I temper	ature	in li	iving are	ea T1 (follo	ow ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	19.9	20.06	20.2	9	20.57	20.81	2	20.95	20.99	20.	99	20.91	20.6	20.19	19.	87		(87)
Temp	erature	during h	eating	g pe	eriods ir	rest o	of dv	velling	from Ta	able	9, Th	12 (°C)						
(88)m=	20.01	20.01	20.0	2	20.02	20.02		20.03	20.03	20.	03	20.03	20.02	20.02	20.	02		(88)
Utilisa	ation fac	ctor for a	ains fo	or re	est of d	wellina	, h2	,m (se	e Table	9a)								
(89)m=	1	0.99	0.98	;	0.94	0.83	<u> </u>	0.63	0.43	0.4	47	0.74	0.95	0.99	1			(89)
Mean	interna	Il temper	ature	in t	he rest	of dwe	llino	T2 (f	Ollow ste	ens 3	to 7	in Tabl	e 9c)		•			
1 2 1 5 7 5 3 1			4445	111 1			minu						~ ~ ~ ~ ~ ~					

_							.						
(90	18.5	18.98	19.56	19.95	20.02	20.03	20	19.84	19.52	19.11	18.78	18.55	(90)m=
0.3 (91	1) =	g area ÷ (4	fLA = Livin	1		-				-			

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.96	19.16	19.47	19.84	20.13	20.29	20.32	20.31	20.24	19.87	19.34	18.91	(92)

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

(93)m=	18.96	19.16	19.47	19.84	20.13	20.29	20.32	20.31	20.24	19.87	19.34	18.91		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9	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	ation fac	tor for g	ains, hm	1:										
(94)m=	0.99	0.99	0.97	0.93	0.84	0.65	0.46	0.5	0.76	0.94	0.99	1		(94)
Usefu	l gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	543.48	623.03	674.9	689.98	635.76	480.23	325.99	341.48	494.81	563.93	533.31	515.1		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m : L	x [(93)m	– (96)m]	4000.00	4040.00		(07)
(97)m=	1321.18	1283.84	1165.35	975.58	751.16	503.3	328.97	346.1	544.97	826.27	1093.86	1318.33		(97)
Space				r each m		vn/mon	$\ln = 0.02$	24 X [(97)m – (95 I)mj x (4 105 10	1)m	507.61		
(90)11-	570.01	444.00	304.09	205.03	00.00	0	0		0	195.10	403.0	597.01	0075.45	
0								lota	i per year	(kvvn/year	r) = Sum(9	8)15,912 =	2875.45	(90)
Space	e heating	g require	ement in	kvvn/m ²	/year								34.64	(99)
9b. En	ergy req	luiremer	nts – Cor	mmunity	heating	scheme								
This pa Fractio	art is use n of spa	ed for sp ace heat	ace hea from se	iting, spa condary/	ace cooli (supplen	ng or wa nentary l	ater heat heating (ting prov (Table 1 ⁻	ided by 1) '0' if n	a comm one	unity sch	neme.	0	(301)
Fractio	n of spa	ice heat	from co	mmunitv	system	$1 - (30^{2})$	1) =	(.,			l	1	(302)
The corr	munity or		u obtoin bu	oot from co	woral sour	roop Tho r	· ,	allows for	CUD and	un to four	othor boot	sources: fl	, a lattor	
includes	boilers, h	eat pumps	s, geotherr	nal and wa	aste heat fi	rom powei	r stations.	See Appel	ndix C.		Siner near	30 <i>010</i> 03, 11		
Fractio	n of hea	at from C	Commun	ity heat p	oump								1	(303a)
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump	D			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commı	unity hea	ating sys	tem			1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	communi	ity heatir	ng syste	m					1.05	(306)
Space	heating	3											kWh/year	4
Annua	space	heating	requirem	nent									2875.45]
Space	heat fro	m Comr	nunity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) =	-	3019.22	(307a)
Efficier	ncy of se	econdary	/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 +	÷ (308) =		0	(309)
Water Annual	heating water h	l neating r	equirem	ent								I	2015 47]
If DHW	/ from co	ommunit	ty schem	ne:	,				(64) x (3)	13a) v (304	5) x (306) :	- -	2116.24]
Electric		h for boa	nunny ne	ution	,			0.01	(04) X (00 x [(307a)	(3070) +	(3100) -	3100)] -	2110.24 	
Cooling	ny uset			ncy Pati	-			0.01	~ [(307d).	(3078) +	(3108)(5106)] -	0	(314)
Space					J D evetor	, if not a	ontor 0)		= (107) ·	(314) -		l	0	(315)
	cooning				y system				- (107) -	(314) -			U	
Electric	nical ve	oumps aintilation	nd fans v - balanc	within dw ed, extra	velling (T act or po	able 4f) sitive inj	: put from	outside				[0	(330a)

warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/ye	ear	=(330a) + (330b)) + (330g) =	Γ	0	(331)
Energy for lighting (calculated in App	endix L)			Γ	355.19	(332)
Total delivered energy for all uses (3	07) + (309) + (31	0) + (312) + (315) + (331) + (33	2)(237b) =	Γ	5490.65	(338)
12b. CO2 Emissions – Community h	eating scheme					
		Energy kWh/year	Emission facto kg CO2/kWh	or Eı kç	nissions g CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)	d water heating (If there	not CHP) is CHP using two fuels repeat (363) to (366) for the second	fuel	401	(367a)
CO2 associated with heat source 1		[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	664.66	(367)
Electrical energy for heat distribution		[(313) x	0.52	=	26.65	(372)
Total CO2 associated with communit	y systems	(363)(366) + (368)(372)	=	691.32	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from imm	ersion heater or	instantaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and	d water heating	(373) + (374) + (375) =			691.32	(376)
CO2 associated with electricity for pu	imps and fans wi	thin dwelling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for lig	hting	(332))) x	0.52	=	184.34	(379)
Total CO2, kg/year	sum of (376)(382) =			875.66	(383)
Dwelling CO2 Emission Rate	ļ				10.55	(384)
El rating (section 14)					90.83	(385)



Appendix 4: 'Be Green' SAP 10 Spreadsheet

Be Green (Communal ASHPs) - SAP 2012 Methodology SAP 10 Carbon Factors

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bluesky UNLIMITED

SAP 2012	Carbon Factor	SAP 10	Carbon Factor
Gas	0.216	Gas	0.210
Grid Elec	0.519	Grid Elec	0.233

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						Pumps/	
Plot	Bedrooms	Floor Area	Location	Space Htg	Water Htg	Lighting	Emissions
1	3	86.7	GND	2739	2532	449	1212
2	1	55.6	GND	1750	2110	362	895
3	2	67.9	GND	2618	2269	402	1120
4	1	65.5	GND	2062	2485	426	1054
5	2	61.4	GND	2367	2052	364	1013
6	1	51.2	GND	1612	1943	333	824
7	1	50.0	GND	1574	1897	325	805
8	1	50.0	GND	1574	1807	325	805
0	1	50.0	CND	1574	1907	325	805
3	1	50.0	GND	1374	1097	325	4000
10	2	62.3	GND	2402	2082	369	1028
11	3	84.3	MID	1860	2482	437	1014
12	1	60.5	MID	1223	2318	394	835
13	2	74.9	MID	2069	2522	443	1067
14	1	65.2	MID	1318	2498	424	900
15	3	86.0	MID	1897	2532	446	1034
16	2	63.9	MID	1765	2151	378	911
17	2	61.0	MID	1685	2054	361	869
18	1	51.1	MID	1033	1958	332	705
19	1	50.0	MID	1011	1916	325	690
20	1	50.0	MID	1011	1916	325	690
21	1	50.0	MID	1011	1916	325	690
22	ST	37.5	MID	758	1437	244	518
23	1	53.0	MID	1000	2065	351	744
20	-	04.0	MID	1000	2000	407	1011
24	3	64.3	MID	1860	2482	437	1014
25	1	60.5	MID	1223	2318	394	835
26	2	74.9	MID	2069	2522	443	1067
27	1	65.2	MID	1318	2498	424	900
28	3	86.0	MID	1897	2532	446	1034
29	2	63.9	MID	1765	2151	378	911
30	2	61.0	MID	1685	2054	361	869
31	1	51.1	MID	1033	1958	332	705
32	1	50.0	MID	1011	1916	325	690
33	1	50.0	MID	1011	1916	325	690
34	1	50.0	MID	1011	1916	325	690
35	ST	37.5	MID	758	1437	244	518
36	1	53.0	MID	1000	2065	251	744
37	3	84.3	TOP	2701	2461	437	1186
20	3	04.5	TOP	2701	2401	437	004
30	1	60.5	TOP	1955	2294	394	984
39	2	74.9	TOP	2687	2508	443	1194
40	2	65.2	TOP	2339	2183	386	1040
41	3	86.0	TOP	2755	2511	446	1210
42	2	63.9	TOP	2292	2139	378	1019
43	2	61.0	MID	1685	2054	361	869
44	1	51.1	MID	1033	1958	332	705
45	1	50.0	MID	1011	1916	325	690
46	1	50.0	MID	1011	1916	325	690
47	1	50.0	MID	1011	1916	325	690
48	ST	37.5	MID	758	1437	244	518
49	1	53.9	MID	1090	2065	351	744
50	2	61.0	MID	1685	2054	361	869
51	1	51.1	MID	1033	1958	332	705
52	1	50.0	MID	1011	1916	325	690
53	1	50.0	MID	1011	1016	325	600
55	4	50.0	IVID MID	1011	1010	323	030
54	1	50.0	WID	1011	1910	325	090
55	SI	37.5	MID	/58	1437	244	518
56	1	53.9	MID	1090	2065	351	744
57	2	61.0	MID	1685	2054	361	869
58	1	51.1	MID	1033	1958	332	705
59	1	50.0	MID	1011	1916	325	690
60	1	50.0	MID	1011	1916	325	690
61	1	50.0	MID	1011	1916	325	690
62	ST	37.5	MID	758	1437	244	518
63	1	53.9	MID	1090	2065	351	744
64	2	61.0	TOP	2188	2042	361	973
65	- 1	51 1	TOP	1651	1039	333	821
66	4	50.0	TOP	1616	1900	332	031
67	1	50.0	TOP	1616	1000	323	013
0/	1	50.0	TOP	1010	1090	325	013
68	1	50.0		1616	1896	325	813
69	ST	37.5	TOP	1212	1422	244	610
70	1	53.9	TOP	1742	2044	351	877
		4026.0					

	DER - Based	SHP System		
Plot	Heating	Distribution	Lighting	Emissions
1	1350	54	371	413.5
2	947	38	281	294.9
3	1168	47	324	358.6
4	1115	45	331	347.4
5	1056	42	293	324.3
6	872	35	259	271.5
7	851	34	253	265.2
0	851	34	253	265.2
10	1072	43	298	329.0
11	903	36	361	302.8
12	757	30	306	254.6
13	1002	40	358	326.1
14	815	33	330	274.4
15	921	37	368	308.9
16	855	34	305	278.2
17	639	33 26	291	205.0
19	625	25	253	210.4
20	625	25	253	210.4
21	625	25	253	210.4
22	469	19	190	157.8
23	674	27	272	226.8
24	903	36	361	302.8
25	/5/	30	306	254.6
20	815	33	330	274.4
28	921	37	368	308.9
29	855	34	305	278.2
30	816	33	291	265.6
31	639	26	258	215.1
32	625	25	253	210.4
33	625	25	253	210.4
35	469	19	190	157.8
36	674	27	272	226.8
37	1301	52	361	399.3
38	1043	42	306	324.0
39	1204	48	358	375.2
40	1048	42	311	326.6
41	1327	53	368	407.3
42	816	33	291	265.6
44	639	26	258	215.1
45	625	25	253	210.4
46	625	25	253	210.4
47	625	25	253	210.4
48	469	19	190	157.8
49	674 816	27	272	226.8
51	639	26	258	205.0
52	625	25	253	210.4
53	625	25	253	210.4
54	625	25	253	210.4
55	469	19	190	157.8
56	674	27	272	226.8
5/	816	33	291	265.6
59	625	25	253	210.4
60	625	25	253	210.4
61	625	25	253	210.4
62	469	19	190	157.8
63	674	27	272	226.8
64	981	39	291	305.6
60 88	862	35 35	∠58 253	2/3./ 267.8
67	862	35	253	267.8
68	862	35	253	267.8
69	647	26	190	200.9
70	929	37	272	288.7
	55001	2245	10505	18132 0

Total Site Target Emissions (Be Lean)

Total Site Design Emissions (Be Green - ASHPs)

Total Reduction

% Reduction

57979.6

57,980 kgCO₂ per year

18,133 kgCO₂ per year

39,847 kgCO₂ per year

68.73%

Total Energy

77824



Appendix 5 – Roof Plans showing Indicative Layout of Photovoltaic Panels



HIGH STREFT	
Home Park Rat	
	Rev Date Description
	ARCHITECTURAL DESIGN SERVICES
	FLUENT ARCHITECTURAL DESIGN SERVICES 69-71 Windmill Road, Sunbury, Middlesex, TW16 7DT TEL: DBDD 0438838 E-Mail: INFO@FLUENT-ADS.CD.UK WeB: FLUENT-ADS.CD.UK
	Kingston Bridge House Church Grove, Hampton Wick
	Proposed Site Plan
/	
2	Scale Dwg No. 1:500 @ A3 FLU.1191.3.10 Date Date
	Drawn N.Millin



Appendix 6 – London Borough of Richmond Sustainable Construction Checklist

LBRUT Sustainable Construction Checklist - June 2020

This document forms part of the Sustainable Construction Checklist SPD. This document **must** be filled out as part of the planning application for the following developments: all residential development providing **one or more new residential units (including conversions leading to one or more new units)**, and all other forms of development providing **100sqm or more of non-residential floor space**. Developments including new non-residential development of less than 100sqm floor space, extensions less than 100sqm, and other conversions are strongly encouraged to comply with this checklist. Where further information is requested, please either fill in the relevant section, or refer to the document where this information may be found in detail, e.g. Flood Risk Assessment or similar. **Further guidance** on completing the Checklist may be found in the Justification and Guidance section of this SPD.

Property Name (if relevant	ant): Kingston Bridg	ge House, Church Grove, Hampton Wick	Application No. (if known):		
Address (include. posto	code) Kingston Bridg	ge House, Church Grove, Hampton Wick			
Completed by:	Ivan Ball - Blu	esky Unlimited			
For Non-Residential Size of development (n	n2)	7	For Residential Number of dwellings 70		
1 MINIMUM CO	MPLIANCE (RESIDENTIA	L AND NON-RESIDENTIAL)			
Energy Accessment	,	,			
Has an energy energy measu	y assessment been subm ures, including the feasibil	itted that demonstrates the expected energy and carbon of the community heating systems? If yes,	dioxide emissions saving from energy efficiency and renewable please select TRUE.	Please Select:	
Carbon Dioxide emiss What is the or Policy LP 22	sions reduction n site carbon dioxide emis B. and Draft London Plan	sions reduction against a Building Regulations Part L (201 Policy 9.2.5 require a 35% onsite reduction in CO_2 emiss	13) baseline sions beyond Building Regulations 2013.	91.53 %	
What is the pe Policy LP 22 (beyond Build	ercentage reduction from C. and Draft London Plan ling Regulations 2013 from	efficiency measures alone Flolicy 9.2.6 require a 10% onsite reduction in CO2 emiss m efficiency measures for residential and 15% for non-resid	sions dential.	10.57 %	
Percentage o	f total site CO2 emissions	saved through renewable energy installation?		80.96 %	
What is the to Policy LP 22 I	otal remaining carbon to be B. and Draft London Plan	e offset Policy 9.2.4 require Major developments to achieve Zero (Carbon after offsetting.	4.913 Tonne	
Are remaining	g emissions going to be of	fset through offset fund payment in accordance with curren	nt guidelines issued for the cost per tonne of CO2?	TRUE	
1A MINIMUM PO	LICY COMPLIANCE (NON	I-RESIDENTIAL AND DOMESTIC REFURBISHMENT)			
		Please check the Guidance Section of this SP	PD for the policy requirements		
Environmental Rating Non-Residential new-br	of development: uild (100sqm or more)				
BREEAM Lev Excellent required und	rel er Policy LP22 A 3	Please Select	Have you attached a pre-assessment to support this?		Please Select:
Extensions and conver BREEAM Dor	rsions for residential dwelli mestic Refurbishment	ngs Please Select	Have you attached a pre-assessment to support this?		Please Select:
Excellent required under Extensions and convert	er Policy LP22 A 4 rsions for non-residential b	uildings			. <u></u>
BREEAM Lev Excellent required und	el er Policy LP 22	Please Select	Have you attached a pre-assessment to support this?		Please Select:
Score awarde BREEAM:	d for Environmental Ratin Good = 0, Ve	g: ry Good = 4, Excellent = 8, Outstanding = 16		Subtotal 0	
10					
TB MINIMUM PO	LICY COMPLIANCE (RES	SIDENTIAL)			
TB MINIMUM PO	LICY COMPLIANCE (RES	SIDENTIAL)		Score	
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 MINIMUM PO Water Usage Internal water Calculations under 100/p/d Requires 100/p/d Requires 2. ENERCY USE AND 2.1 Need for Cooling a. How does the See Draft Lor 2.2 Heat Generation b. How have the How have the How have the Boos the devires b. Does the devires b. Does the devires c. Has an air quires see Policy LP d. Please tick on see Policy LP 	LICY COMPLIANCE (RES rusage after gray/rainwate using the water efficiency u uired for new dwellings un POLLUTION e development incorporate Energy efficie Mechanical ve Active cooling ndon Plan SI3 e heating and cooling syst will be used in the develop ndon Plan SI3 se and Light elopment plan to include a If yes, please information. I Richmond wel ality impact assessment bo If yes, have o 210 hy one option below Has the develop Has the develop	IDENTIAL) ar systems limited to 105 litres person per day. (Excluding a calculator for new dwellings have been submitted. der Policy LP22 A 2 105/p/d required under Draft London ar cooling measures? Tick all that apply: It design incorporating specific heat demand to less than in Reduce heat entering a building through providing/impor Reduce heat entering a building through shading Exposed thermal mass and high ceilings passive ventilation entilation with heat recovery systems, i.e. Air Conditioning Unit ems, with preference to the heating system hierarchy, beer ment: Connection to existing heating or cooling networks powe Site wide CHP network powered by gas Communal heating and cooling powered by gas or elect Individual heating and cooling powered by gas or elect Individual heating and cooling networks power a biomass boiler? refer to the biomass guidelines for the Borough of Richmo the proposed boiler is of a qualifying size, you may need bate. en provided insions Neutral been achieved Compared to boiler so the approved by an existing I for to any of the above are there any sensitive receptor	an allowance 5 litres per person per day for external water consumption). <i>i Plan Policy SI5</i> or equal to 15 kWh/sqm oving insulation and living roofs and walls in selected (defined in London Plan policy SI3) Tick all heating and cooling ered by renewable energy ered by renewable energy ered by gas or electricity energy tricity an sites? ond, please see guidance for supplementary to complete the information request form found on the g pollution os as defined in Policy LP 10 present? ance the existing soundscape of the site? n/ransmission issues in its intended operation?	1 Subtotal 1 Score 6 2 3 4 3 1 0 Score 6 5 4 3 2 1 0 0 2 2 1 1 0 2 1 1 -1 3 1	TRUE FALSE

f.	see Policy LP 10 Have you attached a Lighting Pollution Report?	-	
		Subtotal 29	
Pleas Whilst	se give any additional relevant comments to the Energy Use and Pollution Section below t the energy demand figures quoted in 5.4 of the Sustainability and Energy Statement (26/09/22) sum the space heating and hot water demand, the demand for space heating will be lev	as than 15	
kWh/s other	sqm for each of the modelled units. A communal heating system will be installed which will be powered by heat pumps. A Construction Plan will be prepared, which will seek to reduce dus disturbancies to immediate neighbours	t, noise and	
3. TR.	ANSPORT		
3.1 P a.	rovision for the safe efficient and sustainable movement of people and goods Does your development provide opportunities for occupants to use innovative travel technologies?		FALSE
Pleas The p	se explain: monosal only includes a total of 21 car parking spaces of which seven are allocated to disabled residents and visitors		
	Dass your development provide for 100% active provision for electric vahicle chaming point(s) and have you successfully demonstrated that it would be able to operate	Score	
b.	satisfactorily in the future expectation of all vehicles being electrically owered?	2	TRUE
C.	For major developments ONLY: Has a Transport Assessment been produced for your development based on TfL's Best Practice Guidance? If you have provided a Transport Assessment as part of your planning application, please tick here and move to Section 3 of this Checklist.	5	TRUE
d.	For smaller developments ONLY: Have you provided a Transport Statement?	5	FALSE
e.	Does your development provide cycle storage? (Standard space requirements are set out in the Council's Parking Standards - Local Plan Appendix 3) If so, for how many bicycles?	2 160	TRUE
ŕ	Is this shown on the site plans? See Local Plan Appendix 3 Mill the development exception a simplify with level and wider transport potynetic? If you plans, provide details	2	TRUE
	min de de reapplient dicate or implore mino manocar and made annapolit networks: in yes, prease provide details.	Subtotal 9	TALUL
Pleas	se give any additional relevant comments to the Transport Section below		
4 4.1 M	BIODIVERSITY		
4.1 M a.	unimising the threat to biodiversity from new buildings, lighting, hard surfacing and people Does your development involve the loss of an ecological feature or habitat, including a loss of garden or other green space? (Indicate if yes) If so, please state how much in sqm? See DAS	-2 sqm	FALSE
b.	Does your development involve the removal of any tree(s)? (Indicate if yes) If so, has a tree report been provided in support of your application? (Indicate if yes)		FALSE FALSE
C.	Does your development plan to add (and not remove) any tree(s) on site? (Indicate if yes)		FALSE
d.	Please indicate which features and/or habitats that your development will incorporate to improve on site biodiversity: Pond. reedbed or extensive native planting 6 Area provided:	sam	FALSE
	An extensive green roof 5 Area provided: An intensive green roof 4 Area provided:	sqm sqm	FALSE FALSE
	Garden space 4 Area provided: Additional native and/or wildlife friendly planting to peripheral areas 3 Area provided:	sqm sqm	FALSE TRUE
	Additional planting to peripheral areas 2 Area provided: A living wall 2 Area provided:	sqm sqm	TRUE FALSE
	Bat boxes 0.5 Bird boxes 0.5		TRUE
	Other 0.5		FALSE
	Does your development use at least 70% of available restinates as associlization of	1	EALSE
e.	Policy LP 17 requires 70%	Subtotal 6.5	FALSE
Pleas The p	se give any additional relevant comments to the Biodiversity Section below proposal is for the conversion of an existing building and there is only limited external space for landscape and ecological enhancements. However, the peripheral areas could be used to	provide addi	
5			
5.1 Mitiga a.	ating the risks of flooding and other impacts of climate change in the borough Is your site located in a high flood risk zone (Zone 3)? (Indicate if yes)	-2	FALSE
b.	have you submitted a rivou rook Assessment (inducate ii yes) Which of the following measures of the drainage hierarchy are incorporated onto your site? (tick all that apply)		IRUE
-	Store rainwater for later use Use of infiltration techniques such as porous surfacing materials to allow drainage on-site	5 3	FALSE TRUE
	Attenuate rainwater in ponds or open water features Store rainwater in tanks for gradual release to a watercourse	4 3	FALSE FALSE
	Discharge rainwater directly to watercourse Discharge rainwater to surface water drain	2 1	FALSE FALSE
	Discharge rainwater to combined sewer Have you submitted a Drainage Statement (Indicate if yes)	0	TRUE
C.	See Pruncy Lr 2 / and Urait Longon Plan SL 13 Please give the change in area of permeable surfacing which will result from your development proposal:	sqm	
Pleas	e give any additional relevant comments to the Flooding and Drainage Section below	Subtotal 3	
The s	site lies within Flood Zone 1 and Flood Zone 2 and a site specific FRA has been prepared. There is limited soft landscaping and therefore it is not proposed to store any rainwater runoff	or reuse.	
6	IMPROVING RESOURCE EFFICIENCY		
a.	Will demolition be required on your site prior to construction? (Points will only be awarded if 10% or greater of demolition waste is reused/recycled)	1	TRUE
	If so, what percentage of demolition waste will be reused in the new development? 20	%	
	What percentage of demolition waste will be recycled? 80	%	
b.	Does your site have any contaminated land? Have you submitted an assessment of the site contamination?	1 2	FALSE FALSE

		Are plans in pla	ace to remediate the contamination?			2	FALSE
		Are plans in pla	ace to include composting on site?			1	FALSE
C.	Will a waste manageme	nt plan and facili	ties be in place in line with Policy LP24		Yes		
6 2 Red	ucing levels of water wa	Seto			<u> </u>		
a.	Will the following measu	res of water cons	servation be incorporated into the development? (Please tick al	I that apply):			
		Fitting of water	efficient taps, shower heads etc			1	TRUE
		Rainwater harv	esting for internal use			4	FALSE
		Greywater syst	ems			4	FALSE
		rit a water met	ei			·	TRUE
Please	nive any additional releva	nt comments to t	he Improving Resource Efficiency Section below			Subtotal 3	
It is und	erstood there is no conta	mination within th	ne site. A Site Waste Management Plan will be prepared and for	llowed at the construction stage. It is not propose	ed to provide any rainwat	er or greywater ha	
7	ACCESSIBILITY						
7.1 a.	Ensure flexible adapta If the development is r	ble and long-ter esidential, will it	m use of structures meet the requirements of the nationally described space stand	ard for internal space and layout?		1	TRUE
		If the standard	s are not met, in the space below, please provide details of the	functionality of the internal space and layout			
				The standards of the SPD will be met.			
b.	If the development is r	esidential, will it	meet Building Regulation Requirement M4 (2) 'accessible and a	adaptable dwellings'?		2	TRUE
		If this is not me	t, in the space below, please provide details of any accessibility	y measures included in the development.			
		For major resid	ential developments, are 10% or more of the units in the develo	opment to Building Regulation Requirement M4		1	TRUE
OR		(5) wheelchair	user awenings ?				
C.	If the development is n	on-residential,	does it comply with requirements included in Richmond's Local I	Plan LP1, LP28.B, LP30 & LP45		2	FALSE
		Please provide	details of the accessibility measures specified in the Local Plan	that will be included in the development			
						Subtotal 4	
Please	give any additional releva	nt comments to I	the Design Standards and Accessibility Section below				
RUT Sus	tainable Construction Cl	hecklist- Scorin	g Matrix for New Construction (No	n-Residential and domestic refurb)		TOTAL 55.5	
	Score	Rating	Significance	i]		
	84 or more 75-83	A+	Project strives to achieve highest standard in energy efficient :	sustainable development	-		
	56-74	B	Helps to significantly improve the Borough's stock of sustainable	ble developments			
	40-55	C	Minimal effort to increase sustainability beyond general compli	ance			
	39 OF IESS	FAIL	Does not comply with SPD Policy		1		
RUT Sus	tainable Construction C	hecklist-Scorin	g Matrix for New Construction Res	sidential new-build	•		
	Score	Rating	Significance		4		
	85 or more	A++	Project strives to achieve highest standard in energy efficient :	sustainable development	1		
	59-67	A+ A	Makes a major contribution towards achieving sustainable dev	elopment in Richmond	1		
	39-58	В	Helps to significantly improve the Borough's stock of sustainable	ble developments	1		
	24-38	С	Minimal effort to increase sustainability beyond general compli	ance	4		
	23 or less	FAIL	Does not comply with SPD Policy		J		

Authorisation: I herewith declare that I have filled in this form to the best of my knowledge

Signature _____ Date _____



Appendix 7 – Calculation of Unregulated Emissions

Calculation of Unregulated Emissions

Project Kingston Bridge House, Hampton Wick Client Westcombe Date Sep-22 Rev A



 $\label{eq:Electrical Appliances} E_a \,{=}\, 207.8\,x\,(\text{TFA}\,x\,\text{N})^{0.4714}$

Cooking

E_c = 138 + 28 x N

N = 1 + 1.76 x $[1-exp(-0.000349 x (TFA-13.9)^2)] + 0.0013 x (TFA - 13.9)$

Plot	Bedrooms	Floor Area	Number of Occupants	Energy Demand Appliances	Energy Demand Cooking	Emissions for Apps & Cooking
		m ²		kWh	kWh	kg CO ₂
1	3	86.7	3	2661	210	669
2	1	55.6	2	1848	190	475
3	2	67.9	2	2198	199	559
4	1	65.5	2	2132	198	543
5	2	61.4	2	2017	195	515
6	1	51.2	2	1718	186	444
8	1	50.0	2	1683	185	435
9	1	50.0	2	1683	185	435
10	2	62.3	2	2042	195	521
11	3	84.3	3	2608	209	656
12	1	60.5 74.9	2	1991	194	509
14	1	65.2	2	2124	197	541
15	3	86.0	3	2646	210	665
16	2	63.9	2	2087	197	532
17	2	61.0	2	2005	194	512
18	1	51.1	2	1715	186	443
19	1	50.0	2	1683	185	435
20	1	50.0	2	1683	185	435
22	ST	37.5	1	1318	176	348
23	1	53.9	2	1798	189	463
24	3	84.3	3	2608	209	656
25	1	60.5	2	1991	194	509
20	2	65.2	2	2382	197	541
28	3	86.0	3	2646	210	665
29	2	63.9	2	2087	197	532
30	2	61.0	2	2005	194	512
31	1	51.1	2	1715	186	443
32	1	50.0	2	1683	185	435
34	1	50.0	2	1683	185	435
35	ST	37.5	1	1318	176	348
36	1	53.9	2	1798	189	463
37	3	84.3	3	2608	209	656
38	1	6U.5 74 Q	2	1991	194	509
40	2	65.2	2	2124	197	541
41	3	86.0	3	2646	210	665
42	2	63.9	2	2087	197	532
43	2	61.0	2	2005	194	512
44	1	51.1	2	1715	186	443
45	1	50.0	2	1683	185	435
47	1	50.0	2	1683	185	435
48	ST	37.5	1	1318	176	348
49	1	53.9	2	1798	189	463
50	2	61.U 51.1	2	2005	194	512 443
52	1	50.0	2	1683	185	435
53	1	50.0	2	1683	185	435
54	1	50.0	2	1683	185	435
55	ST	37.5	1	1318	176	348
56	1	53.9	2	1798	189	463
58	∠ 1	51.0	2	2005	186	443
59	1	50.0	2	1683	185	435
60	1	50.0	2	1683	185	435
61	1	50.0	2	1683	185	435
62	ST	37.5	1	1318	176	348
63	1	53.9	2	1/98	189	463
65	2 1	51.1	2	1715	186	443
66	1	50.0	2	1683	185	435
67	1	50.0	2	1683	185	435
68	1	50.0	2	1683	185	435
69 70	ST 1	37.5	1	1318	176	348
10		4026.0	2	1730	103	405



Appendix 8 – GHA Early Stage Overheating Risk Tool

EARLY STAGE OVERHEATING RISK TOOL Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating. The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps. Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.



KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING

(Geographical and	local context					
	#1 Where is the	South east	4		#8 Do the site surroundings feature significant		
S	scheme in the UK?	Northern England, Scotland & NI	0	4	blue/green infrastructure?		
	See guidance for map	Rest of England and Wales	2		Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this	1	1 1
				-	would require at least 50% of surroundings within a 100m		
	#2 Is the site likely to	Central London (see guidance)	3		radius to be blue/green, or a rural context		
	see an Urban Heat	Grtr London, Manchester, B'ham	2	2	· · · · · · · · · · · · · · · · · · ·		
	See guidance for details	Other cities, towns & dense sub- urban areas	1				

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or	Day - reasons to keep all windows closed Day - barriers some of the time, or for some windows e.g. on quiet side	8 4	0	#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	1
very busy road - Security risks/crime - Adjacent to heat rejection plant	Night - reasons to keep all windows closed Night - bedroom windows OK to open, but other windows are likely to stay closed	8 4	0	#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	0

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	3	#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance	1	1
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	3	#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans>2.8m and fan installed > 2.8m	2 1	1

Solar heat gains and ventilation

<u> </u>						
#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65% 12 >50% 7 >35% 4	#13 Is there useful e Shading should apply to glazing. It may include s above, facade articulatie "full" and "part". Scoring proportions as per #6	xternal shading solar exposed (E. shading devices, b on etc. See guidan depends on glazi	? /S/W) alconies ng >50% >35%	Full 6 4 4	Part 3 2 2
#7 Are the dwellings single aspect?Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilationSingle Dua	e-aspect 3 I aspect 0	#14 Do windows & o support effective ver Larger, effective and secure openings will help dissipate heat - see guidance	benings ntilation? Single-aspect Dual aspect	Openings com Part F purge = Part F +50 minimum required 2	pared t rates % +10	o 20% 4 3
TOTAL SCORE 9 = Sum of cor	ntributing factors: 19	minus	S	ອິບກ of mitiດ fa	yatin Ictor:	g s: 10
High 12	l	ledium	8	Low		
score >12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	score between 8 a Seek design chang and/or increase mit AND Carry out a de dynamic modelling	and 12: les to reduce risk factors tigation factors etailed assessment (e.g. against CIBSE TM59)	score <8: Ensure the m and that risk planning con	nitigating meas factors do not i ditions)	ures ar ncreas	re retained se (e.g. in