

Planning Application Energy Assessment

Energy Statement

Howson Terrace

Richmond Hill

Richmond

London

Housing 21

Report No: PA-ES-HT-H21-21-01

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1. PROJECT DETAILS

Type of Application	Full Planning Application	
Project Name	Howson Terrace	
Project Address	Howson Terrace, Richmond Hill, Richmond, London	
Project Description	Redevelopment of the existing sheltered housing block to provide a new building containing 28 no. retirement apartments.	
Developer	Housing 21	
Developer Address	Tricorn House, 51-53 Hagley Road, Birmingham, B16 8TP	
Architect	Hunters	
Architect's Address	Space One, 1 Beadon Road, London, W6 0EA	
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2. EXECUTIVE SUMMARY

This report considers the predicted energy and CO₂ demand for the proposed development at the Howson Terrace located in The London Borough of Richmond Upon Thames.

The report complies with the requirements at both national and local level, as set out in the National Planning Policy Framework (2019), The London Plan (2021), GLA Energy Assessment Guidance (2018), and the London Borough of Richmond Upon Thames Local Plan (2018).

The proposed site will be built under Part L 2013 (with 2016 amendments) of the Building Regulations and in line with the London Plan target to achieve a minimum 35% CO₂ reduction over the baseline using the new draft SAP10 carbon factors.

The development will reduce regulated CO_2 emissions by integrating a range of passive design and energy efficiency measures throughout the building. These measures include improving building fabric standards beyond the requirements of Part L of the Building Regulations. These measures enable the proposed scheme to go beyond Target Emission Rates (TER) and Target Fabric Energy Efficiency (TFEE) minimum standards via energy efficiency measures alone.

Following reduction of the energy demand, the strategy recommends the implementation of hot water heat pump cylinders to efficiently supply hot water to the residential dwellings. Space heating to the residential dwellings will be supplied through lor surface temperature electric panel heaters. In addition, the non-residential elements of the building will have their heating supplied through air source heat pump (ASHP) technology.

The regulated energy CO₂ savings expressed in terms of actual and percentage reduction after each stage of the energy hierarchy for residential and non-residential parts of the development are provided below.

Residential Element

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Residential Baseline	28.53	13.36	41.89
Be Lean	21.88	13.36	35.24
After Heat Network	15.37	13.36	28.73
Be Green	15.37	13.36	28.73

The proposed strategy has first reduced energy demand through fabric and energy efficiency measures. The overall Part L Fabric Energy Efficiency (FEE) performance has been reviewed for the 'be lean' position and compared to the baseline stage of the energy hierarchy. The improvement has been shown to be circa 17%.

Element	TFEE (kWH/m²/year)	DFEE (kWH/m²/year)	Improvement (%)
Residential Development Total	52.54	43.75	17

The proposed strategy shows that including unregulated energy the total CO₂ saved is calculated at 12.94 tonnes.

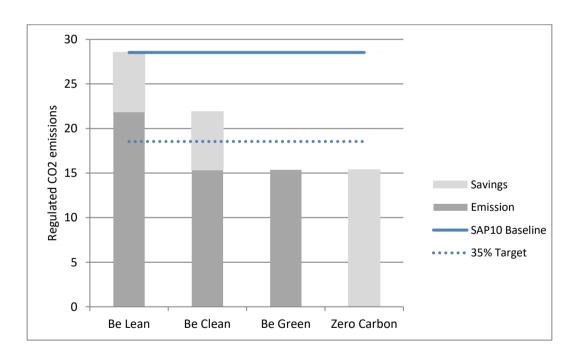
The CO_2 savings attributed to regulated energy only are summarised with the relative percentage improvements shown in the table below. The table shows that the 13.16 tonne saving in CO_2 is equivalent to a 46% reduction when compared to the baseline figure.



To achieve zero carbon a further reduction of circa 15.37 tonnes is required and this is to be met by a cash in lieu contribution payment based on a figure of £95 per tonne over a 30 year period.

	Regulated Energy CO₂ Saving		
	Tonnes per year	%	
Be Lean	6.65	23	
Be Clean after heat network	6.51	23	
Be Green	0.00	0	
Cumulative on-Site Savings	13.16	46	
Carbon Shortfall	15.37		
	Tonnes CO ₂		
Cumulative savings for offset payment	461.10		
Cash-in-lieu contribution	£43,804.50		

The overall reduction in regulated carbon emission to the residential units can be illustrated graphically as below.





Non-Residential Space

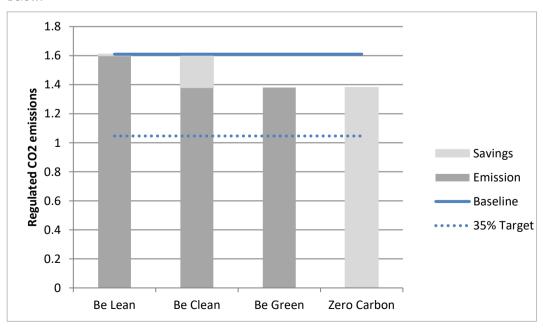
The proposed strategy for the non-residential communal areas shows that including unregulated energy the total CO_2 saved is circa 0.23 tonnes which is equivalent to a reduction of 14%.

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Non-Residential Baseline	1.61	4.45	6.06
After energy demand reductions	1.60	4.45	6.05
After Heat Network	1.38	4.45	5.83
Be Green	1.38	4.45	5.83

The CO_2 savings attributed to regulated energy only are summarised with the relative percentage improvements shown in the table below. This table shows that the 0.23 tonne saving in CO_2 is equivalent to a 14% reduction when compared to the baseline figure.

	Regulated Energy CO ₂ Saving		
	Tonnes per year	%	
Be Lean	0.01	1	
Be Clean	0.22	14	
Be Green	0.00	0	
Cumulative on-Site Savings	0.23	14	

The overall reduction in regulated carbon emission for the non-residential space can be illustrated graphically as below.





Site-Wide CO₂ Savings

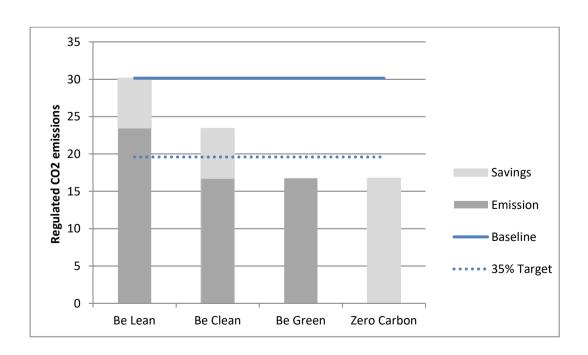
The summary of the overall CO_2 reduction site-wide after each stage of the energy hierarchy is summarised in the table below. The total CO_2 saved is circa 13 tonnes which is equivalent to a reduction of 28% when including unregulated energy.

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Baseline	30.14	17.81	47.95
After energy demand reductions	23.48	17.81	41.29
After Heat Network	16.75	17.81	34.56
Be Green	16.75	17.81	34.56

The CO_2 savings attributed to regulated energy only are summarised with the relative percentage improvements shown in the table below. This table shows that the 13.39-tonne saving in CO_2 is equivalent to a 44% reduction when compared to the baseline figure. This is in excess of the 35% saving required by the London Plan Policy SI 2.

	Regulated Energy CO ₂ Saving		
	Tonnes per year	%	
Be Lean	6.66	22	
Be Clean	6.73	22	
Be Green	0.00	0	
Cumulative on-Site Savings	13.39	44	

The overall reduction in regulated carbon emission can be illustrated graphically as below.





Summary

The proposed energy strategy achieves and meets the following requirements:

- Complies with Part L 2013 building regulations (with 2016 amendments).
- Includes improved optimal building fabric improvements, energy efficient design of building services.
- Meets the TFEE minimum reduction requirements.
- Utilises heat pump technology through hot water heat pump cylinders within the residential dwellings.
- Utilises ASHP to supply heating to the non-residential element of the building.
- Achieves in excess of 35% regulated energy CO₂ emissions reduction on-site.
- Achieves Zero Carbon by making a cash in lieu contribution.



3. Introduction

This report has been prepared by Abbey Consultants (Southern) Ltd, a specialist environmental and energy consultancy on behalf of Housing 21 in support of the Full Planning Application for the proposed development at Howson Terrace located in The London Borough of Richmond Upon Thames .

The proposed application is described as:

Redevelopment of the existing sheltered housing block to provide a new building containing 28 no. retirement apartments.

Figure 1 details the proposed site layout.

Figure 1: Proposed Site Plan (Ground Floor Level)



The report first establishes a baseline assessment of the energy demands and associated CO_2 emissions for the residential units and the non-residential floorspace.

It then follows The London Plan Energy Hierarchy approach of Be Lean, Be Clean, Be Green and Be Seen to enable the maximum viable reductions in Regulated CO₂ emissions to be achieved.

- 1. Be lean: use less energy and manage demand during operation
- 2. 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

The report takes into consideration the layout, use and requirements for the development to recommend a strategy that integrates the most suitable technologies available that are commercially viable, whilst also achieving compliance with all policies applicable to this development.



4. PLANNING POLICY

An effective planning system is required to contribute to achieving sustainable development.

Sustainable development is defined as having the following three overarching objectives which are interdependent and need to be pursued in mutually supportive ways: an economic objective, a social objective, and an environmental objective.

- 1. Economic objective to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
- 2. Social objective to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
- 3. Environmental objective to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

4.1 National Planning Policy Framework (NPPF) 2019

The NPPF sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Chapter 14 Meeting the challenge of climate change, flooding and coastal change

The following paragraphs set out the Government's position in response to reducing carbon emissions:

Paragraph 150: New development should be planned for in ways that:

- **a.** avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- **b.** can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

Paragraph 151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- **a.** provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
- **b.** consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- **c.** identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

Paragraph 153: In determining planning applications, local planning authorities should expect new development to:

- **a.** comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- **b.** take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.



Paragraph 154: When determining planning applications for renewable and low carbon development, local planning authorities should:

a. not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

4.2 LONDON PLAN POLICY

Greater London Authority
The London Plan
Adopted March 2021

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:
- 5. be lean: use less energy and manage demand during operation
- 6. be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
- 7. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
- 8. 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 ring-fenced 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 3 Energy infrastructure

- A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.
- B. Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:
 - 1. major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
 - 2. heat loads from existing buildings that can be connected to future phases of a heat network
 - 3. major heat supply plant including opportunities to utilise heat from energy from waste plants
 - 4. secondary heat sources, including both environmental and waste heat
 - 5. opportunities for low and ambient temperature heat networks
 - 6. possible land for energy centres and/or energy storage
 - 7. possible heating and cooling network routes
 - 8. opportunities for future proofing utility infrastructure networks to minimise the impact from road works
 - 9. infrastructure and land requirements for electricity and gas supplies
 - 10. implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
 - 11. opportunities to maximise renewable electricity generation and incorporate demand-side response measures.
- C. Development Plans should:
 - 1. identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure
 - 2. identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.
- D. Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:
 - 1. the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
 - 2. connect to local existing or planned heat networks
 - 3. use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
 - 4. use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
 - 5. use ultra-low NOx gas boilers
 - 6. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality
 - 7. where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.
- E. Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.



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:
 - 1. 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
 - 3. 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:
 - 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)
 - 3. 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:
 - 1. 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.



4.3 LOCAL POLICY

London Borough of Richmond Upon Thames Local Plan Adopted July 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:
 - 1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floorspace (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.
 - 4. Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

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 of 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 efficient energy
 - 3. Be green: use renewable energy

Decentralised Energy Networks

- A. 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 developments will be required to connect to existing DE networks feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.
 - 2. Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralised energy (DE) networks and combined heat and power (CHP).



3. Where feasible, new development of 50 units of more, or new non-residential development of 1000sqm or more, as well as schemes for the Proposal Sites identified in this Plan, will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to a local DE network should one become available.

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.

Retrofitting

E. High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting. Householder extensions and other development proposals that do not meet the thresholds set out in this policy are encouraged to complete and submit the Sustainable Construction Checklist SPD as far as possible, and opportunities for micro-generation of renewable energy will be supported in line with other policies in this Plan.



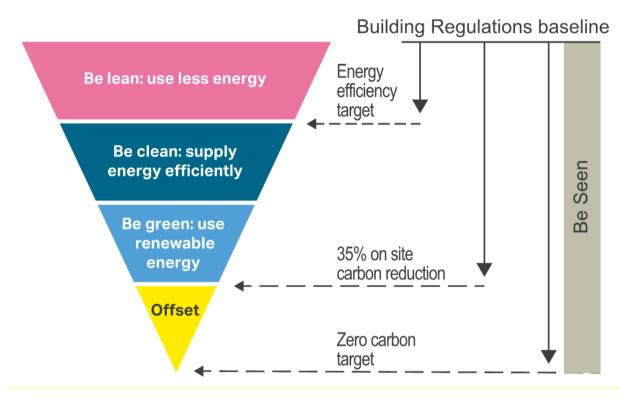
5. DEVELOPMENT APPROACH

The proposed energy strategy follows the London Plan Energy Hierarchy of Be Lean, Be Clean, Be Green and Be Seen to enable the maximum viable reductions in regulated and total CO₂ emissions over the baseline.

Be Lean Use less energy
 Be Clean Supply energy efficiently
 Be Green Use renewable energy systems

• Be Seen Monitor, verify and report on energy performance

Figure 2: The London Plan energy hierarchy and associated targets



The proposed energy supply solutions aim to match energy profiles of the development ensuring effective use. The proposed solutions consider viability and flexibility of the scheme from both a technical and economic point of view by identifying best combination of energy efficiency measures as well as decentralised and renewable energy supply solutions.

Using these principles, Housing 21 aim to deliver the following objectives:

- Comply with the relevant regulatory requirements.
- To propose to reduce energy consumption and carbon dioxide emissions through passive and energy efficiency measures.
- Investigate the feasibility of connecting into an existing district heat network
- To propose to reduce energy consumption and carbon dioxide emissions further through the use of on-site renewable / LZC energy technologies.



5.1 CARBON FIGURES

From January 2019, in line with the latest GLA guidance, the results from these assessments will need be converted using the new draft SAP10 carbon emission factors through a carbon emissions reporting spreadsheet developed by the GLA. The outputs from this spreadsheet are used to demonstrate performance of the development against the new reduction targets.

The following carbon factors have been used in this assessment.

Table 1: Carbon factors

Fuel Type	SAP 2012 kgCO2/kWh	SAP 10 kgCO2/kWh
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

The London Plan's Energy Hierarchy methodology requires separate energy assessments for the residential and non-residential floor space. The results from these separate assessments are combined to provide a predicted sitewide CO₂ emissions reduction.

5.2 RESIDENTIAL UNITS

Stroma's FSAP 2012 has been used to evaluate the CO_2 emissions on a representative sample of the residential dwellings. Using the mix of the development, the energy usage and CO_2 emissions for each dwelling are extrapolated on a weighted basis to evaluate the predicted energy and CO_2 performance for all the residential units.

FSAP has also used to estimate the unregulated energy use for appliances and cooking.

5.3 Non-Residential Space

An initial assessment of CO_2 performance of the non-residential unit is calculated using DesignBuilder software. DesignBuilder is an approved tool for calculating compliance with Part L2A which uses the standard National Calculation Methodology (NCM).

An assessment of the energy performance of the development considers regulated energy usage for different building services such as cooling, heating, lighting and ventilation. An estimate is also provided of unregulated electricity use (equipment) associated with computers, small power, and security systems, etc.



6. BASELINE ENERGY CALCULATIONS

To assess CO₂ performance of the proposed energy strategy a baseline needs to be established. This section describes the approach taken to calculate the baseline for both residential and the non-residential elements of the development.

The total baseline emissions for the proposed development is defined as regulated CO_2 emissions covered by Building Regulations Part L as well as the unregulated CO_2 emissions not covered by Part L. However, the unregulated CO_2 emissions are to be excluded when compliance with planning policy is considered.

6.1 RESIDENTIAL BASELINE

The regulated CO₂ emissions baseline has been established using Part L1A 2013 Target Emission Rate (TER of the sample of representative dwellings.

The TER using SAP 2012 carbon factors have then been adjusted using the new draft SAP10 carbon emission factors using the GLA carbon emissions reporting spreadsheet.

The following table provides the mix used to determine baseline CO₂ demand for the residential units.

Table 2: Residential mix

Туре	Number
1 Bed End - GF	1
1 Bed End - TF	1
1 Bed Mid - GF	5
1 Bed Mid - MF	8
1 Bed Mid - EF	1
1 Bed Mid - TF	6
2 Bed - EF	1
2 Bed - MF	1
2 Bed - TF	1
1 Bed Var - EF	1
1 Bed Var - MF	1
1 Bed Var - TF	1
Total	28

The residential baseline CO_2 emissions including unregulated energy are summarised in the following table. SAP TER sheets are included in the appendices for reference.

Table 3: Residential baseline CO₂ emissions

	Regulated	Unregulated	Total
	(CO₂ tonnes/year)	(CO₂ tonnes/year)	(CO₂ tonnes/year)
Residential Baseline	28.53	13.36	41.89



6.2 Non-Residential Baseline

The regulated CO₂ emissions baseline has been determined by using Part L2A 2013 Target Emission Rate (TER) of the sample of representative dwellings.

The TER using NCM 2012 carbon factors have then been adjusted using the new draft SAP10 carbon emission factors using the GLA carbon emissions reporting spreadsheet.

The following table provides the mix used to determine baseline CO₂ demand for the non-residential units.

Table 4: Non-Residential mix

Space Use	Area (m2)	No of Units
Residential Spaces	388.8	1

The non-residential baseline CO_2 emissions including unregulated energy are summarised in the following table. BRUKL TER sheets are included in the appendices for reference.

Table 5: Non-Residential baseline CO₂ emissions

	Regulated	Unregulated	Total
	(CO ₂ tonnes/year)	(CO₂ tonnes/year)	(CO₂ tonnes/year)
Non-Residential Baseline	1.61	4.45	6.06

6.3 SITE WIDE BASELINE CO₂ EMISSIONS

The site wide CO_2 baseline is determined by combining the residential and non-residential baseline together and is summarised in the following table.

Table 6: Site wide total baseline

	Regulated	Unregulated	Total
	(CO₂ tonnes/year)	(CO₂ tonnes/year)	(CO₂ tonnes/year)
Total Site-Wide Baseline	30.14	17.81	47.95



7. Passive Design and Energy Efficient Measures - Be Lean

In accordance with the London Plan Energy Hierarchy, the energy demands of the development should be reduced as much as practically viable. The desire is to achieve Part L 2013 Building Regulations compliance before low carbon or renewable measures are introduced.

A range of measures to reduce CO₂ emissions and increase resilience to climate change are proposed in the building design, including good building fabric standards as well as energy efficient M&E systems and lighting.

7.1 PASSIVE DESIGN - RESIDENTIAL

A mixed system approach for the ventilation is deemed most suitable due to the high energy efficiency requirements and CO_2 reduction target. The mixed system will utilise natural ventilation through openable windows, which will be supplemented by mechanical ventilation with heat recovery within the dwellings.

Openable windows and balcony doors are proposed but are not essential to provide a fresh air supply. The ventilation strategy will be reviewed and developed as the design progresses to ensure compliance with all the relevant regulations and standards and should certain dwellings be affected by noise issues and cannot open their windows enhanced mechanical ventilation will be introduced to reduce the risk of overheating. It is assumed in this scenario windows can still be opened albeit intermittently for purge ventilation.

The building incorporates passive design measures such as balconies which help to provide shading. The proposed glazed areas have been designed to maximise daylight and optimise solar gains. The glazing specification will be reviewed to ensure that they provide a balance between solar control and solar gain.

The GLA Domestic Overheating Checklist has been completed and is provided in Appendix B.

7.2 BUILDING FABRIC - RESIDENTIAL

To reduce demand for space heating, emphasis has been placed on providing a very high standard of fabric and reducing heat loss through the building envelope. Approved Document Part L1A 2013 sets out the limiting fabric parameters for each of the building elements. Each stated value represents the area-weighted average U-value. The following Table details the proposed U-values to be used in the described exposed element within the fabric of the development along with anticipated percentage improvements over the maximum allowable average weighted U-values in Part L1A 2013.

To further minimise heat loss through the building envelope, air leakage will be made a priority. The airtightness of the dwellings will be set to a level of $2.00 \text{ m}^3/\text{h/m}^2$.

Table 7: Proposed fabric U values Residential space

Element	Part L1A 2013 average allowable U Value	Proposed U Value	Improvement (%)
Ground Floor	0.22	0.13	41
Exposed Floor	0.22	0.13	41
External Walls	0.30	0.18	40
Party Wall	0.20	0.00	0
Roof – flat	0.20	0.11	45
Glazing U-Value	2.00	1.00	50



Door U-Value	2.00	1.00	50
Design Air Permeability	10	2	80

Using the specification detailed previously the overall Part L Fabric Energy Efficiency (FEE) performance has been reviewed for the 'be lean' position and compared to the baseline stage of the energy hierarchy. The results are shown in the following table.

Table 8: Residential FEE Performance

Element	TFEE (kWH/m²/year)	DFEE (kWH/m²/year)	Improvement (%)
Residential Development Total	52.54	43.75	17

7.3 PASSIVE DESIGN — NON-RESIDENTIAL SPACE

Natural ventilation has been considered but is judged to be inappropriate due to the high energy efficiency requirements and CO_2 reduction target, and a mechanical/natural ventilation strategy to supply fresh is deemed to be more suitable.

As per the residential element the proposed glazed areas have been designed to maximise daylight and optimise solar gains. The glazing specification will be reviewed to ensure that they provide a balance between solar control and solar gain.

The GLA Domestic Overheating Checklist has been completed and is provided in Appendix B.

7.4 BUILDING FABRIC - NON-RESIDENTIAL SPACE

Approved Document Part L2A 2013 sets out the limiting fabric parameters for each of the building elements. Each stated value represents the area-weighted average U-value. The following Table details the proposed target U-values to be used within the fabric of the non-residential space.

Air leakage will also be made a priority and the airtightness of the non-residential space will be set to a level of $2m^3/h/m^2$.

Table 9: Proposed fabric U Values - Non-residential space

Element	Part L2A 2013 average allowable U Value	Proposed U Value	Improvement (%)
Ground Floor	0.25	0.13	48
External Walls	0.30	0.18	40
Roof	0.20	0.11	45
Glazing U-Value	2.00	1.00	50
Airtightness	10	2	80



7.5 LIGHTING

A major energy demand within modern non-residential units is generally lighting. Specified lighting in these areas should be low wattage and designed to CIBSE Illuminance levels. Appropriate lighting controls are recommended where appropriate, such as PIRs and daylight dimmers, allowing light output to be automatically adjusted to suit prevailing conditions. Zoning of lighting circuits also allows greater benefit to be made of natural daylight in the areas where it is available, without compromising light levels further away from windows. Additionally, high frequency ballasts and control gear should be utilised where appropriate to further reduce energy demand.

7.6 COOLING

In order to prevent and mitigate any potential overheating risks and minimise excessive heat generation contributing to the urban heat island effect, in accordance with Policy SI 4 of the London Plan 2021, the following design strategies have been considered for inclusion within the development following the GLA cooling hierarchy.

Table 10: Cooling Hierarchy

Cooling Hierarchy	Design Strategy
Minimise internal heat generation through energy efficient design.	Energy efficient measures as per the list above in section 7.0.
Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls.	Effective glazing to be provided with low G values and shading co-efficient to limit the effects of areas with large proportions of glazing. High performance internal blinds optional.
Manage the heat within the building through exposed internal thermal mass and high ceilings.	The majority residential nature of the development limits the feasibility due to the proposed floor levels and heights.
Passive ventilation.	Openable windows.
Mechanical ventilation.	Mechanical ventilation with high efficiency plate heat exchanger heat recovery units are to be installed.
Active cooling systems (ensuring they are the lowest carbon options).	None specified.

7.7 BE LEAN CO₂ SAVINGS RESIDENTIAL UNITS

Based on the proposed energy efficiency measures, the Dwelling Emission Rate (DER) for each representative dwelling provides an indication of the anticipated regulated CO_2 emissions. The DER reports for the sample dwellings have been provided in the appendices. The DER results of the SAP assessments from the representative dwellings for Be Lean have been extrapolated and converted using new draft SAP10 carbon emission factors through the GLA carbon emissions reporting spreadsheet to predict the residential regulated CO_2 emissions after the energy demand reduction.



Table 11: Residential CO₂ Savings (Be Lean)

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Residential Baseline	28.53	13.36	41.89
Be Lean	21.88	13.36	35.24
Saving	6.65	0.00	6.65
Improvement	23%	0%	16%



7.8 BE LEAN CO₂ SAVINGS NON-RESIDENTIAL SPACE

Based on the proposed energy efficiency measures for modelling purposes, the Building Emission Rate (BER) for the non-residential units has been calculated using DesignBuilder software using the standard National Calculation Methodology (NCM).

Table 12: Non-Residential CO₂ Savings (Be Lean)

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Residential Baseline	1.61	4.45	6.06
After energy demand reductions	1.60	4.45	6.05
Saving	0.01	0.00	0.01
Improvement	1%	0%	0%

7.9 BE LEAN CO₂ SAVINGS SITE WIDE

The site wide CO_2 savings is calculated by combining the residential and non-residential space. The site wide savings are summarised in the table below.

Table 13: Site wide CO₂ Savings (Be Lean)

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Baseline	30.14	17.81	47.95
After energy demand reductions	23.48	17.81	41.29
Saving	6.66	0.00	6.66
Improvement	22%	0%	14%



7.10 ENERGY DEMAND

Total delivered energy demand for the development has been assessed and is reported in the table below.

Table 14: Sitewide energy demand

Building	Energy demand following energy efficiency measure (MWh/year)						
Use	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity	Unregulated Gas
Residential Total	44	45	7	6	0	57	0
Non- residential total	2	0	4	1	0	9	0



8. HEATING INFRASTRUCTURE (BE CLEAN)

Decentralised energy refers to energy that is generated off the main grid. This may include micro-renewables, heating and cooling. It can also refer to energy from waste plants, combined heat and power, district heating and cooling, as well as geothermal, biomass or solar energy. Decentralised Energy schemes can serve a single building or a whole community, even being built out across entire cities.

In line with the London Plan, Policy SI 3 Energy infrastructure, major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system that adheres to the following:

The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

- 1. Connect to local or existing planned heat networks
 - a. Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
 - b. Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network)
 - c. Use ultra-low NOx gas boilers
- 2. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality.
- 3. Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

8.1 CONNECTION TO EXISTING DISTRICT HEATING NETWORKS

Existing District Heating Networks have been investigated through the London Heat Map tool. The investigation has confirmed there are no existing, or proposed, district heating networks to which a connection is technically feasible. This is demonstrated in the figure below taken from the London Heat Map. A gas fuelled CHP and is not considered suitable as it does not take advantage of the decarbonised benefits of electricity. Furthermore, the proposed development has less than 800 dwellings, GLA Energy Assessment Guidance suggests that a connection with an ESCO wide heat network is unlikely to be a feasible option.

Figure 3: District Heating opportunities





8.2 PROPOSED HEATING STRATEGY

The proposed development provides an opportunity for the heating strategy to be 'future proofed' by making the best use of low carbon and energy efficient generation using current and future technologies. The technologies which are proposed to be implemented into the heating strategy are detailed in the following section.

8.3 HOT WATER HEAT PUMP CYLINDERS (RESIDENTIAL)

It is proposed that the residential dwellings will have their water heating supplied via hot water heat pump cylinders. This assessment has been based upon using the Dimplex Edel 200 litre cylinders. A technical datasheet for this product can be found in the appendices.

The heat pump cylinders will be housed in utility cupboards within the residential dwellings. The inner vessel of the cylinders is made from stainless steel with a heat pump mounted on top. The heat pump can produce hot water very efficiently as it extracts heat from external air supplied via insulated ductwork.

The space heating for the dwellings will be supplied via low surface temperature electric panel heaters. Therefore, the space and water heating will be fully electric. This will future proof the dwellings against the use of fossil fuels and supports the ongoing decarbonising of the grid.

8.4 AIR SOURCE HEAT PUMPS (NON-RESIDENTIAL)

Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.

It is proposed that the non-residential communal areas will have their heating supplied through the use of air source heat pumps. These units can either be fixed to an external wall or discreetly located on the roof space.

8.5 RESIDENTIAL CO₂ SAVINGS AFTER HEAT NETWORK (BE CLEAN)

Based on the proposed heating strategy previously detailed, the CO_2 emissions can be recalculated using the same methodology as described before for the residential units. The figures are summarised in the table below.

Table 15: Residential CO₂ Savings (Be Clean)

Element	CO₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)	
Residential Baseline	28.53	13.36	41.89	
Be Lean	21.88	13.36	35.24	
After Heat Network	15.37	13.36	28.73	



8.6 Non-Residential CO₂ savings After Heat Network (Be Clean)

Based on the proposed use of ASHP, the CO_2 emissions can be recalculated using the same methodology as described before for the non-residential space. The figures are summarised in the table below.

Table 16: Non-Residential CO₂ Savings (Be Clean)

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Residential Baseline	1.61	4.45	6.06
After energy demand reductions	1.60	4.45	6.05
After Heat Network	1.38	4.45	5.83

8.7 SITE-WIDE CO₂ SAVINGS AFTER HEAT NETWORK (BE CLEAN)

The site wide CO₂ savings is calculated by combining the residential and non-residential space. The site wide savings are summarised in the table below.

Table 17: Site Wide CO₂ Savings (Be Clean)

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Baseline	30.14	17.81	47.95
After energy demand reductions	23.48	17.81	41.29
After Heat Network	16.75	17.81	34.56



9. RENEWABLE ENERGY (BE GREEN)

In addition to the proposed low carbon heat pump technologies detailed in the previous section, the following low/zero carbon and renewable energy technologies have been considered for this scheme:

Wind Turbines

Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available.

A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier)

- Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required.
- Noise considerations can be an issue dependent on density and build-up of the surrounding area.
- Buildings in the immediate area can disrupt wind speed and reduce performance of the system.
- Planning permission will be required along with suitable space to site the turbine, whether ground installed
 or roof mounted

Wind turbines have been discounted due to concerns over reliable wind resources. The use of wind turbines is likely to present aesthetic as well as nuisance issues.

Biomass Boilers

Providing a heating system fuelled by plant-based materials such as wood, crops or food waste. Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.

Biomass is considered a technically-viable option for this development scheme as there are no apparent physical constraints on site in terms of installing biomass boilers or storing a sufficient supply.

- There are, however, concerns regarding a sustainable supply of biomass to the site.
- The capital installation cost would also be high which leads us to the conclusion that biomass would not be a commercially-viable option for this development scheme.

Individual Air Source Heat Pumps (ASHP)

Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.

They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.

As detailed in the previous section, the non-residential areas will have their heating supplied through ASHPs, and the residential dwellings will also utilise the heat pump technology through hot water heat pump cylinders.



Solar Thermal

Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months and overheating of the system.

Unsuitable for blocks of flats and has a low carbon reduction efficiency compared to photovoltaic systems. Solar hot water systems for flatted blocks are only suitable where a central boiler plant room is provided to accommodate a central thermal store.

Solar Photovoltaics (PV)

Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid. Solar energy could be a solution to reduce CO_2 emissions, however, PV is not considered a suitable option in this instance. The development site must also consider heritage issues and it is crucial to lessen the impact of the building in the context of the conservation area and the Grade II listed Terrace Gardens. The proposed green roof will support this objective, but this would be compromised if PV panels were to be installed. In addition, by maximising the energy efficiency of the building fabric and utilising the heat pump technology, compliance with the minimum on-site carbon reduction targets set out in London Plan Policy SI 2 can be achieved without the need for additional renewables.

9.1 RESIDENTIAL CO₂ SAVINGS FROM RENEWABLES

As detailed in the previous section no additional technologies have been added at the 'be green' stage. The figures following this stage of the energy hierarchy have been summarised for the residential element in the table below.

Table 18: Residential CO₂ Savings (Be Green)

Element	nt CO_2 - Regulated CO_2 - Un-Regulated (tonnes/year) (tonnes/year)		Total (tonnes/year)	
Residential Baseline	28.53	13.36	41.89	
Be Lean	21.88	13.36	35.24	
After Heat Network	15.37	13.36	28.73	
Be Green	15.37	13.36	28.73	



9.2 Non-Residential CO₂ savings from Renewables

The figures following the 'be green' stage of the energy hierarchy have been summarised for the non-residential element in the table below.

Table 19: Non-Residential CO₂ Savings (Be Green)

Element	CO ₂ - Regulated CO ₂ - Un-Regulated (tonnes/year)		Total (tonnes/year)	
Residential Baseline	1.61	4.45	6.06	
After energy demand reductions	1.60	4.45	6.05	
After Heat Network	1.38	4.45	5.83	
Be Green	1.38	4.45	5.83	

9.3 SITE-WIDE CO₂ SAVINGS FROM RENEWABLES

The updated site wide CO_2 savings have been calculated by combining the residential and non-residential space. The site wide savings are summarised in the table below.

Table 20: Site Wide CO₂ Savings (Be Green)

Element	CO ₂ - Regulated CO ₂ - Un-Regulated (tonnes/year) (tonnes/year)		Total (tonnes/year)	
Baseline	30.14	17.81	47.95	
After energy demand reductions	23.48	17.81	41.29	
After Heat Network	16.75	17.81	34.56	
Be Green	16.75	17.81	34.56	



10. WATER SAVING MEASURES

The following devices will be incorporated within each apartment:

- Water efficient taps.
- Water efficient cisterns.
- Low output showers.
- Flow restrictors to manage water pressures to achieve optimum levels.
- Water meters to all premises with guidance on water consumption and savings.

Housing 21 will be provided advice to the residents by through a comprehensive Homeowners Pack, detailing how to make optimum use of the devices installed around the home. Further, in marketing the scheme sustainable elements such as water reduction will be promoted.

The following specification or similar will be adopted on the development to ensure that the internal water use is reduced to a maximum of 105 litres per head per day in line with the requirements of London Plan Policy SI 5.

Table 21: Specification of flow rates and volumes for water using appliances

Water using Appliance	Comment
WC Cisterns	Dual Flush to be limited to maximum of 6/3
Baths	Capacity no greater than 190 litres
Basin taps	Flow rates to be no greater than 2.5 litres/minute
Kitchen taps	Flow rates to be no greater than 9 litres/minute
Shower	Flow rates to be no greater than 6 litres/minute
Water softener	Not to be installed
Washing Machine	Water usage to be limited to 17.16 Litres per KG
Dishwasher	Water Usage to be limited to 4.5 litres per place setting



Table 22: Water Calculations

Water Calculations - Apartments					
Installation Type	Unit	Capacity/	Use Factor	Fixed use	Total Use
		Flow Rate		(I/p/day)	(I/p/day)
WC Single Flush	Volume (I)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (I)	6.00	1.46	0.00	8.76
	Pt Flush (I)	3.00	2.96	0.00	8.88
WC's (Multiple)	Volume (I)	0.00	4.42	0.00	0.00
Taps Exc. Kitchen	Flow Rate	2.50	1.58	1.58	5.53
Bath (shower present)	(l/s)	190.00	0.11	0.00	20.90
Shower (bath present)	(l/s)	8.00	4.37	0.00	34.96
Bath Only	(1)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	9.00	0.44	10.36	14.32
Washing Machines	(l/kgdry)	8.17	2.10	0.00	17.16
Dishwashers	(I/place)	1.25	3.60	0.00	4.50
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softener	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Wat	er Use (I/p	/day)			115.01
Grey/Rain Water Reuse	ed (I)				0.00
Normalisation Factor (Factor)					0.91
Total Internal Consumption (I/p/day)				104.66	
External Water Use Allowance (I)				5.00	
Total Consumption Part G (I/p/day)					109.66
Assesment Result					PASS



11. SUMMARY AND CONCLUSIONS

The energy strategy has followed the London Plan Hierarchy Be Lean, Be Clean, Be Green and Be Seen. The energy strategy proposed for the development can be summarised as below.

Table 23: Proposed Energy strategy - Residential Units

Element	Measure
Passive	Optimised design to enable controlled solar gain and improved direct and indirect natural lighting. Incorporation of balconies into the design to provide shading.
Fabric	Building fabric U values have been enhanced over and above those detailed with Part L1A 2013
Heating	Electric panel heaters
Hot Water	Hot water heat pump cylinders (Dimplex
Cooling	None
Ventilation	Mechanical ventilation System 4 Low DAP
Lighting	Energy efficient LED Lighting where applicable

Table 24: Proposed Energy Strategy Non-residential space

Element	Measure
Passive	Optimised design to enable controlled solar gain and improved direct and indirect natural lighting.
Fabric	Building fabric U values have been enhanced over and above those detailed with Part LA2013
Heating	ASHP to supply heating
Hot Water	None
Cooling	None
Ventilation	Mechanical ventilation System 4 Low DAP
Lighting	Energy efficient LED Lighting where applicable



11.1 TOTAL RESIDENTIAL CO₂ SAVINGS

The summary of the overall reduction in residential CO_2 emissions after each stage of the energy hierarchy is summarised in the table below.

Table 25: Summary Residential CO₂ Savings

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Residential Baseline	28.53	13.36	41.89
Be Lean	21.88	13.36	35.24
After Heat Network	15.37	13.36	28.73
Be Green	15.37	13.36	28.73

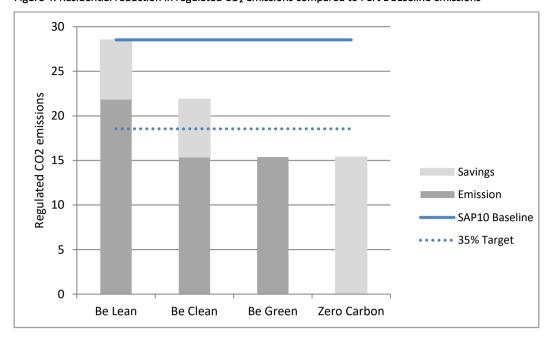
The CO_2 savings attributed to regulated energy only are summarised with the relative percentage improvements shown in the table below.

Table 26: Summary Residential CO₂ percentage savings

	Regulated Ene	rgy CO₂ Saving
	Tonnes per year	%
Be Lean	6.65	23
Be Clean after heat network	6.51	23
Be Green	0.00	0
Cumulative on-Site Savings	13.16	46
Carbon Shortfall	15.37	
	Tonne	es CO ₂
Cumulative savings for offset payment	462	1.10
Cash-in-lieu contribution	£43,8	04.50



Figure 4: Residential reduction in regulated CO₂ emissions compared to Part L baseline emissions



11.2 TOTAL NON-RESIDENTIAL CO₂ SAVINGS

The summary of the overall CO_2 reduction in non-residential spaces after each stage of the energy hierarchy is summarised in the table below.

Table 27: Summary Non-Residential CO₂ Savings

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Non-Residential Baseline	1.61	4.45	6.06
After energy demand reductions	1.60	4.45	6.05
After Heat Network	1.38	4.45	5.83
Be Green	1.38	4.45	5.83

The CO_2 savings attributed to regulated energy only are summarised with the relative percentage improvements shown in the table below.

Table 28: Summary Non-Residential CO₂ percentage savings

	Regulated Ene	rgy CO₂ Saving
	Tonnes per year	%
Be Lean	0.01	1
Be Clean	0.22	14
Be Green	0.00	0
Cumulative on-Site Savings	0.23	14



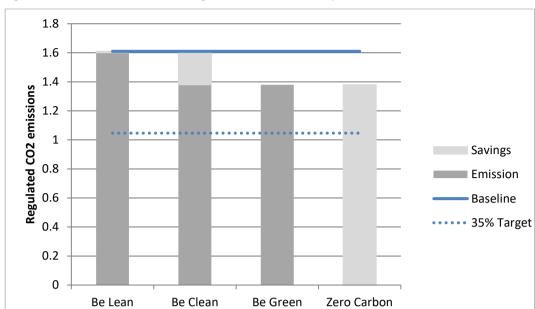


Figure 5: Non-Residential reduction in regulated CO₂ emissions compared to Part L baseline emissions

11.3 SITE-WIDE CO_2 SAVINGS

The summary of the overall CO_2 reduction site-wide after each stage of the energy hierarchy is summarised in the table below.

Table 29: Summary Site-wide CO₂ Savings

Element	CO ₂ - Regulated (tonnes/year)	CO ₂ - Un-Regulated (tonnes/year)	Total (tonnes/year)
Baseline	30.14	17.81	47.95
After energy demand reductions	23.48	17.81	41.29
After Heat Network	16.75	17.81	34.56
Be Green	16.75	17.81	34.56

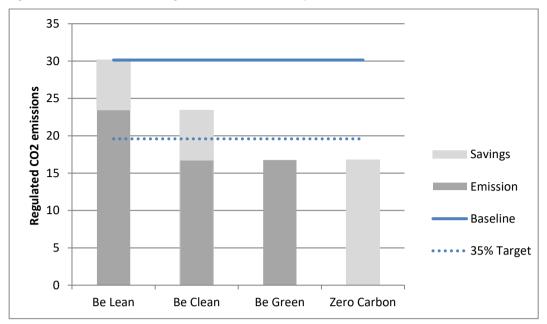
The CO_2 savings attributed to regulated energy only are summarised with the relative percentage improvements shown in the table below.

Table 30: Summary Site-wide CO₂ percentage savings

	Regulated Ene	rgy CO₂ Saving
	Tonnes per year	%
Be Lean	6.66	22
Be Clean	6.73	22
Be Green	0.00	0
Cumulative on-Site Savings	13.39	44



Figure 6: Site-wide reduction in regulated CO₂ emissions compared to Part L baseline emissions



The proposed energy strategy achieves and meets the following requirements:

- Complies with Part L 2013 building regulations (with 2016 amendments).
- Includes improved optimal building fabric improvements, energy efficient design of building services.
- Meets the TFEE minimum reduction requirements.
- Utilises heat pump technology through hot water heat pump cylinders within the residential dwellings.
- Utilises ASHP to supply heating to the non-residential element of the building.
- Achieves in excess of 35% regulated energy CO₂ emissions reduction on-site.
- Achieves Zero Carbon by making a cash in lieu contribution.



APPENDIX A - GLA ENERGY AND CO₂ SPREADSHEET OUTPUTS

The applicant sl	nould complete	te all the light	blue cells inclu	iding information	n on the modelle	d units, the area p	er unit, the numbe	of units, the bas	eline energy con	sumption figures	s, the TER and th	ne TFEE.			SAP 2012 CO ₂ PERFO	RMANCE					SAP 10.0 C	CO ₂ PERFORMANCE				
DOMESTIC	ENERGY (CONSUMF	PTION AND	CO ₂ ANALY	/SIS																					DEMAND
Unit identifier			Total area	VALIDAT	ION CHECK		REGULATED EN	ERGY CONSUM	PTION PER UNIT	(kWh p.a.) - TER	WORKSHEET			REGULAT	ED CO ₂ EMISSIONS PI	ER UNIT (kgCO ₂ p.a.)					REGULATED C	O ₂ EMISSIONS PER U	UNIT			Fabric Energy Efficiency (FEE)
(e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	represented by model (m²)	Calculated TER 2012 (kgCO ₂ / m ²)	TER 2012	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO ₂ emissions (kgCO ₂ p.a.)	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	SAP 10.0 CO ₂ emissions (kgCO ₂ p.a.)	Calculated TER SAP 10.0 (kgCO ₂ / m ²)	Target Fabric Energy Efficiency (TFEE) (kWh/m²)
1 Bed End - GF	TER Worksheet (Row 4)	1	55 94	21.5	TER Worksheet (Row 273)	Worksheet (Row 211)	Natural Gas	TER Worksheet (Row 219)	Natural Gas	TER Worksheet (Row 232)	TER Worksheet (Row 231)	N/A	594	435	133	39		1 200	577	423	60	17		1077	19.3	50.1
1 Bed End - GF 1 Bed Mid - GF 1 Bed Mid - MF 1 Bed Mid - MF 1 Bed Mid - FF 2 Bed - FF 2 Bed - FF 2 Bed - FF 1 Bed Var - FF 1 Bed Var - FF 1 Bed Var - TF	55.94 55.83 55.83 55.83 55.83 67.05 67.05 67.05 54.08 54.08	1 1 5 8 1 6 6 1 1 1 1 1 1 1 1 1 1 1 1 1	55.94 55.94 279.15 446.64 55.83 334.98 67.05 67.05 54.08 54.08	21.5 24.0 20.3 17.9 19.2 22.2 18.8 16.7 21.1 20.7 19.3 24.2	21.5 24.0 20.3 17.9 19.2 22.2 18.8 16.7 21.1 20.7 19.3 24.2	2748.6 3412.2 2434.02 1787.82 2156.22 2926.77 2723.42 2047.29 3455.71 2419.68 2053.25 3316.88	Natural Gas	2013-9 2005.03 2017.2 2041.28 2022.66 2009.23 22206.8 2221.13 2195.56 1985.3 1992.58	Natural Gas	256.01 255.56 255.56 255.56 255.56 255.56 299.64 299.64 299.64 248.46 248.46	75 75 75 75 75 75 75 75 75 75 75 75		594 737 526 386 466 632 588 442 746 523 444 716	433 436 441 437 434 477 480 474 429 430 426	133 133 133 133 133 156 156 156 129 129 129	39 39 39 39 39 39 39 39 39		1,200 1,342 1,133 999 1,074 1,238 1,259 1,116 1,415 1,119 1,042 1,310	517 7117 5111 375 453 615 572 430 726 508 431 697	421 424 429 425 425 463 466 461 417 418 414	60 60 60 60 60 70 70 70 58 58 58	17 17 17 17 17 17 17 17 17 17		1,077 1,215 1,012 881 955 1,114 1,123 984 1,274 1,000 925 1,186	19.3 21.7 18.1 15.8 17.1 19.6 14.7 19.0 18.5 17.1 21.9	59.1 72 53.2 40.9 47.9 62.7 49.8 39.1 61.6 54.5 47.3 72.4
Sum	4.502	20	4.502	20.4		69.267	N/A	57,097	N/A	7 269	2400		44.767	42 224	2772	1000	0	21.060	14.257	44 000	1502	499		20 520	17.9	E2 E4
Sum NON-DOME	1,592 STIC ENEI	28 RGY CON	1,592 SUMPTION	20.1 AND CO ₂ A	NALYSIS	68,367	N/A	57,087	N/A	7,268	2,100	0	14,767	12,331	3,772	1,090	0	31,960	14,357	11,988	1,693	489	0	28,528	17.9	52.54
	STIC ENEI	RGY CON	SUMPTION Total area	AND CO ₂ A		REGUL	ATED ENERGY CO	NSUMPTION BY	END USE (kWh/r	n² p.a.) TER - SO	URCE: BRUKL O	OUTPUT	REGULATED ENER	GY CONSUMPTION B	Y FUEL TYPE (kWh/m²	1,090 p.a.) TER - SOURCE: E		IM.CSV FILE 2012 CO ₂	REGULA	ATED ENERGY CONSUM	MPTION BY FUEL TYPE			REGULATED C	17.9 O2 EMISSIONS BRUKL	52.54
Building Use	Model Area	RGY CON	Total area represented by model (m²)	VALIDATI Calculated TER 2012 (kgCO ₂ / m ²)	NALYSIS ION CHECK BRUKL TER 2012 (kgCO ₂ / m ²)	REGUL Space Heating (kWh/m² p.a.)	ATED ENERGY CO Fuel type Space Heating	NSUMPTION BY Domestic Hot Water (kWh/m² p.a.)	END USE (kWh/r Fuel type Domestic Hot Water	n² p.a.) TER - SO Lighting (kWh/m² p.a.)	URCE: BRUKL O Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)		GY CONSUMPTION B Grid Electricity 0.519 kgCO ₂ /kWh	Y FUEL TYPE (kWh/m² Equipment 0.519 kgC0 ₂ /kWh		BRUKL.INP or *S	IM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	REGULA Natural Gas	Grid Electricity 0.233 kgCO ₂ /kWh	Unregulated Grid Electricity 0.233 kgCO ₂ /kWh	E (kWh/m² p.a.) - TER		REGULATED CO SAP10.0 CO ₂ emissions (kgCO ₂ p.a.)	BRUKL TER SAP10.0 (kgCO ₂ / m ²)	52.54
	Model Area (m²) 338.8	RGY CON. Number of units	SUMPTION Total area represented by model (m²) 338.8	AND CO ₂ A VALIDATI Calculated TER 2012 (kgCO ₂ / m²) 10.5	NALYSIS ION CHECK BRUKL TER 2012 (kgCO ₂ / m²) 10.3	REGUL Space Heating (kWh/m² p.a.) 12.28	Fuel type Space Heating Grid Electricity	NSUMPTION BY Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water Grid Electricity	n² p.a.) TER - SO Lighting (kWh/m² p.a.) 6.58	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m³ p.a.)	REGULATED ENER Natural Gas 0.216 kgCO ₂ /kWh	GY CONSUMPTION B Grid Electricity 0.519 kgCO ₂ /kWh 20	Y FUEL TYPE (kWh/m² Equipment 0.519 kgCO _y /kWh 13	p.a.) TER - SOURCE: E	SRUKLINP or 'S	IM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.) 3,572	REGULA Natural Gas 0.210 kgCO ₂ /kWh	Grid Electricity 0.233 kgCO _y /kWh 20	MPTION BY FUEL TYPE Unregulated Grid Electricity 0.233 kgCO ₂ /kWh 13	E (kWh/m² p.a.) - TER	BRUKL	REGULATED C SAP10.0 CO ₂ emissions (kgCO ₂ p.a.) 1,604	BRUKL TER SAP10.0 (kgCO ₂ / m²)	52.54
Building Use	Model Area (m²) 338.8	RGY CON. Number of units 1	SUMPTION Total area represented by model (m²) 338.8	AND CO ₂ A VALIDATI Calculated TER 2012 (kgCO ₂ / m ²) 10.5	NALYSIS ION CHECK BRUKL TER 2012 (kgCO ₂ / m ²)	REGUL Space Heating (kWh/m² p.a.)	ATED ENERGY CO Fuel type Space Heating	NSUMPTION BY Domestic Hot Water (kWh/m² p.a.)	END USE (kWh/r Fuel type Domestic Hot Water	n² p.a.) TER - SO Lighting (kWh/m² p.a.)	URCE: BRUKL O Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)	REGULATED ENER	GY CONSUMPTION B Grid Electricity 0.519 kgCO ₂ /kWh	Y FUEL TYPE (kWh/m² Equipment 0.519 kgC0 ₂ /kWh		BRUKL.INP or *S	IM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	REGULA Natural Gas	Grid Electricity 0.233 kgCO ₂ /kWh	Unregulated Grid Electricity 0.233 kgCO ₂ /kWh	E (kWh/m² p.a.) - TER		REGULATED CO SAP10.0 CO ₂ emissions (kgCO ₂ p.a.)	BRUKL TER SAP10.0 (kgCO ₂ / m ²)	52.54
Building Use Residential	Model Area (m²) 338.8	RGY CON. Number of units 1	SUMPTION Total area represented by model (m²) 338.8	AND CO ₂ A VALIDATI Calculated TER 2012 (kgCO ₂ / m ²) 10.5	NALYSIS ION CHECK BRUKL TER 2012 (kgCO ₂ / m²) 10.3	REGUL Space Heating (kWh/m² p.a.) 12.28	Fuel type Space Heating Grid Electricity	NSUMPTION BY Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water Grid Electricity	n² p.a.) TER - SO Lighting (kWh/m² p.a.) 6.58	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m³ p.a.)	REGULATED ENER Natural Gas 0.216 kgCO ₂ /kWh	GY CONSUMPTION B Grid Electricity 0.519 kgCO ₂ /kWh 20	Y FUEL TYPE (kWh/m² Equipment 0.519 kgCO _y /kWh 13	p.a.) TER - SOURCE: E	SRUKLINP or *S	IM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.) 3,572 3,572 REGULATED CO ₂	REGULA Natural Gas 0.210 kgCO ₂ /kWh	Grid Electricity 0.233 kgCO _y /kWh 20	MPTION BY FUEL TYPE Unregulated Grid Electricity 0.233 kgCO ₂ /kWh 13	E (kWh/m² p.a.) - TER	BRUKL	REGULATED C SAP10.0 CO ₂ emissions (kgCO ₂ p.a.) 1,604 1,604 REGULATED C	BRUKL TER SAP10.0 (kgC0; /m²) 4.7 4.7	52.54
Building Use Residential	Model Area (m²) 338.8 339 RGY CONSUM	RGY CON. Number of units 1	SUMPTION Total area represented by model (m²) 338.8	AND CO ₂ A VALIDATI Calculated TER 2012 (kgCO ₂ / m ²) 10.5	NALYSIS ION CHECK BRUKL TER 2012 (kgCO ₂ / m²) 10.3	REGUL Space Heating (kWh/m² p.a.) 12.28	Fuel type Space Heating Grid Electricity	NSUMPTION BY Domestic Hot Water (kWh/m² p.a.)	END USE (kWh/r Fuel type Domestic Hot Water Grid Electricity	n² p.a.) TER - SO Lighting (kWh/m² p.a.) 6.58	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m³ p.a.)	REGULATED ENER Natural Gas 0.216 kgCO ₂ /kWh	GY CONSUMPTION B Grid Electricity 0.519 kgCO ₂ /kWh 20	Y FUEL TYPE (kWh/m² Equipment 0.519 kgCO _y /kWh 13	p.a.) TER - SOURCE: E	RUKLINP or *S	IM.CSV FILE 2012 CO2 emissions (kgCO2 p.a.) 3,572	REGULA Natural Gas 0.210 kgCO ₂ /kWh	Grid Electricity 0.233 kgCO _y /kWh 20	MPTION BY FUEL TYPE Unregulated Grid Electricity 0.233 kgCO ₂ /kWh 13	E (kWh/m² p.a.) - TER	BRUKL	REGULATED C SAP10.0 CO ₂ emissions (kgCO ₂ p.a.) 1,604 1,604 REGULATED C PER SAP 10.0 CO ₂	BRUKL TER SAP10.0 (kgCO ₂ / m²) 4.7 4.7	52.54

				AND CO ₂ AN		n' energy consum	ption figures, the 'b	e lean' DER, the DF	EE and the regulate	d energy demand	d of the 'be lean'	'scenario.						SAP 2012 CO ₂ PE	RFORMANCE				SAP	10.0 CO ₂ PERFORM	MANCE			FEES
DOWLS	IC ENER	GT CONSU	INIF HON A		TON CHECK			REGULATED ENER	GY CONSUMPTION	PER UNIT (kWh)	p.a.) - 'BE LEAN'	I' SAP DER WORK	SHEET				REGULATE	ED CO, EMISSION	IS PER UNIT (kgCO ₂ p.a.)				REGULAT	TED CO ₂ EMISSIONS	S PER UNIT			Fabric Energy Efficiency
Unit identii (e.g. plo	Model to		Total area	Calculated	DER Worksheet	Space Heating		Domestic Hot	Fuel type Domestic Hot	Secondary Heating	Fuel type	Lighting	Auxiliary	Cooling	-	Space Heating CO ₂ emissions	Domestic Hot Water	Lighting		2012 CO ₂ emissions	S Space Heating CO ₂ emissions	Domestic Hot Water CO ₂ emissions		Auxiliary	Cooling Unre	gulated SAP 1	0.0 CO ₂ Calcul	(FEE) ated Dwelling
number dwelling ty etc.)	floor ar pe (m²)	'ea unite	by model (m²)				Space Heating	(Heat Source 1)		system	Space reating	l				(kgCO ₂ p.a.)	CO ₂ emissions (kgCO ₂ p.a.)	(kgCO ₂ p.a.)	(kgCO ₂ p.a.) (kgCO ₂ p.		(kgCO ₂ p.a.)	(kgCO ₂ p.a.)	(kgCO ₂ p.a.)	(kgCO ₂ p.a.)			O ₂ p.a.) (kgCO ₂	/ m ²) Efficiency (DFEE)
					DER Sheet	DER Sheet	Select fuel type	DER Sheet	Select fuel type	DER Sheet	Select fuel	DED Shoot	DER Sheet	DER Sheet														(kWh/m²)
					(Row 384)	[(Row 307a) ÷ (Row 367a x	Select fuel type	[Row 310b ÷ (Row 367b x 0.01)]		[Row 309]	type	Row 332	(Row 313 + 331)	Row 315														
1 Bed End - 1 Bed End -	TF 55.94	1 1	55.94 55.94	18.3 18.7	18.3 18.7	0.01)] 2001.13 2090.96	Natural Gas Natural Gas	1577.48 1576.79	Natural Gas Natural Gas			256.01 256.01	228.56 228.56			432 452	341 341	133 133	119 119	1,024 1,044	420 439	331 331	60 60	53 53	4	171 8	864 15. 883 15.	51.9
1 Bed Mid - 1 Bed Mid - 1 Bed Mid -	MF 55.83 EF 55.83	8 8 1	279.15 446.64 55.83	17.4 14.8 16.1	17.4 14.8 16.1	1749.32 1074.86 1409.89	Natural Gas Natural Gas Natural Gas	1577.51 1582.47 1579.65	Natural Gas Natural Gas Natural Gas			255.56 255.56 255.56	228.25 228.25 228.25			378 232 305	341 342 341	133 133 133	118 118 118	970 825 897	367 226 296	331 332 332	60 60 60	53 53 53	4	170 E	311 14. 371 12. 741 13.	35.9 3 41.6
1 Bed Mid - 2 Bed - EF 2 Bed - MF	FF 55.83 67.05 67.05	5 1	334.98 67.05 67.05	17.8 15.7 13.7	17.8 15.7 13.7	1856.05 1829.24 1189.16	Natural Gas Natural Gas Natural Gas	1576.62 1709.36 1714.22	Natural Gas Natural Gas Natural Gas			255.56 299.64 299.64	228.25 259.05 259.05			401 395 257	341 369 370	133 156 156	118 134 134	993 1,054 917	390 384 250	331 359 360	60 70 70	53 60 60		547 8	334 14. 373 13. 740 11.	43
2 Bed - TF 1 Bed Var - 1 Bed Var -		3 1	67.05 54.08 54.08	16.8 17.7 16.3	16.8 17.7 16.3	2171.54 1730.4 1398.57	Natural Gas Natural Gas Natural Gas	1707.28 1555.68 1557.83	Natural Gas Natural Gas Natural Gas			299.64 248.46 248.46	259.05 223.45 223.45			469 374 302	369 336 336	156 129 129	134 116 116	1,128 955 884	456 363 294	359 327 327	70 58 58	60 52 52	4	547 9 158 8	945 14. 800 14. 731 13.	47 3 47.8
1 Bed Var -			54.08	19.1	19.1	2101.12	Natural Gas	1553.6	Natural Gas			248.46	223.45			454	336	129	116	1,034	441	326	58	52		158 8	377 16.	
Sum	1,592		1,592	+		44,404	N/A	44,539	N/A	0	N/A	7,268	6,470	0	N/A	9,591	9,620	3,772	3,358 0	26,341	9,325	9,353	1,693	1,507	0 13	i,363 <u>21</u>	<mark>,879</mark> 13.	7 43.75
NON-DC				TION AND C	O2 ANALYSI	-								0							9,325	9,353				i,363 <u>21</u>	,879 13.	7 43.75
NON-DO	MESTIC I	ENERGY CO	ONSUMPT Total area	TION AND C		s	REGUL	ATED ENERGY COM	NSUMPTION BY EN			BER - SOURCE: BR	RUKL OUTPUT						3,358 0		9,325	9,353		1,507		,363 <u>21</u>	,879 13.	7 43.75
NON-DO	MESTIC I	ENERGY CO	ONSUMPT Total area	VALIDAT	O2 ANALYSIS	-	REGUL Fuel type							Cooling (kWh/m² p.a.)						INP or *SIM.CSV FILE 2012 CO ₂ emissions		9,353 Grid Electricity				SAP 1	0.0 CO ₂ BRU	CL.
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL 2-10.0 / m²)
	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model	VALIDATI	O2 ANALYSIS	Space Heating	REGUL Fuel type	ATED ENERGY COM Domestic Hot Water	NSUMPTION BY EN Fuel type Domestic Hot			BER - SOURCE: BF	RUKL OUTPUT	Cooling	REGULATED ENE	RGY CONSUMPTION Grid Electricity	BY FUEL TYPE (kW			INP or *SIM.CSV FILE 2012 CO ₂ emissions	s Natural Gas	Grid Electricity	REGULAT Equipment	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	10.0 CO ₂ BRU ssions BER SA	SL 2-10.0 / m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL 2-10.0 / m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL 2-10.0 / m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL 2-10.0 / m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL 2-10.0 / m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL. P 10.0 (m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL. P 10.0 (m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL. P 10.0 (m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL. P 10.0 (m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL. P 10.0 (m²)
Building U	MESTIC I Model A (m²)	ENERGY CO	Total area f represented by model (m²)	VALIDATI A did Calculated BER 2012 (kgCO ₂ / m ²)	O2 ANALYSIS TION CHECK BRUKL BER 2012 (kgCO ₂ / m ²)	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emis (kgCr	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	SL. P 10.0 (m²)
Building U	MESTIC I	rea Number of units	Total area of represented by model (m²)	VALIDAT VALIDAT Calculated BER 2012 (kgCO ₂ / m²) 10.3	O2 ANALYSI: TION CHECK BRUKL BER 2012 (kgC02/m²) 10.3	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating Grid Electricity	ATED ENERGY COI Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water Grid Electricity	D USE (kWh/m² p	a, 'BE LEAN' B	Lighting (kWh/m² p.a.)	Auxillary (kWh/m² p.a.) 3.07	Cooling (KWh/m² p.a.)	REGULATED ENE Natural Gas 0.216 kgCO ₂ /kWh	Grid Electricity 0.519 kgCOy/kWh 20	Equipment 0.519 kgCO ₂ /kWh 13	fh/m² p.a.) 'BE LE	EAN'BER -SOURCE: BRUKI	2012 CO ₂ emissions (kgCO ₂ p.a.) 3,473	Natural Gas 0.210 kgCO ₃ /kWh	Grid Electricity 0.233 kgCO ₂ /kWh 20	REGULAT Equipment 0.233 kgCO ₂ /kWh 13	TED CO ₂ EMISSIONS		SAP 1 emin (kgCi	(0.0 CO ₂ BRUSSIONS O ₂ p.a.) (kgCO ₂	(L 10.0 / m²)
Building U	MESTIC I	rea Number of units	Total area of represented by model (m²) 338.8	VALIDAT VALIDAT Calculated BER 2012 (kgCO ₂ / m²) 10.3	O2 ANALYSI: TION CHECK BRUKL BER 2012 (kgC02/m²) 10.3	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating	ATED ENERGY COM Domestic Hot Water	Fuel type Domestic Hot Water			BER - SOURCE: BF Lighting (kWh/m² p.a.)	RUKL OUTPUT Auxiliary (kWh/m² p.a.)	Cooling	REGULATED ENE	Grid Electricity 0.519 kgCO ₂ /kWh	BY FUEL TYPE (kW Equipment 0.519 kgCO ₂ /kWh			INP or *SIM.CSV FILE 2012 CO ₂ emissions (kgCO ₂ p.a.)	s Natural Gas	Grid Electricity 0.233 kgCO₂/kWh	REGULA1 Equipment 0.233 kgCO ₂ /kWh	TED CO ₂ EMISSIONS		SAP 1 emin (kgCi	i0.0 CO ₂ BRU ssions BER SA O ₂ p.a.) (kgCO ₂	(L 10.0 / m²)
Building U	MESTIC I	rea Number of units	Total area of represented by model (m²) 338.8	VALIDAT VALIDAT Calculated BER 2012 (kgCO ₂ / m ²) 10.3	O2 ANALYSI: TION CHECK BRUKL BER 2012 (kgC02/m²) 10.3	Space Heating (kWh/m² p.a.)	REGUL Fuel type Space Heating Grid Electricity	ATED ENERGY COI Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water Grid Electricity	D USE (kWh/m² p	N/A	Lighting (kWh/m² p.a.)	Auxillary (kWh/m² p.a.) 3.07	Cooling (KWh/m² p.a.)	REGULATED ENE Natural Gas 0.216 kgCO ₂ /kWh	Grid Electricity 0.519 kgCOy/kWh 20	Equipment 0.519 kgCO ₂ /kWh 13	fh/m² p.a.) 'BE LE	EAN'BER -SOURCE: BRUKI	2012 CO ₂ emissions (kgCO ₂ p.a.) 3,473 REGULATED CO ₂	Natural Gas 0.210 kgCO ₃ /kWh	Grid Electricity 0.233 kgCO ₂ /kWh 20	REGULAT Equipment 0.233 kgCO ₂ /kWh 13	TED CO ₂ EMISSIONS		SAP 1 emit (kgCi	(0.0 CO ₂ BRUSSIONS O ₂ p.a.) (kgCO ₂	(L 110.0 (m²)
Building U Residential	MESTIC I	rea Number of units	Total area of represented by model (m²) 338.8 MPTION A	TION AND C VALIDAT Calculated BER 2012 (kgC0_2 / m²) 10.3 AND CO2 AN Calculated BER 2012	O2 ANALYSIS DION CHECK BRUKL BER 2012 (kgCO2/m²) 10.3	Space Heating (kWh/m² p.a.) 5.07	Fuel type Space Heating Grid Electricity	Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water Grid Electricity	D USE (kWh/m² p	N/A	Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.) 3.07	Cooling (kWh/m² p.a.)	REGULATED ENE Natural Gas 0.216 kgCO ₂ /kWh	Grid Electricity 0.519 kgCOy/kWh 20	Equipment 0.519 kgCO ₂ /kWh 13	fh/m² p.a.) 'BE LE	EAN'BER -SOURCE: BRUKI	2012 CO ₂ emissions (kgCO ₂ p.a.) 3,473 REGULATED CO ₂ EMISSIONS	Natural Gas 0.210 kgCO ₃ /kWh	Grid Electricity 0.233 kgCO ₂ /kWh 20	REGULAT Equipment 0.233 kgCO ₂ /kWh 13	TED CO ₂ EMISSIONS		SAP 1 emin (kgCi	(0.0 CO ₂ BRUS SISIONS O ₂ P.a.) BER SA (kgCO ₂ SiSS) 4.1	(L 10.0 m²)
Residential Residential	MESTIC I	energy co	Total area of represented by model (m²) 338.8 MPTION A	TION AND C VALIDAT Calculated BER 2012 (kgCO ₂ / m ²) 10.3 10.3 AND CO2 AN	O2 ANALYSIS DION CHECK BRUKL BER 2012 (kgCO2/m²) 10.3	Space Heating (kWh/m² p.a.)	Fuel type Space Heating Grid Electricity	ATED ENERGY COI Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water Grid Electricity	D USE (kWh/m² p	N/A	Lighting (kWh/m² p.a.)	Auxillary (kWh/m² p.a.) 3.07	Cooling (KWh/m² p.a.)	REGULATED ENE Natural Gas 0.216 kgCO ₂ /kWh	Grid Electricity 0.519 kgCOy/kWh 20	Equipment 0.519 kgCO ₂ /kWh 13	fh/m² p.a.) 'BE LE	EAN'BER -SOURCE: BRUKI	2012 CO ₂ emissions (kgCO ₂ p.a.) 3,473 REGULATED CO ₂	Natural Gas 0.210 kgCO ₃ /kWh	Grid Electricity 0.233 kgCO ₂ /kWh 20	REGULAT Equipment 0.233 kgCO ₂ /kWh 13	TED CO ₂ EMISSIONS		SAP 1 emin (kgCi	(0.0 CO ₂ BRU BER SA (kgCO ₂ S559 4.4	(L 10.0 / m²) / m²) / m²)

						lean' energy cons	sumption figures ar	nd the 'be clean' DE	ER.											s	SAP 2012 CO ₂ PERFOR	RMANCE							SAP 10.0 CC	PERFORMANCE			
DOMESTIC I	ENERGY	CONSUM	PTION AN																							ı							
Unit identifier (e.g. plot number.	Model total		Total area	VALIDATIO		Space Heating	Fuel type	Domestic Hot				INIT (kWh p.a.) - 'BE Total Electricity		Fuel type	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Wate	REGULATED r Space Heating and E	D CO ₂ EMISSIONS PE) Auxiliary	Cooling 2	2012 CO ₂ emissions	Space Heating	Domestic Hot Wate		EGULATED CO ₂ EMIS Electricity generate	SIONS PER UNIT (kgC0		Cooling SAP 10.0 C	O ₂ Calculated
	floor area (m²)	Number of 1	represented	DER 2012 (kgCO ₂ / m ²)	DER 2012	(Heat Source 1)	Space Heating	Water (Heat Source 1)	Domestic Hot	Domestic Hot Water from CHP		generated by CHP (-)	Heating system	Secondary Heating		,		.,		DHW from CHP	by CHP				(kgCO ₂ p.a.)			DHW from CHP			,	emissions	
etc.)										if applicable	if applicable	if applicable								if applicable	if applicable							if applicable	if applicable				
					DER Sheet (Row 384)	DER Sheet [Row 307b + (Row 367b x	Select fuel type	DER Sheet [Row 310b + (Row 367b x	Select fuel type	DER Sheet [(Row 307a + 310a) +	Select fuel type	DER Sheet [(Row 307a + 310a) × (Row		Select fuel type		DER Sheet (Row 313 + 331)	DER Sheet Row 315																
1 Bed End - GF	55.94	1	55.94	25.4	25.4	0.01)] 1880.51	Grid Electricity	0.01)] 444.26	Grid Electricity	(Row 362 x		361 + 362)]			256.0115607	153.56		976	231			133	80	-	1,419	438	104			60	36	637	11.4
1 Bed End - TF 1 Bed Mid - GF 1 Bed Mid - MF		1 5 8	55.94 279.15 446.64	26.1 23.3 17.4	26.1 23.3 17.4	1956.38 1648.44 1020.58	Grid Electricity Grid Electricity Grid Electricity	443.92	Grid Electricity Grid Electricity Grid Electricity						256.0115607 255.5684008 255.5684008	153.25 153.25 153.25		1,015 856 530	231 230 230			133 133 133	80 80 80		1,458 1,298 972	456 384 238	104 103 103			60 60 60	36 36 36	655 583 436	11.7 10.4 7.8
1 Bed Mid - EF 1 Bed Mid - TF	55.83 55.83	1 6	55.83 334.98	20.3 24.1	20.3 24.1	1331.91 1739.86	Grid Electricity Grid Electricity	443.92 443.92	Grid Electricity Grid Electricity						255.5684008 255.5684008	153.25 153.25		691 903	230 230			133 133	80 80		1,134 1,346	310 405	103 103			60 60	36 36	509 604	9.1 10.8
2 Bed - EF 2 Bed - MF 2 Bed - TF	67.05 67.05 67.05	1 1	67.05 67.05 67.05	20.8 16.2 23.2	20.8 16.2 23.2	1722.33 1128.57 2033.49	Grid Electricity Grid Electricity Grid Electricity	477.15	Grid Electricity Grid Electricity Grid Electricity						299.6339114 299.6339114 299.6339114	184.05 184.05 184.05		894 586 1,055	248 248 248			156 156 156	96 96 96		1,393 1,084 1,554	401 263 474	111 111 111			70 70 70	43 43 43	625 487 698	9.3 7.3 10.4
1 Bed Var - EF 1 Bed Var - MF	54.08	1	54.08 54.08	23.6 20.7	23.6 20.7	1627.12 1319.38	Grid Electricity Grid Electricity	438.43	Grid Electricity Grid Electricity						248.4585742 248.4585742	148.45 148.45		844 685 1.020	228 228			129 129 129	77 77		1,278 1,118 1,454	379 307 458	102 102			58 58	35 35	574 502	10.4 10.6 9.3 12.1
1 Bed Var - TF	54.08	1	54.08	26.9	26.9	1965.27	Grid Electricity	438.43	Grid Electricity						248.4585742	148.45		1,020	228			129	77		1,454	458	102			58	35	653	12.1
Sum		28	1,592		-	41,811	N/A	12,514	N/A	0	N/A	0	0	N/A	7,268	4,370	0	21,700	6,495	0	0	3,772	2,268	0	34,234	9,742	2,916	0	0	1,693	1,018	0 15,369	9.7
NON-DOME	STIC ENE	ERGY CO		VALIDATIO	ON CHECK	1			REGULATED EN	ERGY CONSUMPT	TION BY END USE	(kWh/m² p.a.) 'BE Cl	EAN' BER - SOUR	CE: BRUKL OUTF	PUT			REG	ULATED ENERGY C	ONSUMPTION BY FUEL 1	TYPE (kWh/m² p.a.) 'E	BE CLEAN' BER - SI	OURCE: BRUKL.IN	NP or *SIM.CSV FI	ILE			REG	ULATED CO2 EMISSIO	NS PER UNIT			
Building Use	Model Area	Number of 1		Calculated BER 2012 (kgCO ₂ / m ²)		Space Heating (kWh/m² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water			Electricity generated by CHP			Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)	Natural Gas	Grid Electricity	Bespoke DH Factor E	lectricity generated by CHP (-)	Equipment		2	2012 CO ₂ emissions (kgCO ₂ p.a.)	Natural Gas	Grid Electricity	Bespoke DH Facto	r Electricity generate by CHP (-)	d Equipment		SAP 10.0 C emissions (kgCO ₂ p.a	O ₂ BRUKL BER SAP10.0 L) (kgCO ₂ / m ²)
	(m²)	units	by model (m²)	(kg0027 iii)	(xg002/)							(-)									if applicable								if applicable			(.9-27	, (ngoo21 iii)
Residential	338.8	1	338.8	9.1	9.1	2.83	Grid Electricity	0	Grid Electricity			if applicable			11.62	3.07	0	0.216 kgCO ₃ /kWh	0.519 kgCO ₃ /kWh	0.000 kgCO ₃ /kWh	0.519 kgCO ₂ /kWh	0.519 kgCO ₂ /kWh 13			3,081	0.210 kgCO ₂ /kWh	0.233 kgCO ₂ /kWh 18	0.000 kgCO ₂ /kWh	0.233 kgCO ₂ /kWh	0.233 kgCO ₂ /kWh 13		1,383	4.1
										NA	NA		_{EM} A	_N A									_{ELIP}	N/P									
										`	`		`	`									`	`									
Sum SITE-WIDE I		1			AL VOIC	959	N/A	0	N/A			0			3,937	1,040	0	0	5,936	0	0	4,448			3,081	0	5,936	0	0	4,448		1,383	4.1
SITE-WIDE	ENERGY	CONSUM	PTION AN	ND CO2 ANA	ALYSIS						REGULATED EN	IERGY CONSUMPTI	ON											R	REGULATED CO ₂							REGULAT	ED CO ₂ EMISSIONS
				Calculated BER 2012						1	AEGOLATED EN	Electricity			1									E	MISSIONS								PER UNIT
Use	т	otal Area (m²)		BER 2012 (kgCO ₂ / m ²)	-	Space Heating (kWh p.a.)		Domestic Hot Water		Space and Domestic Hot Water from CHP		generated by CHP	Secondary Heating System		Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)							2	2012 CO ₂ emissions (kgCO ₂ p.a.)							SAP 10.0 C emissions	O ₂ Calculated BER SAP 10.0 c) (kgCO ₂ / m ²)
							HIA	(kWh p.a.)	HIP	(kWh p.a.)		(kWh p.a.) if applicable	(kWh p.a.)	HIP																			
Sum		1,931		19.3	-	42,770		12,514		0		0	0		11,205	5,410	0								37,315							16,752	8.7

		the light blue cells in			nergy consumption	igures and the 'be g	reen' DER.																	SAP 2012 CO ₂ PERFORI	MANCE								SAP 10.0 CO ₂	PERFORMANCE				
DOMEST	IC ENERGY CO	INSUMPTION A	_	ION CHECK						PEGIII	ATER ENERGY CON	INGLIMOTION DED LIN	IT (MM) o a 1 - 195 (REEN' SAP DER WORK	KSHEET								REGIII AT	ED CO, EMISSIONS PER	LINIT (knCO. n.a.)	,							REGULATED CO. E	EMISSIONS PER UNIT				
Unit identifi (e.g. plot	er Model total	Total are	a Calculated	DER Worksheet	Space Heating	Fuel type	Domestic Hot	Fuel type	Space Heating							fary Fuel type	Electricity L	nting Auxiliary	Cooling	Space Heating	Domestic Hot Water 3	pace Heating and Elect	tricity generated Elect	icity generated LI		Auxiliary Cooling		2012 CO ₂ emission	s Space Heating	Domestic Hot Water 3	Space Heating and	Electricity generated Ele	ectricity generated		Auxiliary C	ooling	SAP 10.0 CO ₂ Calcu	ated
Unit identifi (e.g. plot number, dwelling tyj etc.)	floor area oe (m²)	Total are umber of represent units by mode (m²)	DER 2012 (kgCO ₂ / m ²)	DER 2012 (kgCO ₂ / m ²)	(Heat Source 1)	Space Heating	Water (Heat Source 1)	Domestic Hot Water	(Heat source 2)	Space Heating (I	(Heat source 2)	Domestic Hot Do Water Wat	omestic Hot ter from CHP	type CHP Total Elec generate CHP (ed by Heating sy (-)	ystem Secondar Heating	generated by renewable (-)					DHW from CHP	by CHP b	renewable				(kgCO ₂ p.a.)			DHW from CHP	by CHP	by renewable				SAP 10.0 CO ₂ Calcu emissions DER SA (kgCO ₂ p.a.) (kgCO)	/ m ²)
,									If applicable		if applicable		applicable if a	pplicable If applica	able		if applicable					l'applicable I	f applicable i	applicable							if applicable	if applicable	if applicable					
				DER Sheet (Row 384)	DER Sheet [Row 307b +	Select fuel type	DER Sheet [Row 310b +	Select fuel type	DER Sheet 5 [Row 307c +	Select fuel type	DER Sheet S [Row 310c +	Select fuel type [(f	DER Sheet Sele Row 307a +	ct fuel type DER Sh [(Row 30	heet DER Shi 07a + Row 30	neet Select fuel t 09	if applicable pe DER Sheet DE Row 333 Ri	Sheet DER Sheet v 332 (Row 313 + 3	DER Sheet 1) Row 315																			
1 Bed End - 1 Bed End - 1 Bed Mid - 6 1 Bed Mid - 6 1 Bed Mid - 1 Bed Mid - 2 Bed - EF 2 Bed - MF 2 Bed - TF 1 Bed Var - 8 1 Bed Var - 1 Bed Var - 1 Bed Var - 7	GF 55.94	1 55.94	25.4	25.4	0.01)]			****	NOW SETC X 0.01/J	(NC	ow serex d.org	(Ro	w 362 x 0.01)]	+ 362	2 <u>11</u>					976	231				133	80		1,419	438	104				60	36		637 11	
1 Bed End - 1 1 Bed Mid - 0 1 Bed Mid - N	FF 55.94 FF 55.83 FF 55.83	1 55.94 5 279.15 8 446.64 1 55.83 6 334.98 1 67.05 1 67.05 1 67.05 1 54.08 1 54.08	26.1 23.3 17.4 20.3 24.1 20.8 16.2 23.2 23.5 20.7 26.9	26.1 22.3 17.4 20.3 24.1 20.8 16.2 23.2 23.2 22.6 20.7 26.9	1956.38 1648.44 1020.58	Grid Electricity	444.26 444.26 443.92 443.92 443.92 443.92 477.15 477.15 477.15 477.15 478.43 438.43 438.43	Gnd Electricity									256 2555 255 255 255 259 299 299 248	175607 153.56 175607 153.56 884008 153.25 884008 153.25 884008 153.25 884008 153.35 884008 153.35 339114 184.05 339114 184.05 339114 184.05 339114 184.05 339114 184.05		976 1,015 856 530 691 903 894 586 1,055 844 685 1,120	231 230 230				133 133 133	80 80 80		1,419 1,458 1,298 972 1,134 1,346 1,393 1,084 1,554 1,278 1,118 1,454	456 384 238 310 405 401 263 474 379 307 458	104 103 103				60 60	36 36 36		637 11 655 11 583 10 436 7. 599 9. 604 10 625 9. 487 7. 698 10 574 10 502 9.	1
1 Bed Mid - E 1 Bed Mid - T	F 55.83	1 55.83 6 334.98	20.3 24.1	20.3 24.1	1331.91 1739.86	Grid Electricity Grid Electricity	443.92 443.92	Grid Electricity Grid Electricity									255 255	684008 153.25 684008 153.25		691 903	230 230 248				133 133	80 80		1,134 1,346	310 405	103 103				60	36 36		509 9. 604 10	3
2 Bed - EF 2 Bed - MF	67.05 67.05	1 67.05 1 67.05	20.8 16.2	20.8 16.2	1722.33 1128.57	Grid Electricity Grid Electricity	477.15 477.15	Grid Electricity Grid Electricity									299	339114 184.05 339114 184.05		894 586	248 248				156 156	96 96		1,393 1,084	401 263	111 111				70 70	43 43		625 9. 487 7.	
1 Bed Var - E	F 54.08 F 54.08	1 54.08 1 54.08	23.6 20.7	23.6 20.7	1627.12 1319.38	Grid Electricity Grid Electricity	438.43 438.43	Grid Electricity Grid Electricity									248 248 248	585742 148.45 585742 148.45		844 685	248 248 228 228 228 228				129 129	77 77		1,278 1,118	379 307	102 102				58 58	35 35		574 10 502 9.	
1 Bed Var - T	F 54.08	1 54.08	26.9	26.9	1965.27	Grid Electricity	438.43	Grid Electricity									248	585742 148.45		1,020	228				129	77		1,454	458	102				58	35		653 12	
NON-DO		28 1,592 BY CONSUMPT		ANALYSIS		N/A	12,514	N/A	0	N/A	0	N/A	0	N/A 0	0	N/A	0	268 4,370	0	21,700	6,495	0	0	0	3,772	2,268 0	NA NA	34,234	9,742	2,916	0	0	0	1,693	1,018	0 NA	15,369 9.	
None	IIZOTIO ENER	Total are represent by mode (m²)	VALIDAT Calculated	ION CHECK	Space Heating	Fuel type	Domestic Hot	Fuel type		REGULATED E	ENERGY CONSUMPT	PTION BY END USE (R	(Wh/m² p.a.) 'BE GR	EEN' BER - SOURCE: B	RUKL OUTPUT		Flectricity 1	Mino Auxiliary	Cooling	Natural Gas	Grid Floritrishy F	GULATED ENERGY CO	NSUMPTION BY FUE	TYPE (kWh/m² p.a.) 'BE	E GREEN' BER - S	OURCE: BRUKLINP or "SM.CS"	FILE Foultment	2012 CO. emission	s Natural Gas	Grid Electricity	Resnoke DH Factor	REGULATED CO ₂ EMIS:	SIONS PER UNIT	nter Carbon Factor - Ente	r Carbon Factor Enter Ca	irhon Factor Foultime	ent SAP 10 0 CO. BRI	KI
Use	Area per N	Total are umber of represent units by mode	BER 2012 (kgCO ₂ / m ²)	BER 2012 (kgCO ₂ / m ²)	(kWh/m² p.a.)	Fuel type Space Heating	Water (kWh/m² p.a.)	Domestic Hot Water						generate CHP (-)	ed by		generated by (kW renewable	hting Auxiliary m² p.a.) (kWhim² p.a) (kWhim' p.a.)	Name of	Unit Catalogy C	Espone Dill scale Caci	by CHP b	renewable echnology	1	OURCE: BRUKLINP or *SM.CS* er Carbon Factor Enter Carbon i 2 3	acioi Equipinani	(kgCO ₂ p.a.)	NELDIE GES	OID ENCORNY	Despote Dil I sciol	by CHP	by renewable technology	1	2	3	ent SAP 10.0 CO ₂ BRU emissions BER SA (kgCO)	10.0 / m²)
	um (m)	(m²)												(-)			technology (-)			2.0451-00 BHB	A 540 L-00 AMB		fapplicable j	applicable		000 kgCOylkWh 0.000 kgCOy	A 540 L-00 044		0 M0 I+00 0 M0	0.222 b=00.000b	0 MA 1-00 IMB	If applicable	(-) If applicable	MAI-00 BM A A	M 1-00 IMP 0 000 I	gCO _a /kWh 0.233 kgCO _a	2000	
Residential	338.8	1 338.8	9.1	9.1	2.83	Grid Electricity	0	Grid Electricity						т аррис			Гаррилан	1.62 3.07	0	0.216 AQCOGRAMII	18 18	LBB AgCOSKINI U.S.	15 Agoog amii 1.5	sagooyanii taati	agooyann u.	and ago og a anii	KMII U.SISAQCOŞKIII	3,081	0.210 kgCO4kWii	18	E.BUE KgCOykWii	0.233 kgCOQKWII 0	.233 kgc Og kimi U.	.uu kgcogkiii u.u	oo agcogaanii	gcoşikwii u.zas kgcoş	1,383 4.	
									N.P	_M P	N/A	N.P	NE	w.P	N.P.																							
									42	4.	4.	42	4.	4.	42.	4																						
Sum		1 339		-	959	N/A	0	N/A						0			0	937 1,040	0	0	5,936	0	0	0	0	0 0	0	3,081	0	5,936	0	0	0	0	0	0 0	1,383 4.	╛
SITE-WID	E ENERGY CO	NSUMPTION A	ND CO2 ANAL	YSIS																																		
												REGULATED ENE	RGY CONSUMPTIO	N														REGULATED CO ₂ EMISSIONS									REGULATED CO ₂ EMIS	IONS
	_	al Area (m²)	Calculated	İ	- 1		- 1							Firms	e Bu		Electricity																					f
Use	То	as Area (mr)	Calculated BER 2012 (kgCO ₂ / m²)	-	Space Heating (kWh p.a.)	H _P	Domestic Hot Water (kWh p.a.)		Space Heating (Heat source 2) (kWh p.a.)	Don (F	mestic Hot Water Heat source 2) (kWh p.a.)		Space and omestic Hot ter from CHP (kWh p.a.)	Electric generate CHP (kWh p if applica	city ed by Seconds P Heating sy p.a.) (kWh p.	tary ystem	Electricity generated by renewable (kWh p.a.) (if applicable	hting Auxiliary h p.a.) (kWh p.a.)	Cooling (kWh p.a.)									2012 CO ₂ emission									SAP 10.0 CO ₂ Calcu emissions BER SA	4ed 2 10.0
			- 1		(xwn p.a.)	MA	(kWh p.a.)	448	(kWh p.a.)	Mb.	(kWh p.a.)	_H P Wat	our Irom CHP	(kWh p	p.a.) (kWh p.	ystem La.) 44P	(kWhpa) (ki	np.e.j (xwhp.a.)	(xwn p.a.)																	414	(kgCO	/m²)
						· ·		· ·					(xwn p.a.)	If applica	able		If applicable																					

SAP 2012 Performance

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	32.0	29.8
After energy demand reduction (be lean)	26.3	29.8
After heat network connection (be clean)	34.2	29.8
After renewable energy (be green)	34.2	29.8

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	5.6	18%
Be clean: savings from heat network	-7.9	-25%
Be green: savings from renewable energy	0.0	0%
Cumulative on site savings	-2.3	-7%
Annual savings from off-set payment	34.2	-
	(Tonnes CO ₂)	
Cumulative savings for off- set payment	1,027	-
Cash in-lieu contribution (£)	97,568	

(E)

**Carbon price is based on GLA recommended price of £95 per torne of carbon dioxide unless
Local Plannino Authority orice is involted in the "Development Hormation" tab.

Non-domestic

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	3	,
	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	3.6	9.9
After energy demand reduction (be lean)	3.5	9.9
After heat network connection (be clean)	3.1	9.9
After renewable energy (be green)	3.1	9.9

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.1	3%
Be clean: savings from heat network	0.4	11%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	0.5	14%
Annual savings from off-set payment	3.1	-
	(Tonnes CO ₂)	
Cumulative savings for off- set payment	92	-
Cash in-lieu contribution (£)	8,780	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless
Local Planning Authority price is inputted in the *Development Information* tab

SITE-WIDE

01.12 WIDE			
	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings
Part L 2013 baseline	35.5		
Be lean	29.8	5.7	16%
Be clean	37.3	-7.5	-21%
Be green	37.3	0.0	0%
Total Savings	-	-1.8	-5%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	1,119.4	-

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	28.5	13.4
After energy demand reduction (be lean)	21.9	13.4
After heat network connection (be clean)	15.4	13.4
After renewable energy (be green)	15.4	13.4

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	6.6	23%
Be clean: Savings from heat network	6.5	23%
Be green: Savings from renewable energy	0.0	0%
Cumulative on site savings	13.2	46%
Annual savings from off-set payment	15.4	-
	(Tonnes CO ₂)	
Cumulative savings for off- set payment	461	-
Cash in-lieu contribution (£)	43,802	

*carbon price is based on GLA recommended price of £95 per torne of carbon dioxide unless

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	1.6	4.5
After energy demand reduction (be lean)	1.6	4.5
After heat network connection (be clean)	1.4	4.5
After renewable energy (be green)	1.4	4.5

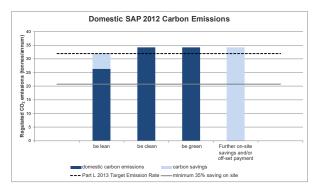
Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

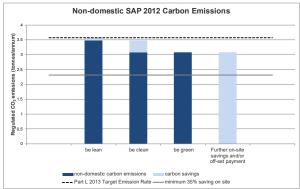
	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	3%
Be clean: savings from heat network	0.2	11%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	0.2	14%
Annual savings from off-set payment	1.4	-
	(Tonne	es CO ₂)
Cumulative savings for off- set payment	41	-
Cash in-lieu contribution (£)*	3,942	

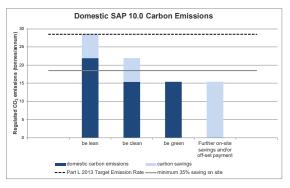
	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	30.1		
Be lean	23.4	6.7	22%
Be clean	16.8	6.7	22%
Be green	16.8	0.0	0%
Total Savings	-	13.4	44%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	502.6	-

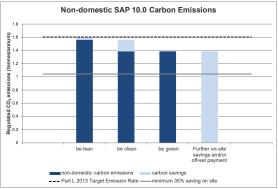
	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	52.54	43.75	17%

	Area weighted non-domestic cooling demand (MJ/m²)	Total area weighted non-domestic cooling demand (MJ/year)	
Actual			
Notional			











APPENDIX B - DOMESTIC OVERHEATING CHECKLIST

This checklist is intended to assist designers to identify potential overheating risk in residential accommodation early on in the design process and trigger the incorporation of passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand in line with London Plan policy SI 4.

Section 1 - Site features affecting vulnerability to	overheating	
Site location	Urban — within central London ³² or in a high density conurbation	No
	Peri-urban — on the suburban fringes of London ³³	Yes
Air quality and/or Noise sensitivity	Busy roads / A roads	Yes
– are any of the following in the vicinity of buildings?	Railways / Overground / DLR	Yes
	Airport / Flight path	Yes
	Industrial uses / waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Yes
	Are residents likely to be at home during the day (e.g. students)?	Yes
Dwelling aspect	Are there any single aspect units?	No
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	Glazing = 543.6 m ² Internal Floor Area = 2187 m ² Glazing ratio = 24.8%
	If yes, is this to allow acceptable levels of daylighting?	N/A
Security - Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	Yes
	Vulnerable areas identified by the Police Architectural Liaison Officer	N/A
	Other	All flat entrances and windows to deck access will be PAS 24 or STS equivalent standard.



Section 2 - Design featu	res implemented to mitigate overheating risk	Please respond
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided?	Yes
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Yes
Materials	Have high albedo (light colour) materials been specified?	Yes
Dwelling aspect	% of total units that are single aspect	0%
	% single aspect with N / NE / NW orientation	N/A
	% single aspect with E orientation	N/A
	% single aspect with S / SE / SW orientation	N/A
	% single aspect with W orientation	N/A
Glazing ratio - What is the glazing ratio	N / NE / NW	30.6m ²
(glazing; internal floor area) on each facade?	E	236.6m ²
	S / SE / SW	234.4m ²
	W	42m ²
Daylighting	What is the average daylight factor range?	Refer to Hydrock report
Window opening	Are windows openable?	Openable = 66%
		Not openable = 34%
Window opening	What is the average percentage of openable area for the windows?	As above
Window opening - What is the extent of	Fully openable	As above
the opening?	Limited (e.g. for security, safety, wind loading reasons)	As above
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	MVHR to provide ventilation when windows closed



APPENDIX C - HOT WATER HEAT PUMP CYLINDER DETAILS

℃Dimplex®

Edel Hot Water Heat Pump



Product Description

The Edel range of heat pump cylinders comes in two sizes, 200L and 270L. The inner vessel is made from Stainless Steel with a Hot Water Heat Pump mounted on top. The heat pump can produce hot water very efficiently as it extracts heat from external air supplied via insulated ductwork, which is available as an accessory. Due to the high efficiencies, the cylinder reduces the Dwelling emissions in SAP making it possible to pass using electric space heating and the Edel cylinder.

Key Features

- The Edel heat pump consumes 5 times less electricity than standard electric water heaters
- Helps to pass Part L building of the regulations whilst specifying electric heating
- Compact unit with 630mm diameter with options of 200L or 270L storage
- Stainless steel tank with 5 year UK guarantee and no requirement for sacrificial anode
- Very quiet operation due to sound proof hood, variable speed fan and a high performance rotary compressor mounted on anti-vibration pads
- Patented high performance heat exchanger and defrost mode of operation in UK climates

_								
Tec	hnical D	etails						
Heat Pump Performance		Edel 200 UK	Edel 270 UK					
Model Code		EDL200UK-630	EDL270UK-630					
Nominal Volume	L	200	270					
Air Operating Range	°C	-7 to	+35					
Achievable Hot Water Temperature Via Heat Pump	°C	60						
Max. Electrical Power Input (Heat Pump AND Immersion)	w	700 + 1200	0 = 1900					
Max. Thermal Power Output From Heat Pump ONLY At 45°C	W	130	0					
Max. Power Output From Heat Pump AND Immersion At 45°C	w	1300 + 120	0 = 2500					
Air Flow	m³/hr	320 to	400					
Sound Pressure Level At 2m	dB(A)	37 (Speed 1) /	40 (Speed 2)					
Refrigerant	/kg	R290/	0.15					
Standing Heat Loss	kWh/24hr	1.61	1.77					
Air Ducting Method		Separate inlet & o	utlet to exterior					
Heating Time From Cold (10°C)	n Cold (10°C) 7h15 9h							
Coefficient Of Performance		3.36	3.30					
Dimensions and Connections								
Dimensions	mm	630 x H 1460	630 x H 1780					
Weight With Packaging	kg	70	79					
Weight Without Packaging	kg	56.5	63					
Air Duct Diameter	mm	160						
Max. Ducting Pressure Drop		260Pa at minimum a 320m ³ /hr	air flow rate of					
Water Connections	Inch	M 3/	4"					
Condensate Tube	mm	18/2	24					
Electrical Supply		230V - 50	Hz-8A					
IP Rating		IPX	4					
RCBO/MCB Type C	Amp	16						
Hot Water Cylinder								
Material		Stainles	steel					
Insulation		45mm PU foam						
Refrigeration Heat Exchanger		Double walled se potable						
Maximum Operating Pressure	bar	6						
Max. Condensate Production	L/h	0.3	3					
Integrated Electric Immersion	W	120	0					
Max. Temperature with Immersion								
Approvals								
Water Regulations		G3 KIWA approv	al to EN12897					
T&P Valve		Factory fitted						
Accessories		Inlet group, tundish	expansion vessel					
Guarantee (UK)		5 years tank (2 ye	ars other parts)					

EDEL (Glen Dimplex Heating & Ventilation)

Issue 1

Date 17/08/2020



APPENDIX D - SAP CALCULATIONS



Baseline

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012	:		Strom Softwa				Versio	on: 1.0.5.41	
			Р	roperty .	Address	1 Bed I	End - GF	=			
Address :	1 Bed End -	GF, Lond	don, TE	BC							
1. Overall dwelling dime	ensions:										
0 10				Area	a(m²)		Av. He	ight(m)	7	Volume(m ³	_
Ground floor				5	5.94	(1a) x	2	2.5	(2a) =	139.85	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)-	+(1n	1) 5	5.94	(4)					
Dwelling volume						(3a)+(3b)+(3c)+(3d	d)+(3e)+	.(3n) =	139.85	(5)
2. Ventilation rate:											
	main heating		condar ating	у	other		total			m³ per hou	r
Number of chimneys	0	7 + [0	+ [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	T + F	0	- - - -	0	i - F	0	x	20 =	0	(6b)
Number of intermittent fa	ıns					_ _ _	2	x ·	10 =	20	
Number of passive vents	.					F	0	x	10 =	0	(7b)
Number of flueless gas fi						Ļ			40 =		
Number of flueless gas in	iles					L	0		10 -	0	(7c)
									Air ch	nanges per ho	ur
Infiltration due to chimne	vs, flues and fa	ans = (6a)	+(6b)+(7	a)+(7b)+(7c) =	Г	20		÷ (5) =	0.14	(8)
If a pressurisation test has b						ontinue fr			. (-)	0.14	(-/
Number of storeys in the	he dw <mark>elling</mark> (ns	s)								0	(9)
Additional infiltration								[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0						•	ruction			0	(11)
if both types of wall are pa deducting areas of openia			onaing to	tne great	er wall are	a (anter					
If suspended wooden t	floor, enter 0.2	(unseale	d) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else	enter 0								0	(13)
Percentage of windows	s and doors dr	aught stri	pped							0	(14)
Window infiltration					0.25 - [0.2			. (45)		0	(15)
Infiltration rate Air permeability value,	aEO everence	d in oubic	motro	a nor ha	. , . ,		12) + (13) -	, ,	oroo	0	= (16)
If based on air permeabil	•			•	•	•	elle ol e	rivelope	area	0.39	(17)
Air permeability value applie	-						is being u	sed		0.39	(10)
Number of sides sheltered	ed									2	(19)
Shelter factor					(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•				(21) = (18)	x (20) =				0.33	(21)
Infiltration rate modified f		 			l .	_	-		-	1	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	
Monthly average wind sp				_	T -		T .	T .	T .	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	2)m ÷ 4										
	1.23 1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(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		
Calculate effe		•	rate for t	he appli	cable ca	se	l						
If mechanic			and a N. (O	Ol-) (OO-) (OO-)			0	(23a)
If exhaust air h) = (23a)			0	(23b)
If balanced wit		•	•	· ·		`		,		_		0	(23c)
a) If balance	1	1	i			<u> </u>	- 	ŕ	 		<u> </u>	÷ 100]	(0.4=)
(24a)m= 0	0	0	0	0	. 0	0	0	0	0	0	0		(24a)
b) If balance	1	1					- ´ ` -	í `	<u> </u>				(2.4h)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h		tract ver < (23b), t		•	•				5 v (23h	.\			
(24c)m = 0	0.57	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural									Ŭ				(= 10)
		en (24d)							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)
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (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)
3. Heat losse	o and he	oot loog i	ooromet) r:								_	
ELEMENT	S and no		Openin		Net Ar	03	U-valı	110	AXU		k-value		ΑΧk
ELEWIEN		(m²)	m		A ,r		W/m2		(W/I	<)	kJ/m ² ·l		kJ/K
Doors					3.57	x	1.2	= [4.284				(26)
Windows Type	e 1				5.73	x1.	/[1/(1.4)+	0.04] =	7.6	Ħ			(27)
Windows Type	e 2				2.96	x1,	/[1/(1.4)+	0.04] =	3.92	Ħ			(27)
Windows Type	e 3				1.72	x1.	/[1/(1.4)+	0.04] =	2.28	5			(27)
Floor					55.94	x	0.13	= [7.2722	=			(28)
Walls	64.9	93	13.98	3	50.95		0.18	≓ ¦	9.17	=		7 H	(29)
Total area of e					120.8	=							(31)
Party wall		,			19.92	_	0		0	— [(32)
Party ceiling					55.94	=						-	(32b
Internal wall *	ŧ.					=				L		╡┝	
* for windows and		lows use e	effective wi	ndow I I-va	63.63		ı formula 1	/[(1/Ll-valu	ıe)±0 041 a	L Is aiven in	naragranh		(32c)
** include the are						ateu using	nonnula 1	/[(1/ O -vaic	0)+0.0+j a	s giveii iii	paragrapii	J.2	
Fabric heat lo	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				34.53	(33)
Heat capacity	Cm = S	(A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	7558.07	7 (34)
Thermal mass	parame	eter (TMF	= Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
For design asses can be used inste				construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridg	es : S (L	.xY) cal	culated (using Ap	pendix ł	<						9.04	(36)
if details of therm. Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =		, 	43.57	(37)
Ventilation he		alculated	d monthly	/					$= 0.33 \times ($	25)m x (5))	45.57	(07)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Jan	1 1 90	I wai	Ι Αρι	iviay	I Juli	Jui	ı Aug	Годр	1 001	1400	Dec		

	T				I		l			l		ſ	(00)
(38)m= 27.26	27.1	26.94	26.19	26.05	25.4	25.4	25.28	25.65	26.05	26.33	26.63		(38)
Heat transfer							T	· · · ·	= (37) + (_	l	1	
(39)m= 70.83	70.67	70.51	69.76	69.62	68.97	68.97	68.85	69.22	69.62	69.9	70.2	60.76	(39)
Heat loss para	meter (H	ILP), W	m²K						= (39)m ÷	Sum(39)₁ · (4)	12 /12=	69.76	(39)
(40)m= 1.27	1.26	1.26	1.25	1.24	1.23	1.23	1.23	1.24	1.24	1.25	1.25		_
Number of day	rs in moi	nth (Tah	le 1a\					,	Average =	Sum(40) ₁	12 /12=	1.25	(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)
	ļ												
4. Water hea	ting ener	av reani	rement:								kWh/ye	ar.	
4. Water nea	ung ener	gy requi	rement.								KVVII/yt	zai.	
Assumed occi			r.,) 40 (T	- 40.0	\0\1 0 4	2040 /	FF 4 40		.86		(42)
if TFA > 13. if TFA £ 13.		+ 1./6 x	[1 - exp	(-0.0003	349 x (11	-A -13.9)2)] + 0.0)013 x (IFA -13.	.9)			
Annual average	•	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		78	3.49		(43)
Reduce the annua	_				_	_	to achieve	a water us	se target o	f			
not more that 125	litres per j	person per	aay (ali w		not and co	ia)						1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pei	day for ea		Va,m = fa	ctor from I	able 1c x	(43)				,		
(44)m= 86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34		_
Energy content of	hot wa <mark>ter</mark>	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x E	OTm / 3600			m(44) ₁₁₂ : ables 1b, 1		941.88	(44)
(45)m= 128.04	111.98	115.56	100.75	96.67	83.42	77.3	88.7	89.76	104.61	114.19	124		
									Total = Su	m(45) ₁₁₂ :	=	1234.95	(45)
If instantaneous v	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)					
(46)m= 19.21	16.8	17.33	15.11	14.5	12.51	11.59	13.31	13.46	15.69	17.13	18.6		(46)
Water storage		المارام ما		.lo., o., \A	WILLDO	-4	م ماطفانی		امما			1	
Storage volum	, ,		0 ,			Ü		ame ves	sei		0		(47)
If community hotherwise if no	•			_			` '	are) ante	ar 'O' in <i>(</i>	47)			
Water storage		not wate	i (uno n	iciuues i	nstantai	ieous co	ATTION DOIL	craj crite	51 0 111 (71)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If manufact	urer's de	eclared o	ylinder l	oss fact	or is not	known:							, ,
Hot water stor	-			e 2 (kW	h/litre/da	ıy)					0		(51)
If community had Volume factor	_		on 4.3										(50)
Temperature f			2h							-	0		(52) (53)
·				201			(47) × (54)) v (F2) v (l	E0)				
Energy lost fro Enter (50) or		_	, KVVII/Y6	zai			(47) x (51)) X (OZ) X (JJ) =	-	0		(54) (55)
Water storage	. , .	•	or each	month			((56)m = (55) × (41):	m		U		(33)
					_		· · · · ·			<u> </u>			(EC)
(56)m= 0 If cylinder contain	0 s dedicate	0 d solar sto	0 rage (57)	0 m = (56)m	0 x [(50) = (0 H11)] <i>- (</i> 5)	0) else (5)	0 7)m = (56)	0 m where (0 H11) is fro	0 m Annend	ix H	(56)
				1		1	r			r		IA 11	, -
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3	0	(58)										
Primary circuit loss calculated for each month (59)m = (58) \div 365 \times (41)m												
(modified by factor from Table H5 if there is solar water heating and a cylinder therm	nostat)	1										
(59)m= 0 0 0 0 0 0 0 0 0	0 0	(59)										
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m												
(61)m= 44 38.29 40.8 37.93 37.6 34.84 36 37.6 37.93 40.8	41.03 44	(61)										
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m -	+ (46)m + (57)m +	(59)m + (61)m										
(62)m= 172.04 150.28 156.35 138.68 134.27 118.25 113.3 126.3 127.69 145.4	155.22 168	(62)										
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contrib	ution to water heating)	ı										
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)												
(63)m= 0 0 0 0 0 0 0 0 0	(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (63)											
Output from water heater	, ,	J										
(64)m= 172.04 150.28 156.35 138.68 134.27 118.25 113.3 126.3 127.69 145.4	155.22 168											
Output from water heat	ter (annual) ₁₁₂	1705.77 (64)										
Heat gains from water heating, kWh/month 0.25 $^{\circ}$ [0.85 \times (45)m + (61)m] + 0.8 \times [(46)n		1										
(65)m= 53.57 46.81 48.62 42.98 41.54 36.45 34.7 38.89 39.33 44.98	- 	(65)										
		· '										
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	from community r	leating										
5. Internal gains (see Table 5 and 5a):												
Metabolic gains (Table 5), Watts		ı										
Jan Feb Mar Apr May Jun Jul Aug Sep Oct		(00)										
(66)m= 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24	93.24 93.24	(66)										
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m= 14.5 12.88 10.47 7.93 5.93 5 5.41 7.03 9.43 11.97	13.98 14.9	(67)										
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m= 162.6 164.29 160.04 150.99 139.56 128.82 121.65 119.96 124.21 133.26	144.69 155.43	(68)										
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m= 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32	32.32 32.32	(69)										
Pumps and fans gains (Table 5a)	-	'										
(70)m= 3 3 3 3 3 3 3 3 3 3	3 3	(70)										
Losses e.g. evaporation (negative values) (Table 5)	•	J										
(71)m= -74.59 -74.59 -74.59 -74.59 -74.59 -74.59 -74.59 -74.59 -74.59 -74.59 -74.59	74.59 -74.59	(71)										
Water heating gains (Table 5)		l										
(72)m= 72.01 69.65 65.35 59.7 55.84 50.62 46.64 52.27 54.62 60.46	66.98 70.2	(72)										
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m +$		` ′										
(73)m= 303.08 300.79 289.84 272.58 255.29 238.42 227.67 233.23 242.24 259.67	· , , , ,	(73)										
6. Solar gains:	219.02 294.3	(10)										
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applications.	able orientation.											
	FF	Gains										
0=	Table 6c	(W)										
Southeast 0.9x 0.77 x 2.96 x 36.79 x 0.63 x	0.7											
	<u> </u>											
Southeast 0.9x 0.77 x 2.96 x 62.67 x 0.63 x	0.7	56.7 (77)										

Southeast on		(77 \
Southeast 0.9x 0.77 x 2.96 x 85.75 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 106.25 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 119.01 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 118.15 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 113.91 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 104.39 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 92.85 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 69.27 x 0.63 x 0.7 =		(77)
Southeast 0.9x 0.77 × 2.96 × 44.07 × 0.63 × 0.7 =		(77)
Southeast 0.9x 0.77 x 2.96 x 31.49 x 0.63 x 0.7 =		(77)
Southwest _{0.9x} 0.77 x 1.72 x 36.79 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 62.67 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 85.75 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 106.25 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 119.01 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 118.15 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 113.91 0.63 x 0.7 =		(79)
Southwest _{0.9x} 0.77 x 1.72 x 104.39 0.63 x 0.7 =	54.87	(79)
Southwesto.9x 0.77 x 1.72 x 92.85 0.63 x 0.7 =	48.81	(79)
Southwest _{0.9x} 0.77 × 1.72 × 69.27 0.63 × 0.7 =	36.41	(79)
Southwesto.9x 0.77 x 1.72 x 44.07 0.63 x 0.7 =	23.17	(79)
Southwesto.9x 0.77 x 1.72 x 31.49 0.63 x 0.7 =	16.55	(79)
Northwest 0.9x 0.77 × 5.73 × 11.28 × 0.63 × 0.7 =	19.76	(81)
Northwest 0.9x 0.77 × 5.73 × 22.97 × 0.63 × 0.7 =	40.22	(81)
Northwest 0.9x 0.77 x 5.73 x 41.38 x 0.63 x 0.7 =	72.46	(81)
Northwest 0.9x 0.77 x 5.73 x 67.96 x 0.63 x 0.7 =		(81)
Northwest 0.9x 0.77 x 5.73 x 91.35 x 0.63 x 0.7 =	159.96	(81)
Northwest 0.9x 0.77 x 5.73 x 97.38 x 0.63 x 0.7 =	170.54	(81)
Northwest 0.9x 0.77 x 5.73 x 91.1 x 0.63 x 0.7 =	159.53	(81)
Northwest 0.9x 0.77 x 5.73 x 72.63 x 0.63 x 0.7 =	127.18	(81)
Northwest 0.9x 0.77 x 5.73 x 50.42 x 0.63 x 0.7 =	88.29	(81)
Northwest 0.9x 0.77 x 5.73 x 28.07 x 0.63 x 0.7 =	49.15	(81)
Northwest 0.9x 0.77 x 5.73 x 14.2 x 0.63 x 0.7 =	24.86	(81)
Northwest 0.9x 0.77 x 5.73 x 9.21 x 0.63 x 0.7 =	16.14	(81)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m		(00)
(83)m= 72.38 129.86 195.11 270.97 330.18 339.52 322.45 276.49 221.1 148.22 87.89 61.17 Total gains – internal and solar (84)m = (73)m + (83)m, watts		(83)
		(84)
		(04)
7. Mean internal temperature (heating season)		
Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		

							_	_	_				_	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.6	0.84	0.97	0.99	1		(86)
Mean i	internal	tempera	ature in l	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.67	19.83	20.1	20.46	20.77	20.94	20.99	20.98	20.85	20.46	20	19.64		(87)
Tempe	erature o	during h	eating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.87	19.87	19.87	19.88	19.88	19.89	19.89	19.9	19.89	19.88	19.88	19.88		(88)
Utilisat	ion fact	or for g	ains for r	rest of d	welling,	h2,m (se	e Table	9a)					1	
(89)m=	1	0.99	0.98	0.93	0.81	0.6	0.41	0.47	0.76	0.95	0.99	1		(89)
Mean i	internal	temper	ature in t	the rest	of dwelli	na T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)	•		ı	
	18.11	18.35	18.74	19.26	19.66	19.85	19.89	19.89	19.77	19.26	18.6	18.08		(90)
_	<u>.</u>							!	f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean i	internal	tempera	ature (fo	r the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) x T2					
	19.05	19.24	19.56	19.98	20.33	20.51	20.55	20.55	20.42	19.98	19.45	19.02		(92)
Apply a	adjustm	ent to th	ne mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate	<u> </u>	Į.	l	
(93)m=	19.05	19.24	19.56	19.98	20.33	20.51	20.55	20.55	20.42	19.98	19.45	19.02		(93)
8. Spa	ce heat	ing requ	uirement											
						ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the util			or gains							0 /				
Litilioot	Jan ion foot	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	ains, hm 0.98	0.93	0.84	0.66	0.49	0.54	0.8	0.96	0.99	1	1	(94)
			W = (94			0.00	0.10	0.07	0.0	0.00	0.00			(5.7)
	373.41	426.05	473.18	508.14	489.18	381.17	267.53	277.15	371.41	390.1	363.68	354.14		(95)
		ige exte	rnal tem	perature	from Ta	able 8							l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat lo	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1044.9	1013.63	921.02	773.13	600.6	407.51	272.48	285.37	437.77	653.3	862.97	1040.38		(97)
						//h/mon	th = 0.02	24 x [(97)m – (95		1)m		1	
(98)m=	499.59	394.85	333.2	190.79	82.89	0	0	0	0	195.82	359.49	510.56		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2567.2	(98)
Space	heating	g require	ement in	kWh/m ²	/year								45.89	(99)
9a. Ene	rgy req	uiremen	ıts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	heatin	_												
Fractio	n of spa	ace hea	t from se	econdar	y/supple	mentary	•						0	(201)
Fractio	n of spa	ace hea	t from m	ain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fractio	n of tot	al heatir	ng from i	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficier	ncy of m	nain spa	ace heati	ing syste	em 1								93.4	(206)
Efficier	ncy of s	econda	ry/supple	ementar	y heating	g systen	ո, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	—— ′year
Space	heating	g require	ement (c		d above))	ļ.				ļ.			
	499.59	394.85	333.2	190.79	82.89	0	0	0	0	195.82	359.49	510.56		
(211)m	= {[(98)	m x (20	4)] } x 1	00 ÷ (20	16)								_	(211)
Γ	534.89	422.75	356.74	204.27	88.75	0	0	0	0	209.66	384.89	546.64		
_								Tota	l (kWh/yea	ar) =Sum(2	211),,,,10,12	- <u>- </u>	2748.6	(211)

Space heating fuel (secondary), kWh/month							
$= \{[(98)m \times (201)]\} \times 100 \div (208)$							
(215)m= 0 0 0 0 0	0 0	0 0	0	0	0		
	•	Total (kWh/y	rear) =Sum(215) _{15,101}		0	(215)
Water heating							
Output from water heater (calculated above) 172.04 150.28 156.35 138.68 134.27 1	18.25 113.3	126.3 127.69	145.4	155.22	168	1	
Efficiency of water heater	10.23	120.3	143.4	133.22	100	80.3	(216)
<u> </u>	80.3 80.3	80.3 80.3	85.8	87.1	87.67	00.0	(217)
Fuel for water heating, kWh/month		I		!	!	ı	
$(219)m = (64)m \times 100 \div (217)m$	47.00 444.00	1,57.00 1,50.00	1 400 47	170.04	1,04,00	1	
(219)m= 196.44 172 179.91 161.53 160.07 1	47.26 141.09	157.28 159.03 Total = Sum		178.21	191.62	2013.9	(219)
Annual totals		rotar – Cum		Wh/yea	r	kWh/yea	
Space heating fuel used, main system 1			•	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	•	2748.6	
Water heating fuel used						2013.9	Ī
Electricity for pumps, fans and electric keep-hot							
central heating pump:					30]	(230c)
boi <mark>ler with a fan-assisted flue</mark>					45		(230e)
Total electricity for the above, kWh/year		sum of (230	a)(2 <mark>3</mark> 0g) =			75	(231)
Electricity for lighting						256.01	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)	(237b) =				5093.51	(338)
12a. CO2 emissions – Individual heating system	s including mi	icro-CHP					
	Energy		Fmiss	ion fac	tor	Emissions	:
	kWh/year			2/kWh		kg CO2/ye	
Space heating (main system 1)	(211) x		0.2	16	=	593.7	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2	16	=	435	(264)
Space and water heating	(261) + (262)	+ (263) + (264) =				1028.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	38.93	(267)
Electricity for lighting	(232) x		0.5	19	=	132.87	(268)
Total CO2, kg/year		sum	of (265)(271) =		1200.49	(272)
TER =						21.46	(273)

			User D	Details: _						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed End - TF, I			Audress	преш	=110 - 17				
1. Overall dwelling dime	nsions:									
			Area	a(m²)		Av. He	ight(m)	7	Volume(m ³	_
Ground floor				55.94	(1a) x	2	2.5	(2a) =	139.85	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	1) 5	55.94	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	d)+(3e)+	.(3n) =	139.85	(5)
2. Ventilation rate:		_								
	main heating	secondar heating	у 	other	_	total			m³ per hou	r
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	ns					2	x .	10 =	20	(7a)
Number of passive vents					Ī	0	x .	10 =	0	(7b)
Number of flueless gas fin	res				Ē	0	X 4	40 =	0	(7c)
					_					
					_		<u> </u>	Air ch	nanges per ho	ur
Infiltration due to chimney						20		÷ (5) =	0.14	(8)
If a pressurisation test has be Number of storeys in the		ended, procee	d to (17), (otherwise (continue tr	rom (9) to ((16)		0	(9)
Additional infiltration	is all olding (i.i.s)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openin		rresponding to	the great	ter wall are	a (after					
If suspended wooden f	• / .	ealed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	,	•	`	,.					0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	_			0	(15)
Infiltration rate	50 1:			(8) + (10)					0	(16)
Air permeability value, If based on air permeabili	•		•	•	•	etre of e	envelope	area	5	(17)
Air permeability value applies	•					is being us	sed		0.39	(18)
Number of sides sheltere	d				-				2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.33	(21)
Infiltration rate modified for		i		Ι	0			<u> </u>	1	
	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind specification (22)m= 5.1 5	1	20	3.8	2.7		4.3	1 1 5	4.7	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.0	3.7	4	4.3	4.5	4./	I	
Wind Factor (22a)m = $(22a)$ m =	2)m ÷ 4								_	
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infilti	ration rat	e (allowi	na 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		
Calculate effe		_	rate for t	he appli	cable ca	se							
If mechanic				ah) (aa-	· \		IT\\ _+!) (00-)			0	(23a)
If exhaust air h) = (23a)			0	(23b)
If balanced wit		-	-	_					> /			0	(23c)
a) If balance	1					- ` ` 	- ^ ` ` - 	í `	, 	, 	i i	÷ 100] I	(240)
(24a)m= 0	0		0	0	0	0	0	0	0	0	0		(24a)
b) If balance	1	1						``	r Ó - Ò	 		Ī	(24b)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h	nouse ex m < 0.5 ×			•	•				5 v (23h	,)			
(24c)m = 0	0.5 7	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural													(= : -)
,	m = 1, the				•				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)
Effective air	change	rate - en	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(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)
3. Heat losse	on and he	et loss r	oromot	Dr.									_
ELEMENT	Gros		Openin		Net Ar	93	U-val	10	AXU		k-value		ΑΧk
ELEIVIEINI	area		m		A ,r		W/m2		(W/I	K)	kJ/m ² ·l		kJ/K
Doors					3.57	х	1.2	= [4.284				(26)
Windows Type	e 1				5.73	x1,	/[1/(1.4)+	0.04] =	7.6	Ħ			(27)
Windows Type	e 2				2.96	x1,	/[1/(1.4)+	0.04] =	3.92	Ħ			(27)
Windows Type	e 3				1.72	x ₁ ,	/[1/(1.4)+	0.04] =	2.28	5			(27)
Walls	64.9	93	13.98	3	50.95	x	0.18	¦	9.17	=			(29)
Roof	55.9		0		55.94	=	0.13	╡┇	7.27	=		╡┝	(30)
Total area of					120.8		0.10		1.21				(31)
Party wall	Siomonio	,				=			0				(32)
Party floor					19.92	=	0		0	<u> </u>		╣	
Internal wall *	*				55.94	=				L		┥	(32a)
			ffootivo wi	ndow II ve	63.63		formula 1	/[/1/	(0) (0.041 (naraarank		(32c)
* for windows and ** include the are						at e u usirig	TOTTIUIA 1	ıı(ıı∪-vall	ı c /+∪.∪4] 6	ıs giv e ri ifi	μαια <u></u> ΥιαρΓ	ı J.Z	
Fabric heat lo	ss, W/K :	= S (A x	U)	-			(26)(30)	+ (32) =				34.53	(33)
Heat capacity	Cm = S	(A x k)						((28)	(30) + (32	2) + (32a).	(32e) =	4425.4	.3 (34)
Thermal mass	s parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design asses				construct	ion are not	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f		
Thermal bridg	es : S (L	x Y) cal	culated ı	using Ap	pendix ł	<						19.75	(36)
if details of therm Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			54.27	
Ventilation he		alculated	monthly	/					$= 0.33 \times ($	(25)m x (5))	J4.27	(01)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Jan	1 1 60	Iviai	ΑΡΙ	iviay	L	L	L Aug	l Ogb	1 001	1100			

(00)												l	(00)
(38)m= 27.26	27.1	26.94	26.19	26.05	25.4	25.4	25.28	25.65	26.05	26.33	26.63	ı	(38)
Heat transfer (· · · · ·	00.40	00.00	70.07	70.07	70.55		= (37) + (00.0		
(39)m= 81.54	81.37	81.21	80.46	80.32	79.67	79.67	79.55	79.92	80.32	80.61	80.9	80.46	(39)
Heat loss para	meter (l	HLP), W	m²K						= (39)m ÷	Sum(39)₁ · (4)	12 / 12=	80.40	(00)
(40)m= 1.46	1.45	1.45	1.44	1.44	1.42	1.42	1.42	1.43	1.44	1.44	1.45		_
Number of day	e in mo	nth (Tah	(12 ما					•	Average =	Sum(40) ₁	12 /12=	1.44	(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)
, ,	<u> </u>										l		
4. Water hea	ting ene	rav reaui	irement								kWh/ye	ear	
			nomoni.								TXVVIII y X	par.	
Assumed occu if TFA > 13.			[1 - AVD	(<u>-</u> 0 0003	2/0 v /TF	- Δ -13 Q)2)]	1013 v (Γ Γ Δ ₋ 13		86	I	(42)
if TFA £ 13.		T 1.70 X	II - exp	(-0.000	743 X (11	A - 10.5	<i>)</i> ∠)] + 0.0) X C10X	II A - 13.	.9)			
Annual averag											3.49		(43)
Reduce the annuance that 125	_				_	_	to achieve	a water us	se target o	f			
							Aug	Sep	Oct	Nov	Doo		
Jan Hot water usage i	Feb in litres per	Mar r day for ea	Apr ach month	May $Vd,m = fa$	Jun	Jul Fable 1c x	(43)	Sep	Oct	Nov	Dec		
(44)m= 86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34		
(44)11= 00.34	00.2	00.00	70.92	75.76	70.04	70.04	73.70			m(44) ₁₁₂ =		941.88	(44)
Energy content of	hot wa <mark>ter</mark>	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			· '		0+1.00	
(45)m= 128.04	111.98	115.56	100.75	96.67	83.42	77.3	88.7	89.76	104.61	114.19	124		
		1		1			•		Total = Su	m(45) ₁₁₂ =	=	1234.95	(45)
If instantaneous v	vater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)				1	
(46)m= 19.21	16.8	17.33	15.11	14.5	12.51	11.59	13.31	13.46	15.69	17.13	18.6		(46)
Water storage Storage volum		\ includir	na anv e	olar or M	/\//HRS	storana	within es	ama vas	امء		0		(47)
If community h	, ,		•			•		airie ves	361		0		(47)
Otherwise if no	•			_			. ,	ers) ente	er '0' in (47)			
Water storage			`					,	`	,			
a) If manufact	turer's de	eclared I	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro		•					(48) x (49)) =			0		(50)
b) If manufact			-								_		(54)
Hot water stor If community h	•			e z (KVV	n/iitre/ua	iy)					0	i	(51)
Volume factor	_		011 110								0		(52)
Temperature f	actor fro	m Table	2b							-	0		(53)
Energy lost fro	m water	r 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 t	for each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder 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= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
								l		1			

Primary circuit loss calculated for each month (59) m = (58) + 365 × (41) m (modified by factor from Table H 51 freme is solar water heating and a cylinder thermostativ (61) m = (60) + 365 × (41) m (61) m = 44 38.29 40.8 37.33 37.6 34.84 36 37.6 37.93 40.8 41.03 44 44 48 48 48 48 48 38 37.6 37.8 37.93 40.8 41.03 44 48
Combilified by Factor from Table H5 if there is solar water heating and a cylinder thermostat) Combilions calculated for each month (61)m = (60) ÷ 365 × (41)m
(89)me
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m (61)m = 44
(61)me
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m = 172.04 150.28 156.35 138.68 134.27 118.25 113.3 126.3 127.69 145.4 155.22 168 (62) Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter 10° if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)me 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Output from water heater (64)m= 172.04 150.28 156.35 138.68 134.27 118.25 113.3 126.3 127.69 145.4 155.22 168 Couput from water heater (annual) 1705.77 (64)
Composition 172.04 150.28 156.35 138.68 134.27 118.25 113.3 126.3 127.68 145.4 155.22 168
Couput from water heater (annual) Couput from water heater (annual) Couput from water heating, kWh/month 0.25 [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
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= 53.57 46.81 48.62 42.98 41.54 36.45 34.7 38.89 39.33 44.98 48.22 52.23 (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= 33.24 93.24
(65)m= 53.57
(65)m= 53.57
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 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 [66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m 14.5 12.88 10.47 7.93 5.93 5 5.41 7.03 9.43 11.97 13.98 14.9 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m 162.6 164.29 160.04 150.99 139.56 128.82 121.65 119.96 124.21 133.26 144.69 155.43 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 (69) Pumps and fans gains (Table 5a) (70)m 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 93.24 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 14.5 12.88 10.47 7.93 5.93 5 5.41 7.03 9.43 11.97 13.98 14.9 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 162.6 164.29 160.04 150.99 139.56 128.82 121.65 119.96 124.21 133.26 144.69 155.43 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 14.5 12.88 10.47 7.93 5.93 5 5.41 7.03 9.43 11.97 13.98 14.9 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 162.6 164.29 160.04 150.99 139.56 128.82 121.65 119.96 124.21 133.26 144.69 155.43 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
(67)m=
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m=
(68)m= 162.6 164.29 160.04 150.99 139.56 128.82 121.65 119.96 124.21 133.26 144.69 155.43 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
(69)m= 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 32.32 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
(70)m= 3 4 5 3 3 7 7 4 59 7 7 4 59 7 7 4 59 7 7 4 59 7 7 4 59 7 7 4 59 7 7
Losses e.g. evaporation (negative values) (Table 5) (71)m=
(71)m=
Water heating gains (Table 5) (72)m= 72.01 69.65 65.35 59.7 55.84 50.62 46.64 52.27 54.62 60.46 66.98 70.2 (72)
(72)m= 72.01 69.65 65.35 59.7 55.84 50.62 46.64 52.27 54.62 60.46 66.98 70.2 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
(73)m= 303.08 300.79 289.84 272.58 255.29 238.42 227.67 233.23 242.24 259.67 279.62 294.5 (73)
6. Solar gains:
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux g_ FF Gains
Table 6d m² Table 6a Table 6b Table 6c (W)
Southeast 0.9x 0.77 x 2.96 x 36.79 x 0.63 x 0.77 = 33.28 (77)

Southeast _{0.9x}								1 . 1			7.				
Southeast 0.9x	0.77	X	2.9		X		5.75	X		0.63	X	0.7	=	77.57	(77)
<u> </u>	0.77	X	2.9		X		06.25	X		0.63	X	0.7	= =	96.12	(77)
Southeast 0.9x	0.77	X	2.9		X		19.01	X		0.63	X	0.7	=	107.66	(77)
Southeast 0.9x	0.77	X	2.9		X		18.15	X		0.63	_ ×	0.7	=	106.88	(77)
Southeast 0.9x	0.77	X	2.9		X		13.91	X		0.63	×	0.7	=	103.04	(77)
Southeast 0.9x	0.77	X	2.9	6	X	10)4.39	X		0.63	X	0.7	=	94.43	(77)
Southeast 0.9x	0.77	X	2.9	6	X	9	2.85	X		0.63	X	0.7	=	84	(77)
Southeast _{0.9x}	0.77	X	2.9	6	X	6	9.27	X		0.63	X	0.7	=	62.66	(77)
Southeast _{0.9x}	0.77	X	2.9	6	X	4	4.07	X		0.63	X	0.7	=	39.87	(77)
Southeast 0.9x	0.77	X	2.9	6	X	3	1.49	X		0.63	X	0.7	=	28.48	(77)
Southwest _{0.9x}	0.77	X	1.7	2	X	3	6.79			0.63	X	0.7	=	19.34	(79)
Southwest _{0.9x}	0.77	X	1.7	2	X	6	2.67			0.63	x	0.7	=	32.94	(79)
Southwest _{0.9x}	0.77	X	1.7	2	X	8	5.75			0.63	x	0.7	=	45.08	(79)
Southwest _{0.9x}	0.77	X	1.7	2	X	10	06.25			0.63	x	0.7	=	55.85	(79)
Southwest _{0.9x}	0.77	X	1.7	2	X	11	19.01]		0.63	x	0.7	=	62.56	(79)
Southwest _{0.9x}	0.77	X	1.7	2	x	11	18.15]		0.63	x	0.7	=	62.11	(79)
Southwest _{0.9x}	0.77	X	1.7	2	X	11	13.91			0.63	x	0.7	=	59.88	(79)
Southwest _{0.9x}	0.77	X	1.7	2	X	10	04.39			0.63	X	0.7	=	54.87	(79)
Southwest _{0.9x}	0.77	X	1.7	2	Х	9	2.85			0.63	x	0.7		48.81	(79)
Southwest _{0.9x}	0.77	x	1.7	2	Х	6	9.27			0.63	x	0.7	=	36.41	(79)
Sout <mark>hwest_{0.9x}</mark>	0.77	x	1.7	2	X	4	4.07			0.63	х	0.7	=	23.17	(79)
Southwest _{0.9x}	0.77	x	1.7	2	x	3	1.49			0.63	х	0.7		16.55	(79)
Northwest _{0.9x}	0.77	x	5.7	3	x	1	1.28	X		0.63	х	0.7	=	19.76	(81)
Northwest _{0.9x}	0.77	x	5.7	3	Х	2	2.97	x		0.63	х	0.7	=	40.22	(81)
Northwest 0.9x	0.77	x	5.7	3	X	4	1.38	x		0.63	x	0.7		72.46	(81)
Northwest 0.9x	0.77	x	5.7	3	X	6	7.96	x		0.63	x	0.7		119	(81)
Northwest 0.9x	0.77	X	5.7	3	X	9	1.35	x		0.63	x	0.7	=	159.96	(81)
Northwest 0.9x	0.77	x	5.7	3	X	9	7.38	x		0.63	x	0.7		170.54	(81)
Northwest _{0.9x}	0.77	x	5.7	3	X	9	91.1	X		0.63	x	0.7	=	159.53	(81)
Northwest 0.9x	0.77	x	5.7	3	X	7	2.63	x		0.63	x	0.7	<u> </u>	127.18	(81)
Northwest _{0.9x}	0.77	x	5.7	3	X	5	0.42	x		0.63	×	0.7		88.29	(81)
Northwest _{0.9x}	0.77	x	5.7	3	X	2	8.07	x		0.63	×	0.7		49.15	(81)
Northwest 0.9x	0.77	x	5.7	3	X	1	4.2	x		0.63	T x	0.7		24.86	(81)
Northwest _{0.9x}	0.77	x	5.7	3	X	9	9.21	X		0.63	X	0.7	-	16.14	(81)
_								.							
Solar gains in v	watts, ca	lculated	for eacl	n montl	1			(83)m	ı = Su	m(74)m	(82)m				
(83)m= 72.38	129.86	195.11	270.97	330.18	33	39.52	322.45	276	.49	221.1	148.22	87.89	61.17		(83)
Total gains – in	nternal ar	nd solar	(84)m =	(73)m	+ (8	33)m	watts							- -	
(84)m= 375.46	430.65	484.95	543.55	585.47	5	77.94	550.12	509	.72	463.34	407.89	367.51	355.67		(84)
7. Mean interr	nal tempe	erature	(heating	seaso	n)										
Temperature	during he	eating p	eriods ir	the liv	ing	area f	rom Tab	ole 9,	, Th1	(°C)				21	(85)
Utilisation fact	tor for ga	ins for I	iving are	ea, h1,r	n (s	ee Ta	ble 9a)								
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
					•			-		<u>.</u>		•	-	_	

(86)m=	1	0.99	0.99	0.96	0.89	0.76	0.6	0.66	0.87	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.43	19.6	19.89	20.28	20.64	20.88	20.97	20.95	20.76	20.3	19.8	19.4		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.72	19.72	19.72	19.73	19.74	19.74	19.74	19.75	19.74	19.74	19.73	19.73		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)					•	
(89)m=	1	0.99	0.98	0.94	0.85	0.65	0.45	0.51	0.8	0.96	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)		•	!	
(90)m=	17.66	17.91	18.33	18.9	19.38	19.67	19.73	19.73	19.55	18.94	18.2	17.62		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) × T2			'		
(92)m=	18.73	18.93	19.27	19.73	20.14	20.4	20.48	20.47	20.28	19.76	19.16	18.7		(92)
Apply	adjustn	nent to t	he mear	interna	l temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	18.73	18.93	19.27	19.73	20.14	20.4	20.48	20.47	20.28	19.76	19.16	18.7		(93)
			uirement											
				mperatui using Ta		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
uic ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		ividy	Juli	<u> </u>	/tug	ОСР	001	1101	_ D00		
(94)m=	0.99	0.99	0.98	0.94	0.86	0.71	0.54	0.6	0.83	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m	r								
(95)m=	373.29	426.08	474.04	513.04	505.23	410.34	296.69	304.65	386.57	392.13	363.7	354.02		(95)
Montl	nly avera	age exte	rnal tem	perature	from T	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			r	·	1	1			– (96)m				I	(07)
` '		1141.35	ļ	871.5	678.2	462.16	308.94	323.42	494.21	735.78	972.52	1172.74		(97)
Space (98)m=	597.56	g require 480.67	418.82	258.09	128.69	/vn/mon	$\ln = 0.02$	24 X [(97)m – (95 0)mj x (4 255.68	438.35	609.13		
(50)111=	007.00	400.07	410.02	200.00	120.00				l per year			l	3187	(98)
Space	o bootin	a roquir	omant in	kWh/m²	2/voor			7010	ii poi youi	(ittiii) oai) = Ga m(G	O/15,912 —		(99)
·		•											56.97	(99)
			nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir	_	nt from s	econdar	v/supple	mentarv	system						0	(201)
	-			nain syst			-	(202) = 1	- (201) =				1	(202)
				main sys	` '				02) × [1 – ((203)] =			1	(204)
			•	ing syste				(== -) (=		(===)]			93.4	(206)
	•	•		•		a cycton	o 0/							
EIIICI				ementar I	·					_			0	(208)
0	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
Space	597.56	g require 480.67	418.82	alculate 258.09	128.69	0	0	0	0	255.68	438.35	609.13		
(044)			<u> </u>	<u> </u>					U	200.00	430.33	009.13		(011)
(211)m	$1 = \{[(98) \\ 639.79]$)m x (20 514.63	4)] } x 1 448.42	00 ÷ (20 276.33	137.78	0	0	0	0	273.75	469.33	652.17		(211)
	033.13	514.03	++0.42	210.33	137.70	L "	L "		l (kWh/yea				3412.2	(211)
								. 5 . 6	,, 30	,	/15,1012	2	J412.2	(211)

(215)m = 0 0 0 0 0	0 0	0	0	0	0	0		
	ļ.	Total	(kWh/yea	ar) =Sum(2	1 215) _{15,1012}	<u> </u> =	0	(215)
Water heating								
Output from water heater (calculated above)					1	1	1	
	118.25 113.3	126.3	127.69	145.4	155.22	168		7(246)
Efficiency of water heater (217)m= 87.93 87.77 87.41 86.59 84.94	80.3 80.3	80.3	80.3	86.46	87.52	88.01	80.3	(216) (217)
Fuel for water heating, kWh/month	00.3	00.5	00.5	00.40	07.52	00.01		(217)
(219) m = (64) m x $100 \div (217)$ m							•	
(219)m= 195.66 171.22 178.87 160.15 158.06 1	147.26 141.09		159.02	168.18	177.35	190.89		_
		Total	= Sum(2				2005.03	(219)
Annual totals Space heating fuel used, main system 1				K	Wh/yeaı		kWh/yea 3412.2	<u>r</u>
Water heating fuel used							2005.03	╡
•							2005.03	
Electricity for pumps, fans and electric keep-hot							1	,
central heating pump:						30		(2300
boiler with a fan-assisted flue						45		(230
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =	:		75	(231)
Total electricity for the above, kWh/year Electricity for lighting		sum	of (230a).	(230g) =			75 256.01	=
	(231) + (232			(230g) =				(231)
Electricity for lighting)(237b) :		(230g) =			256.01	(232)
Electricity for lighting Total delivered energy for all uses (211)(221) +	ns including m)(237b) :				tor	256.01 5748.24	(232)
Electricity for lighting Total delivered energy for all uses (211)(221) +)(237b) : nicro-CHP			ion fac	tor	256.01	(232)
Electricity for lighting Total delivered energy for all uses (211)(221) +	es including n)(237b) : nicro-CHP		Emiss	ion fac 2/kWh	tor	256.01 5748.24 Emissions	(232)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system	Energy kWh/yea)(237b) : nicro-CHP		Emiss kg CO	ion fac 2/kWh		256.01 5748.24 Emissions kg CO2/ye	(232) (338) (338)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1)	Energy kWh/yea)(237b) : nicro-CHP		Emiss kg CO	ion fac 2/kWh 16	=	256.01 5748.24 Emissions kg CO2/ye	(232) (338) S sar (261) (263)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary)	Energy kWh/yea (211) x (215) x)(237b) : nicro-CHP		Emiss kg CO	ion fac 2/kWh 16	=	256.01 5748.24 Emissions kg CO2/ye 737.04	(232) (338) Sar (261) (263) (264)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/yea (211) x (215) x (219) x)(237b) : nicro-CHP		Emiss kg CO	ion fac 2/kWh 16 19	=	256.01 5748.24 Emissions kg CO2/ye 737.04 0 433.09	(232) (338) Sear (261)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/yea (211) x (215) x (219) x (261) + (262))(237b) : nicro-CHP		Emiss kg CO	ion fac 2/kWh 16 19	= = =	256.01 5748.24 Emissions kg CO2/ye 737.04 0 433.09 1170.12	(232) (338) (338) (338) (261) (263) (264) (265)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/yea (211) x (215) x (219) x (261) + (262 (231) x)(237b) : nicro-CHP	= 264) =	Emiss kg CO	ion fac 2/kWh 16 19 16	= = =	256.01 5748.24 Emissions kg CO2/ye 737.04 0 433.09 1170.12 38.93	(232) (338) (338) (338) (261) (263) (264) (265) (267)

			User D	etails:						
Assessor Name:				Strom	a Num	ber:				
Software Name:	Stroma FSAP 2	012		Softwa	are Vei	rsion:		Versio	on: 1.0.5.41	
			i i	Address	1 Bed I	Mid - EF				
Address: 1. Overall dwelling dime	1 Bed Mid - EF, L	ondon, TE	3C							
1. Overall dwelling dime	HISIONS.		Δre	a(m²)		Av He	ight(m)		Volume(m³	\
Ground floor				` 	(1a) x		2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1ı	n)	55.83	(4)			_		
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	ry	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X (40 =	0	(6a)
Number of open flues	0 +	0	+	0] = [0	x :	20 =	0	(6b)
Number of intermittent fa	ins					2	X	10 =	20	(7a)
Number of passive vents	3					0	X	10 =	0	(7b)
Number of flueless gas f	ires					0	X ·	40 =	0	(7c)
					_			Δir ch	nanges per ho	ur
Infiltration due to chimne	vo fluor and fans –	(63)+(6b)+(7	7a)±(7h)±(70) -	_		_			_
If a pressurisation test has b					continue fr	20 om (9) to		÷ (5) =	0.14	(8)
Number of storeys in t									0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0					•	ruction			0	(11)
if both types of wall are p deducting areas of openi		responding to	o the great	ter wall are	a (after					
If suspended wooden	- :	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter)							0	(13)
Percentage of window	s and doors draught	stripped							0	(14)
Window infiltration				0.25 - [0.2					0	(15)
Infiltration rate				(8) + (10)	, , ,	, , ,	, ,		0	(16)
Air permeability value,	•		•	•	•	etre of e	envelope	area	5	(17)
If based on air permeabil	-						1		0.39	(18)
Air permeability value applie Number of sides sheltere	•	nas been dol	ne or a de	gree air pe	теаршіу	is being u	sea		2	(19)
Shelter factor	, u			(20) = 1 -	[0.0 75 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor			(21) = (18) x (20) =				0.33	(21)
Infiltration rate modified f	for monthly wind spe	ed								
Jan Feb	Mar Apr Ma	y Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7	•	-	-		-	-	-	-	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Factor (22a)m = (2										
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
					L	L			ı	

Calculate effective air change rate for the applicable case If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + (24a)m = 0	•	(allo		ng for s	helter ar	nd wind s	speed) :	= (21a) x 0.31	(22a)m 0.33	0.26	1 0 20	1 0 20	7	
If mechanical ventilation: If exhaust air heat pump using Appendix N. (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) If balanced with heat recovery; efficiency in % allowing for in-use factor (from Table 4h) = 24a) m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-	-				1		0.31	0.33	0.36	0.38	0.39		
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (234a)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		_	•		• •								()
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (25 Ma)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ng	sing Ap	Арре	endix N, (2	23b) = (23a	a) × Fmv (equation	(N5)) , othe	erwise (23b	o) = (23a)			()
### 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ry:	ery: ef	effici	eiency in %	allowing	for in-use f	factor (fro	m Table 4h	n) =				()
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	ica	nical	l ve	entilation	with he	at recov	ery (M\	/HR) (24	a)m = (2	2b)m + (23b) × [1 – (230	<u>•)</u> ÷ 100]	
Atom 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	C	0		0	0	0	0	0	0	0	0	0		(
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) (4c)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 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)m² × 0.5] (4d)m = 0.59 0.59 0.58 0.57 0.56 0.55 0.55 0.55 0.56 0.56 0.56 0.57 0.58 Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (5)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 3. Heat losses and heat loss parameter: ELEMENT Gross area (m²) (indows Type 1 (indows Type 2 (indows Type 3 ica	nical	l ve	entilation	without	heat red	covery ((MV) (24I	o)m = (2	2b)m + (23b)		_		
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) 4c)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	C	0		0	0	0	0	0	0	0	0	0		(
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 + I(22b)m² × 0.5] 4d)m= 0.59					•	•				.5 × (23k	o)	_	_	
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] 4dd)m = 0.59	C	0		0	0	0	0	0	0	0	0	0		(
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) 5										0.5]				
3. Heat losses and heat loss parameter: SLEMENT Gross area (m²) Oors Jindows Type 1 Jindows Type 2 Jindows Type 3 Jindows Type 1 Jindows Type 3 Jindows Type 1 Jindows Type 1 Jindows Type 1 Jindows Type 1 Jindows Type 2 Jindows Type 1 Jindows Type 2 Jindows Type 3 Jindows Type 1 Jindow	0.5	0.58	8	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58		(
A Heat losses and heat loss parameter: CLEMENT Gross area (m²) Openings M²	te	ate -	- en	nter (24a	a) or (24	b) or (24	c) or (2	4d) in bo	x (25)				_	
LEMENT Gross area (m²) Openings $Met Area A , m² W/m2K A $	0.5	0.58	8	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58		
LEMENT Gross area (m²) Openings A ,	t lo	t los	ss i	oaramet	er:							_	_	
indows Type 1 indows Type 2 indows Type 3 indows Type 2 indows Type 3 indows Type 3 indows Type 2 indows Type 3 indows Type 1 indows Type 3 indow		3		Openir	ngs							k-valu		A X k kJ/K
indows Type 2 indows Type 3 2.95 $x1/[1/(1.4) + 0.04] = 3.91$ indows Type 3 1.72 $x1/[1/(1.4) + 0.04] = 2.28$ oor 13.85 x 0.13 1.8005 indicative Value: Medium or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f						3.57	· x	1.2	=	4.284	$\dot{\Box}$			
findows Type 3 1.72 $x1/[1/(1.4) + 0.04] = 2.28$ foor $x1/[1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1.4) + 0.04] = 2.28$ $x1/[1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1/(1.4) + 0.04] = 2.28$ $x1/[1/(1/(1/(1/(1/(1/(1/(1/(1/(1/(1/(1/(1/(1$						5.71	×	1/[1/(1.4)-	- 0.04] =	7.57	Ħ			
loor 13.85 x 0.13 = 1.8005 241 x 31.03 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 39.86 x 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98 41.98						2.95	×	1/[1/(1.4)+	- 0.04] =	3.91	Ħ			
Valls 44.98 13.95 31.03 X 0.18 = 5.59 otal area of elements, m² arty wall 39.86 X 0 = 0 arty floor 41.98 oternal wall ** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragrainclude the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) eat capacity Cm = S(A x k) for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragrainclude the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) (26)(30) + (32) = eat capacity Cm = S(A x k) for design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f						1.72	x	1/[1/(1.4)+	- 0.04] =	2.28	5			
otal area of elements, m ² arty wall arty floor 41.98 arty ceiling 55.83 arty windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragratic include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) eat capacity Cm = S(A x k) (26)(30) + (32) = ((28)(30) + (32) + (32a)(32e) = ((28)(30) + (32) + (32a)(32e) = ((28)(30) + (32) + (32a)(32e) = ((30) + (32a) + (32a)(32e) = ((13.8		0.13		1.8005			— г	
ortal area of elements, m² 58.83 arrty wall 39.86 x 0 = 0 arrty floor 41.98 arrty ceiling 55.83 arrty ceiling 55.83 arrty design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f				13.9	5	31.0	3 X	0.18	_	5.59	=		=	
arty wall arty floor $ 39.86 \times 0 = 0 $ arty floor $ 41.98 $ arty ceiling $ 55.83 $ ternal wall ** $ 63.71 $ for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragratic include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) eat capacity Cm = S(A x k) for design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f	n²						_							
arty floor arty ceiling 55.83 ternal wall ** 63.71 for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragratic include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) eat capacity Cm = S(A x k) hermal mass parameter (TMP = Cm \div TFA) in kJ/m²K Indicative Value: Medium or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f								0		0				
ternal wall ** 63.71 for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragratic include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) eat capacity Cm = S(A x k) for design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f							=						=	
ternal wall ** 63.71 for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragratic include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) eat capacity Cm = S(A x k) hermal mass parameter (TMP = Cm \div TFA) in kJ/m²K Indicative Value: Medium or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f											[=	
for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragra-include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) (26)(30) + (32) = (28)(30) + (32) + (32a)(32e) = (28)(30) + (32) + (32a)(32e) = (32a)(32e)											<u>.</u> [터 ㅏ	
eat capacity $Cm = S(A \times K)$ ((28)(30) + (32) + (32a)(32e) thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m²K Indicative Value: Medium or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f						alue calcu		g formula	1/[(1/U-valu	ue)+0.04] a	L as given in	paragrap	L oh 3.2	
nermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f	S (S (A	λ×	U)				(26)(30) + (32) =				25.	.43
r design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f	хl	xk)	()						((28).	(30) + (3	2) + (32a)	(32e) =	619	7.86
	r (er (TN	MF	= Cm	÷ TFA) ii	n kJ/m²K			Indica	ative Value	: Medium		25	50
					e construc	tion are no	t known p	orecisely th	e indicative	e values of	TMP in T	able 1f		
nermal bridges : S (L x Y) calculated using Appendix K	Y)	(Y) c	cal	culated	using Ap	opendix	K						8.	78
details of thermal bridging are not known (36) = $0.05 \times (31)$ otal fabric heat loss (33) + (36) =	e n	re not	t kn	own (36)	= 0.05 x (3	31)								

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.21	27.05	26.89	26.14	26	25.35	25.35	25.23	25.6	26	26.29	26.58		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	61.42	61.26	61.1	60.35	60.21	59.56	59.56	59.44	59.81	60.21	60.5	60.79		
Heat Ic	ss para	meter (H	HLP), W/	′m²K				-		Average = = (39)m ÷	Sum(39) ₁ . · (4)	12 /12=	60.35	(39)
(40)m=	1.1	1.1	1.09	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09		
Numbe	er of day	s in moi	nth (Tab	le 1a)			-			Average =	Sum(40) ₁	12 /12=	1.08	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ener	rgy requi	rement:								kWh/ye	ear:	
Assum	ed occu	ıpancy, İ	N								1	.86		(42)
if TF.		9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.00		(/
								(25 x N)				3.41		(43)
		ai average litres per j					-	to achieve	a water us	se target o	Ī			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate		n litres per							ОСР	Oct	1407			
(44)m=	86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		
Epergy	content of	hot water	used - cal	culated m	onthly – 1	100 x Vd r	n v nm v l	OTm / 3600			m(44) ₁₁₂ =		940.97	(44)
(45)m=	127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
(12)					00.01						m(45) ₁₁₂ =		1233.75	(45)
If instant	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)		, ,	L		
(46)m=	19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
	storage		اماريطانه		olor or M	WALLDO	otorogo	within o		مما				(47)
_		e (iiires) eating a					•	within sa	ame ves	sei		0		(47)
Otherw	•	stored			•			ombi boil	ers) ente	er '0' in (47)			
	_	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b			.,					0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
•		urer's de		-										
		age loss leating s			e 2 (KVVI	n/litre/da	ıy)					0		(51)
	-	from Tal		JII 4.3								0		(52)
		actor fro		2b								0		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
		(54) in (5	-	·								0		(55)
Water	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)

If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) - (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circui Primary circui (modified by	t loss cal	culated f	for each	month (,	` '	` '		r thormo		0		(58)
(59)m= 0	0	0	0	0	olai wal	0			0	0	0		(59)
					ŭ								(==)
Combi loss ca	1						·	1 27.0	10.70	40.00	12.05	1	(61)
(61)m= 43.95	38.26	40.76	37.9	37.56	34.8	35.96	37.56	37.9	40.76	40.99	43.95	(50) (04)	, ,
Total heat req	1						`		` 	`	r` ´ 	(59)m + (61)r l	
(62)m= 171.87	ļ	156.2	138.54	134.13	118.14	113.19	126.18	127.57	145.26	155.06	167.83		(62)
Solar DHW input (add additional									ir contribut	ion to wate	er neating)		
(63)m= 0	0	0	0	0	applies 0	, see Ap	0	0	0	0	0		(63)
				U	U								(55)
Output from w (64) m= 171.87	150.13	156.2	138.54	134.13	118.14	113.19	126.18	127.57	145.26	155.06	167.83		
(04)111= 171.07	130.13	130.2	130.34	134.13	110.14	113.19			ater heate			1704.11	(64)
Heat gains fro	m water	hoating	k\\/h/m/	anth 0 2	5 ′ [0 85	v (45)m							
(65)m= 53.52	46.76	48.57	42.94	41.5	36.41	34.67	38.85	39.29	44.94	48.18	52.18]	(65)
` ']	(55)
include (57)			, ,		yiirider is	s in the t	aweiling	or not w	aler is ii	om com	munity r	leating	
5. Internal g	ains (see	e Table 5	and 5a):									
												_	
Metabolic gair				-						Nie			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(66)
(66)m= 93.08	Feb 93.08	Mar 93.08	Apr 93.08	93.08	93.08	93.08	93.08	93.08	Oct 93.08	Nov 93.08	Dec 93.08		(66)
Jan (66)m= 93.08 Lighting gains	Feb 93.08 (calcula	Mar 93.08 ted in Ap	Apr 93.08 opendix	93.08 L, equat	93.08 ion L9 oi	93.08 r L9a), a	93.08 lso see	93.08 Table 5	93.08	93.08	93.08		, ,
Jan (66)m= 93.08 Lighting gains (67)m= 14.47	93.08 93.08 (calcula 12.85	Mar 93.08 ted in Ap 10.45	Apr 93.08 opendix 7.91	93.08 L, equati 5.92	93.08 ion L9 or 4.99	93.08 r L9a), a 5.4	93.08 Iso see	93.08 Table 5 9.41	9 <mark>3.08</mark>		_		(66) (67)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga	93.08 (calcula 12.85 ains (calcula	Mar 93.08 ted in Ap 10.45 ulated in	Apr 93.08 ppendix 7.91 Append	93.08 L, equati 5.92 dix L, eq	93.08 ion L9 or 4.99 uation L	93.08 r L9a), a 5.4 13 or L1	93.08 Iso see 7.01 3a), also	93.08 Table 5 9.41 o see Ta	9 <mark>3.08</mark> 11.95 ble 5	93.08	93.08		(67)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32	93.08 (calcula 12.85 ains (calcula 164.01	93.08 ted in Ap 10.45 ulated in	Apr 93.08 ppendix 7.91 Append 150.73	93.08 L, equati 5.92 dix L, equati 139.32	93.08 ion L9 or 4.99 uation L	93.08 r L9a), a 5.4 13 or L1 121.44	93.08 Iso see 7.01 3a), also	93.08 Table 5 9.41 o see Ta	9 <mark>3.08</mark> 11.95 ble 5 133.03	93.08	93.08		, ,
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains	Feb 93.08 (calcula 12.85 ains (calcula 164.01 s (calcula	Mar 93.08 ted in Ap 10.45 ulated in 159.76	Apr 93.08 ppendix 7.91 Append 150.73	93.08 L, equati 5.92 dix L, eq 139.32 L, equat	93.08 ion L9 or 4.99 uation L 128.6 ion L15	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a	93.08 lso see 7.01 3a), also 119.75	93.08 Table 5 9.41 9 see Ta 124 ee Table	9 <mark>3.08</mark> 11.95 ble 5 133.03	93.08 13.95 144.44	93.08 14.87 155.16		(67) (68)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32	93.08 (calcula 12.85 ains (calcula 164.01	93.08 ted in Ap 10.45 ulated in	Apr 93.08 ppendix 7.91 Append 150.73	93.08 L, equati 5.92 dix L, equati 139.32	93.08 ion L9 or 4.99 uation L	93.08 r L9a), a 5.4 13 or L1 121.44	93.08 Iso see 7.01 3a), also	93.08 Table 5 9.41 o see Ta	9 <mark>3.08</mark> 11.95 ble 5 133.03	93.08	93.08		(67)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa	Feb 93.08 (calcula 12.85 ains (calcula 164.01 s (calcula 32.31	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31	93.08 L, equati 5.92 dix L, eq 139.32 L, equat	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	93.08 Iso see 7.01 3a), also 119.75), also se 32.31	93.08 Table 5 9.41 p see Ta 124 ee Table 32.31	93.08 11.95 ble 5 133.03 5 5 32.31	93.08 13.95 144.44 32.31	93.08 14.87 155.16		(67) (68) (69)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31	Feb 93.08 (calcula 12.85 ains (calcula 164.01 s (calcula 32.31	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31	93.08 L, equati 5.92 dix L, eq 139.32 L, equat	93.08 ion L9 or 4.99 uation L 128.6 ion L15	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a	93.08 lso see 7.01 3a), also 119.75	93.08 Table 5 9.41 9 see Ta 124 ee Table	9 <mark>3.08</mark> 11.95 ble 5 133.03	93.08 13.95 144.44	93.08 14.87 155.16		(67) (68)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa	Feb 93.08 (calcula 12.85 ains (calcula 164.01 s (calcula 32.31 ans gains	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a)	93.08 L, equati 5.92 dix L, eq 139.32 L, equat 32.31	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	93.08 Iso see 7.01 3a), also 119.75), also se 32.31	93.08 Table 5 9.41 p see Ta 124 ee Table 32.31	93.08 11.95 ble 5 133.03 5 5 32.31	93.08 13.95 144.44 32.31	93.08 14.87 155.16 32.31		(67) (68) (69)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3	Feb 93.08 (calcula 12.85 ains (calcula 164.01 s (calcula 32.31 ans gains	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a)	93.08 L, equati 5.92 dix L, eq 139.32 L, equat 32.31	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	93.08 Iso see 7.01 3a), also 119.75), also se 32.31	93.08 Table 5 9.41 p see Ta 124 ee Table 32.31	93.08 11.95 ble 5 133.03 5 5 32.31	93.08 13.95 144.44 32.31	93.08 14.87 155.16 32.31		(67) (68) (69)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3 Losses e.g. e	Feb 93.08 (calcula 12.85 ains (calcula 32.31 as gains 3 vaporatio -74.47	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5 3 on (negating)	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 3	93.08 L, equati 5.92 dix L, equati 139.32 L, equati 32.31 3 es) (Tab	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31 3 le 5)	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a 32.31	93.08 Iso see 7.01 3a), also 119.75 0, also se 32.31	93.08 Table 5 9.41 Disee Ta 124 Dee Table 32.31	93.08 11.95 ble 5 133.03 5 32.31	93.08 13.95 144.44 32.31	93.08 14.87 155.16 32.31		(67) (68) (69) (70)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3 Losses e.g. et (71)m= -74.47	Feb 93.08 (calcula 12.85 ains (calcula 32.31 as gains 3 vaporatio -74.47	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5 3 on (negating)	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 3	93.08 L, equati 5.92 dix L, equati 139.32 L, equati 32.31 3 es) (Tab	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31 3 le 5)	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a 32.31	93.08 Iso see 7.01 3a), also 119.75 0, also se 32.31	93.08 Table 5 9.41 Disee Ta 124 Dee Table 32.31	93.08 11.95 ble 5 133.03 5 32.31	93.08 13.95 144.44 32.31	93.08 14.87 155.16 32.31		(67) (68) (69) (70)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3 Losses e.g. et (71)m= -74.47 Water heating	Feb 93.08 (calcula 12.85 ains (calcula 32.31 as gains 3 vaporatio -74.47 gains (T 69.59	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5 3 on (negator) -74.47 able 5) 65.29	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 3 tive valu	93.08 L, equati 5.92 dix L, equati 139.32 L, equati 32.31 3 es) (Tab	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31 3 le 5) -74.47	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a 32.31 3	93.08 so see	93.08 Table 5 9.41 Disee Ta 124 Dee Table 32.31 3 -74.47	93.08 11.95 ble 5 133.03 3 3 -74.47	93.08 13.95 144.44 32.31 3 -74.47	93.08 14.87 155.16 32.31 3 -74.47		(67) (68) (69) (70)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3 Losses e.g. et (71)m= -74.47 Water heating (72)m= 71.94	Feb 93.08 (calcula 12.85 ains (calcula 32.31 as gains 3 vaporatio -74.47 gains (T 69.59	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5 3 on (negator) -74.47 able 5) 65.29	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 3 tive valu	93.08 L, equati 5.92 dix L, equati 139.32 L, equati 32.31 3 es) (Tab	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31 3 le 5) -74.47	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a 32.31 3	93.08 so see	93.08 Table 5 9.41 Disee Ta 124 Dee Table 32.31 3 -74.47	93.08 11.95 ble 5 133.03 5 32.31 3 -74.47	93.08 13.95 144.44 32.31 3 -74.47	93.08 14.87 155.16 32.31 3 -74.47		(67) (68) (69) (70)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3 Losses e.g. et (71)m= -74.47 Water heating (72)m= 71.94 Total interna	Feb 93.08 (calcula 12.85 ains (calcula 32.31 as gains 3 vaporatio -74.47 gains (T 69.59 1 gains =	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in Ap 32.31 (Table 5 3 on (negat -74.47 able 5) 65.29	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 3 tive valu -74.47	93.08 L, equati 5.92 dix L, equati 139.32 L, equati 32.31 3 es) (Tab -74.47	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31 3 le 5) -74.47	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31 3 -74.47 46.6 m + (67)m	93.08 so see	93.08 Table 5 9.41 9 see Ta 124 ee Table 32.31 3 -74.47 54.57 + (69)m +	93.08 11.95 ble 5 133.03 25 32.31 3 -74.47 60.4 (70)m + (7	93.08 13.95 144.44 32.31 3 -74.47 66.91 1)m + (72)	93.08 14.87 155.16 32.31 3 -74.47 70.13		(67) (68) (69) (70) (71) (72)
Jan (66)m= 93.08 Lighting gains (67)m= 14.47 Appliances ga (68)m= 162.32 Cooking gains (69)m= 32.31 Pumps and fa (70)m= 3 Losses e.g. et (71)m= -74.47 Water heating (72)m= 71.94 Total interna (73)m= 302.65	Feb 93.08 (calcula 12.85 ains (calcula 164.01 s (calcula 32.31 ans gains 3 vaporatic -74.47 gains (T 69.59 gains = 300.37 s: calculated	Mar 93.08 ted in Ap 10.45 ulated in 159.76 tted in Ap 32.31 (Table 5 3 on (negat -74.47 able 5) 65.29 : 289.43	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 3 tive valu -74.47	93.08 L, equati 5.92 dix L, equati 139.32 L, equati 32.31 3 es) (Tab -74.47 55.78	93.08 ion L9 or 4.99 uation L 128.6 ion L15 32.31 3 le 5) -74.47 50.57 (66) 238.09	93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31 3 -74.47 46.6 m + (67)m 227.35	93.08 so see	93.08 Table 5 9.41 0 see Ta 124 ee Table 32.31 3 -74.47 54.57 + (69)m +	93.08 11.95 ble 5 133.03 25 32.31 3 -74.47 60.4 (70)m + (7 259.31	93.08 13.95 144.44 32.31 3 -74.47 66.91 1)m + (72) 279.23	93.08 14.87 155.16 32.31 3 -74.47 70.13	Gains	(67) (68) (69) (70) (71) (72)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Southeast 0.9x	0.77	X	2.95	X	36.	79	x	0.6	3	×	0.7	=	33.17	(77)
Southeast 0.9x	0.77	x	2.95	x	62.	67	x	0.6	3	x	0.7		56.5	(77)
Southeast 0.9x	0.77	×	2.95	x	85.	75	x	0.6	3	x	0.7	=	77.31	(77)
Southeast 0.9x	0.77	×	2.95	x	106	.25	x	0.6	3	x	0.7		95.79	(77)
Southeast 0.9x	0.77	×	2.95	x	119	.01	x	0.6	3	x	0.7	=	107.3	(77)
Southeast 0.9x	0.77	×	2.95	x	118	.15	x	0.6	3	x	0.7	=	106.52	(77)
Southeast 0.9x	0.77	×	2.95	x	113	.91	x	0.6	3	x	0.7	=	102.7	(77)
Southeast 0.9x	0.77	×	2.95	x	104	.39	X	0.6	3	i x	0.7		94.11	(77)
Southeast 0.9x	0.77	×	2.95	x	92.	85	x	0.6	3] x [0.7		83.71	(77)
Southeast 0.9x	0.77	×	2.95	X	69.	<u> </u>	jx	0.6	3] x [0.7		62.45	(77)
Southeast 0.9x	0.77	i x	2.95	x	44.	07	jx	0.6	3	j × [0.7		39.73	(77)
Southeast 0.9x	0.77	×	2.95	x	31.	49	X	0.6	3] x [0.7		28.39	(77)
Southwest _{0.9x}	0.77	×	1.72	x	36.	79	<u>ו</u>	0.6	3	i x	0.7		19.34	(79)
Southwest _{0.9x}	0.77	x	1.72	x	62.	67	ĺ	0.6	3	x	0.7	=	32.94	(79)
Southwest _{0.9x}	0.77	x	1.72	x	85.	75	j	0.6	3	x	0.7	=	45.08	(79)
Southwest _{0.9x}	0.77	×	1.72	x	106	.25]	0.6	3	x	0.7		55.85	(79)
Southwest _{0.9x}	0.77	×	1.72	x	119	.01]	0.6	3] x [0.7	=	62.56	(79)
Southwest _{0.9x}	0.77	X	1.72	X	118	.15		0.6	3	Х	0.7	=	62.11	(79)
Southwest _{0.9x}	0.77	×	1.72	х	113	.91		0.6	3	х	0.7		59.88	(79)
Southwest _{0.9x}	0.77	x	1.72	х	104	.39		0.6	3	х	0.7	=	54.87	(79)
Southwest _{0.9x}	0.7 <mark>7</mark>	X	1.72	x	92.	85		0.6	3	x	0.7	=	48.81	(79)
Southwest _{0.9x}	0.77	X	1.72	X	69.	27		0.6	3	х	0.7	=	36.41	(79)
Southwest _{0.9x}	0.77	X	1.72	x	44.	07		0.6	3	x	0.7	=	23.17	(79)
Southwest _{0.9x}	0.77	X	1.72	х	31.	49]	0.63	3	x	0.7	=	16.55	(79)
Northwest 0.9x	0.77	X	5.71	X	11.	28	x	0.6	3	_ x [0.7	=	19.69	(81)
Northwest 0.9x	0.77	X	5.71	X	22.	97	X	0.6	3	x	0.7	=	40.08	(81)
Northwest 0.9x	0.77	X	5.71	X	41.	38	X	0.6	3	_ x [0.7	=	72.21	(81)
Northwest 0.9x	0.77	X	5.71	X	67.	96	X	0.6	3] x	0.7	=	118.59	(81)
Northwest _{0.9x}	0.77	X	5.71	X	91.	35	X	0.6	3] x	0.7	=	159.4	(81)
Northwest 0.9x	0.77	X	5.71	X	97.	38	X	0.6	3	x	0.7	=	169.94	(81)
Northwest _{0.9x}	0.77	X	5.71	X	91	.1	X	0.6	3	x	0.7	=	158.98	(81)
Northwest _{0.9x}	0.77	X	5.71	X	72.	63	X	0.6	3	x	0.7	=	126.74	(81)
Northwest 0.9x	0.77	X	5.71	X	50.	42	X	0.6	3	x	0.7	=	87.99	(81)
Northwest _{0.9x}	0.77	X	5.71	X	28.	07	X	0.6	3	x	0.7	=	48.98	(81)
Northwest _{0.9x}	0.77	X	5.71	X	14	.2	X	0.6	3	x	0.7	=	24.77	(81)
Northwest 0.9x	0.77	X	5.71	X	9.2	21	X	0.6	3	X	0.7	=	16.08	(81)
Solar gains in water (83) m= 72.2 1		11ated 194.6	for each mon 270.23 329.2		38.57	321.55	(83)m 275	$\frac{1 = Sum(7)}{.72}$		<mark>(82)m</mark> 147.84	87.67	61.02	1	(83)
Total gains – inte			Į .				213	.72 220	7.51	147.04	07.07	01.02]	(00)
		4.02	542.43 584.2	<u> </u>		548.9	508	.64 462	2.41	407.15	366.9	355.11	1	(84)
7. Mean interna														
7. Mean Interna	•	`			area fro	m Tal	hle 0	Th1 /º/	<u>.)</u>				04	(85)
Utilisation facto	•	•		_			ы с 9,	1111 (رر				21	(00)
Stroma FSAP 2012	<u>`</u>	$\overline{}$		Ť			Δ	ug S	ер	Oct	Nov	Dec	1 _	. 5 (7
Stroma #SAP*201 2 \	versioni 1.0	.5:41 (9	5AP 8.92] - http://	PW\\\	stromalc	om~'	1 '	-9 O	۱ ۲۳		1	1 200	J Pag	ge 5 of 7

(86)m= 1	0.99	0.98	0.94	0.82	0.63	0.47	0.53	0.79	0.96	0.99	1		(86)
Mean intern	al tempe	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m= 19.89	20.05	20.3	20.62	20.86	20.97	21	20.99	20.92	20.6	20.19	19.87		(87)
Temperatur	e during h	neating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m= 20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01		(88)
Utilisation fa	actor for a	ains for i	rest of d	wellina.	h2.m (se	e Table	9a)	•		•		•	
(89)m= 1	0.99	0.97	0.92	0.77	0.55	0.37	0.42	0.71	0.94	0.99	1		(89)
Mean intern	al tempe	ature in	the rest	of dwelli	na T2 (f	ollow ste	ens 3 to	7 in Tahl	e 9c)			•	
(90)m= 18.53		19.12	19.58	19.89	20.01	20.03	20.03	19.96	19.56	18.97	18.5		(90)
	Į.				<u>I</u>	Į		l f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean intern	al tempo	aturo (fo	r the wh	olo dwo	lling) – f	ΙΛ ν Τ1	⊥ /1 _ fl	۸) ی T2					
Mean intern (92)m= 19.35		19.83	20.21	20.48	20.59	20.61	20.61	20.54	20.19	19.71	19.32		(92)
Apply adjus					<u> </u>						.0.02		,
(93)m= 19.35		19.83	20.21	20.48	20.59	20.61	20.61	20.54	20.19	19.71	19.32		(93)
8. Space he	ating req	uirement											
Set Ti to the					ed at st	ep 11 of	Table 9	b, so tha	t Ti <u>,</u> m=(76)m an	d re-calc	culate	
the utilisation	1							ı					
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa	0.99	ains, hm 0.97	0.92	0.8	0.6	0.43	0.49	0.76	0.95	0.99	1		(94)
Useful gains					0.6	0.43	0.49	0.76	0.95	0.99	l l		(34)
(95)m= 372.82		470.6	499.13	465.15	345.88	237.31	247.3	349.67	385.89	362.84	353.63		(95)
Monthly ave					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 ra	ite for me	an intern	al tempe	erature,	Lm , W :	=[(39)m	x [(93)m	– (96)m]				
(97)m= 924.57	7 896.73	814.73	682.53	528.58	356.9	238.91	250.19	385.19	577.35	762.6	919.32		(97)
Space heat					Wh/mon	th = 0.02	24 x [(97)m – (95		1)m		ı	
(98)m= 410.5	316.99	256.03	132.05	47.2	0	0	0	0	142.45	287.83	420.88		
							Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	2013.91	(98)
Space heat	ng requir	ement in	kWh/m²	/year								36.07	(99)
9a. Energy re	equireme	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heat	_												
Fraction of	•				mentary	•						0	(201)
Fraction of	space hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of t	otal heati	ng from	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency o	f main spa	ace heat	ing syste	em 1								93.4	(206)
Efficiency o	f seconda	ry/supple	ementar	y heating	g systen	ո, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	 year
Space heat	ng requir	ement (c	alculate	d above))								
410.5	316.99	256.03	132.05	47.2	0	0	0	0	142.45	287.83	420.88		
(211)m = {[(9	8)m x (20)4)] } x 1	00 ÷ (20	(6)									(211)
439.5	339.39	274.12	141.38	50.53	0	0	0	0	152.51	308.17	450.62		<u>_</u>
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	2156.22	(211)

Space heating fuel (secondary), kWh/month							
$= \{[(98)m \times (201)]\} \times 100 \div (208)$ (215)m= 0 0 0 0 0	0 0	0 0	0	0	0	1	
(215)m= 0 0 0 0 0	0 0	Total (kWh/yea	_			0	(215)
Water heating				715,1012		U	(210)
Output from water heater (calculated above)							
	18.14 113.19	126.18 127.57	145.26	155.06	167.83		_
Efficiency of water heater					ī	80.3	(216)
` '	80.3 80.3	80.3 80.3	85	86.59	87.27		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m							
	47.12 140.95	157.13 158.87	170.89	179.09	192.31		
	-	Total = Sum(2	19a) ₁₁₂ =		-	2022.66	(219)
Annual totals			k\	Nh/year	•	kWh/year	¬
Space heating fuel used, main system 1						2156.22	_
Water heating fuel used						2022.66	
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)	(<mark>2</mark> 30g) =			75	(231)
Electricity for lighting						255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) =				4509.45	(338)
12a. CO2 emissions – Individual heating system	s including mi	cro-CHP					
	Energy		Fmiss	ion fac	tor	Emissions	
	kWh/year		kg CO			kg CO2/yea	
Space heating (main system 1)	(211) x		0.2	16	=	465.74	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2	16	=	436.9	(264)
Space and water heating	(261) + (262)	+ (263) + (264) =				902.64	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	38.93	(267)
Electricity for lighting	(232) x		0.5	19	=	132.64	(268)
Total CO2, kg/year		sum o	of (265)(2	271) =		1074.2	(272)
TER =						19.24	(273)

Stroma Number: Stroma FSAP 2012 Software Version: Version: 1.0.5.41					User D	etails:						
Address: 1 Bed Mid - GF, London, TBC 1. Overall dwelling dimensions: Area(m²)	Assessor Name:						a Num	ber:				
## Address: 1 Bed Mid - GF, London, TBC 1. Overall dwelling dimensions: Area(m²)	Software Name:	Stroma FS	AP 2012	2		Softwa	are Ve	rsion:		Versio	on: 1.0.5.41	
Area(m²)						Address	: 1 Bed	Mid - GF				
Area(m²) Av. Height(m) Volume(m²)			GF, Lond	don, TB	SC .							
Structural Infiltration Storty single Structural Infiltration Storty single Structural Infiltration Storty single Structural Infiltration Storty single Structural Infiltration Stru	1. Overall dwelling diffle	11510115.			Area	a(m²)		Av. He	iaht(m)		Volume(m ³)
Number of chimneys	Ground floor					• •	(1a) x			(2a) =	· ·	_
Sal+(3b)+(3c)+(3d)+(3e)+(3n) Expression Expressi	Total floor area TFA = (1a	a)+(1b)+(1c)+((1d)+(1e)	+(1r	1) 5	55.83	(4)	L		_		
Number of chimneys	•		, , , ,	,	′		l)+(3c)+(3c	d)+(3e)+	.(3n) =	130 58	7(5)
Number of chimneys											139.30	
Number of chimneys	2. Ventilation rate:				у	other		total			m³ per hou	r
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 (7b) Number of passive vents 0 x40 = 0 (7c) Number of flueless gas fires 0 x40 = 0 (7c) Air changes per hour Infiltration due to chimneys, flues and fans = (6b)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.14 (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration 0.25 for steel or timber frame or 0.35 for masonry construction If both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal vero 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Percentage of windows and doors draught stripped Window infiltration 0 25 - [0.2 x (14) + 100] = 0 (15) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (15) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (5) (17) If based on air permeability value, then (18) = [(17) ÷ 20)+(8), otherwise (18) = (16) Air permeability value applies if a pressur/isation test has been done or a degree air permeability is being used Number of sides sheltered Q (19) Shelter factor (20) = 1 - [0.075 x (19)] = 0.33 (21) Infiltration rate modified for monthly wind speed Monthly average wind speed from Table 7 (22)me 5.1 5 4.9 4.4 4.3 3.8 3.8 3.8 3.7 4 4.3 4.5 4.7	Number of chimneys] + [0	¬ - Г	0	x 4	40 =	0	(6a)
Number of intermittent fans 2	•		┪╻		- - - - -]		x	20 =		╡``
Number of passive vents	·								x	10 =		╡`´
Air changes per hour							L		x	10 =		╡` ´
Air changes per hour Infiltration due to chirmneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	·						L					
Infiltration due to chimneys, flues and fans = (88)+(6b)+(7a)+(7b)+(7b) = 20 + (5) = 0.14 (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Q (13) Percentage of windows and doors draught stripped Window infiltration Q (25 - [0.2 x (14) ÷ 100] = 0 (15) Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.8 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	Number of flueless gas in	163					L	0	^		0	(76)
Number of storeys in the dwelling (ns) Q Q										Air ch	nanges <mark>per</mark> ho	ur
Number of storeys in the dwelling (ns) Additional infiltration (9)-1]x0.1 = 0	Infiltration due to chimne	ys, flues and fa	ans = (6a))+(6b)+(7	'a)+(7b)+(7c) =		20		÷ (5) =	0.14	(8)
Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Days (19) O.85 (20) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7				d, procee	d to (17), d	otherwise o	continue fi	rom (9) to	(16)			_
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 O (12) If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration O (14) Window infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = O (15) O (16) O (15) O (16) O (16) O (17) O (18) O (19) O (19		he dw <mark>elling</mark> (ns	5)						[(0)	11v0 1 =		
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 If no draught lobby, enter 0.05 , else enter 0 Percentage of windows and doors draught stripped Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85$ (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.33$ Infiltration rate modified for monthly wind speed Monthly average wind speed from Table 7 $(22)m= 5.1 $ $5 $ $4.9 $ $4.4 $ $4.3 $ $3.8 $ $3.8 $ $3.7 $ $4 $ $4.3 $ $4.3 $ $4.5 $ $4.7 $.25 for steel or	timber fr	ame or	0.35 for	r masonı	ry const	ruction	[(9)]	-1]XU.1 =		=
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	if both types of wall are p	resent, use the va	lue corresp				•					()
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 (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 5 (17) If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) 0.39 (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 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7				ed) or 0	1 (seale	ad) else	enter 0				0	7(12)
Percentage of windows and doors draught stripped 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 If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	•		,	,u) 01 0.	i (Scale	<i>Ju)</i> , cisc	Critor o					= ' '
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) \div 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 1nfiltration rate incorporating shelter factor (21) = (18) × (20) = 1nfiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	• •			ipped								=
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 $(22)m = 5.1 5 4.9 4.4 4.3 3.8 3.8 3.8 3.7 4 4.3 4.5 4.7$	Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 $(22)m = 5.1 + 5 + 4.9 + 4.4 + 4.3 + 3.8 + 3.8 + 3.7 + 4 + 4.3 + 4.5 + 4.7$	Infiltration rate					(8) + (10)	+ (11) + (12) + (13)	+ (15) =		0	(16)
Number of sides sheltered Shelter factor Infiltration rate modified for monthly wind speed Monthly average wind speed from Table 7 (20) = 1 - [0.075 x (19)] = (20) (20) (21) = (18) x (20) = (21) = (18) x (20) = (21) = (18) x (20) = (21)	•				•	•	•	etre of e	envelope	area	5	(17)
Number of sides sheltered Shelter factor $ (20) = 1 - [0.075 \times (19)] = $		-									0.39	(18)
Shelter factor $ (20) = 1 - [0.075 \times (19)] = $, , , , , , , , , , , , , , , , , , , ,	•	on test has l	been don	e or a deg	gree air pe	rmeability	is being u	sed			7(10)
Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7		·u				(20) = 1 -	[0.075 x (19)] =				⊣ ``
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7	Infiltration rate incorporat	ing shelter fac	tor			(21) = (18) x (20) =					=
Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7	Infiltration rate modified for	or monthly win	d speed									
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
	Monthly average wind sp	eed from Tabl	e 7									
W. 15 (20) (20) (20)	(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Factor $(22a)m = (22)m \div 4$	Wind Factor (22a\m = (2	2\m <i>÷</i> 4										
			1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	

ljusted infiltr			ing for sr	neiter an	nd wind s	speed) =	(21a) x	(22a)m	т	,		1	
0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39		
a <i>lcul<mark>ate effed</mark> If</i> mechanica		-	iale ioi l	пе аррп	cable ca	is e						0	(2
If exhaust air he	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0	(2
If balanced with	heat reco	overy: effic	ciency in %	allowing t	for in-use f	actor (fron	n Table 4h) =				0	(2
a) If balance	d mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ИV) (24b	m = (22)	2b)m + (2	23b)	•	•	
b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h if (22b)n				-	•				.5 × (23b	·))	•		
c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(
d) If natural if (22b)n				•					0.5]		•		
d)m= 0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58]	(
Effective air	change	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (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		(.
. Heat losse	s and he	eat loss	paramet	er:								_	
EMENT	Gros area	ss	Openin m	gs	Net Ar A ,ı		U-vali W/m2		A X U (W/I	K)	k-value kJ/m²-		A X k kJ/K
oors					3.57	X	1.2	=	4.284				(2
ndows Type					5.71	x1.	/[1/(1.4)+	0.04] =	7.57	Ц			(
ndows Type	2				2.95	x1	/[1/(1.4)+	0.04] =	3.91	Ц			(
ndows Type	3				1.72	x1	/[1/(1.4)+	0.04] =	2.28				(
oor					55.83	3 X	0.13	=	7.2579				(
alls	44.9	98	13.9	5	31.03	3 X	0.18	=	5.59				(
tal area of e	lements	s, m²			100.8	1							(
rty wall					39.86	5 x	0	=	0				(
rty ceiling					55.83	3							(
ernal wall **					63.7	1				Ī		$\overline{}$	(
or windows and nclude the area						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	n 3.2	
bric heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				30.89	(
at capacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	7667.1	6 (
ermal mass	parame	eter (TMI	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(
design assess be used inste	ad of a de	tailed calc	ulation.			•	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
ermal bridge					-	K						7.69	(
etails of therma tal fabric he		are not kr	nown (36) =	= 0.05 x (3	31)			(33) +	(36) =			20 50	3 (
entilation hea		alculated	d monthly	,					$= 0.33 \times ($	25)m x (5))	38.58	
mination Hea	11 1035 6	uicuiale	2 111011U11	y	_	_		(30)111	- 0.00 x (20)111 X (3)	<i>'</i>		

(20)	27.05	26.80	26.14	26	25.35	25.35	25.23	25.6	26	26.20	26.50	l	(38)
(38)m= 27.21		26.89	20.14	26	25.55	25.55	25.25	25.6	26	26.29	26.58		(30)
Heat transfer of (39)m= 65.79	65.63	1t, VV/K 65.47	64.72	64.58	63.93	63.93	63.81	64.18	= (37) + (37) 64.58	64.87	65.16		
(00)111= 00.73	00.00	05.47	04.72	04.00	00.00	00.00	00.01			Sum(39) ₁		64.72	(39)
Heat loss para	meter (F	HLP), W	m²K						= (39)m ÷		_		
(40)m= 1.18	1.18	1.17	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.16	1.17		_
Number of day	rs in mor	nth (Tah	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.16	(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)
							l			l	l	,	
4. Water heat	ing ener	rgy requi	rement:								kWh/ye	ear:	
												ı	4
Assumed occu if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.86		(42)
if TFA £ 13.9	•			`	,	•	, , <u>-</u>	,				•	
Annual averag Reduce the annua									se target o		3.41		(43)
not more that 125	_				_	_			J				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot w <mark>ater u</mark> sage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)				•		
(44)m= 86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		_
Energy content of	hot water	used cal	culated me	onthly - 4	100 v Vd r	n v nm v F	Tm / 2600			m(44) ₁₁₂ =		940.97	(44)
	111.87	115.44	100.65	96.57				89.67	104.5		123.88		
(45)m= 127.91	111.07	115.44	100.65	90.57	83.34	77.22	88.61			114.07 m(45) ₁₁₂ =		1233.75	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		rotar – ou	111(40)112		1200.70	
(46)m= 19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
Water storage					/\/\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	-1	20.2		1		•	ı	
Storage volum	,					_		ame ves	sei		0		(47)
If community h Otherwise if no	_			_			. ,	ers) ente	er 'O' in <i>(</i>	47)			
Water storage			(4.1.6 1.1					o. o, o	. • (,			
a) If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro		•	•				(48) x (49)) =			0		(50)
b) If manufactHot water stora			-								0		(51)
If community h	_			0 2 (1111)	1,11110,00	· y /					U	I	(01)
Volume factor	from Tal	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro		-	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (, , ,	•	. <u>.</u>				<i>(1=5)</i>				0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m	1	ı	1	
(56)m= 0	0	0	0	0	0	0	0	0 (50)	0	0	0	 	(56)
If cylinder contains												IX TI	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3	0	(58)
Primary circuit loss calculated for each month (59)m = (58) \div 365 x (41)m		
(modified by factor from Table H5 if there is solar water heating and a cylinder therm	ostat)	1
(59)m= 0 0 0 0 0 0 0 0 0	0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m		
(61)m= 43.95 38.26 40.76 37.9 37.56 34.8 35.96 37.56 37.9 40.76	40.99 43.95	(61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m +	- (46)m + (57)m +	(59)m + (61)m
(62)m= 171.87 150.13 156.2 138.54 134.13 118.14 113.19 126.18 127.57 145.26	155.06 167.83	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution of the contr	ution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)		
(63)m= 0 0 0 0 0 0 0 0 0	0 0	(63)
Output from water heater	'	
(64)m= 171.87 150.13 156.2 138.54 134.13 118.14 113.19 126.18 127.57 145.26	155.06 167.83	1
Output from water heat	er (annual) ₁₁₂	1704.11 (64)
Heat gains from water heating, kWh/month $0.25 (0.85 \times (45)) + (61) + 0.8 \times (46)$	י n + (57)m + (59)m	1
(65)m= 53.52 46.76 48.57 42.94 41.5 36.41 34.67 38.85 39.29 44.94	48.18 52.18	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is		eating
	Troffi community fr	eating
5. Internal gains (see Table 5 and 5a):		_
Metabolic gains (Table 5), Watts	New Dee	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct (66)m= 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08	Nov Dec	(66)
	93.08 93.08	(00)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	1 40 05 1 44 07	(07)
(67)m= 14.47 12.85 10.45 7.91 5.92 4.99 5.4 7.01 9.41 11.95	13.95 14.87	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		
(68)m= 162.32 164.01 159.76 150.73 139.32 128.6 121.44 119.75 124 133.03	144.44 155.16	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		1
(69)m= 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31	32.31 32.31	(69)
Pumps and fans gains (Table 5a)	<u>, </u>	
(70)m= 3 3 3 3 3 3 3 3 3 3 3	3 3	(70)
Losses e.g. evaporation (negative values) (Table 5)		
(71)m= -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47	-74.47 -74.47	(71)
Water heating gains (Table 5)		
(72)m= 71.94 69.59 65.29 59.64 55.78 50.57 46.6 52.22 54.57 60.4	66.91 70.13	(72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m	71)m + (72)m	
(73)m= 302.65 300.37 289.43 272.2 254.94 238.09 227.35 232.91 241.9 259.31	279.23 294.09	(73)
6. Solar gains:		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applica-	able orientation.	
Orientation: Access Factor Area Flux g_	FF	Gains
Table 6d m ² Table 6a Table 6b	Table 6c	(W)
Southeast 0.9x 0.77 x 2.95 x 36.79 x 0.63 x	0.7 =	33.17 (77)
Southeast 0.9x 0.77 x 2.95 x 62.67 x 0.63 x	0.7 =	56.5 (77)
	l	

Southeast _{0.9x}	^ 77				v		- 7F] ,		2.62	ا پ	0.7		77.04	(77)
Southeast 0.9x	0.77	x	2.9	=	X		5.75	X		0.63	」 × ¬ 、	0.7	┥ -	77.31	= ' '
Southeast 0.9x	0.77	x	2.9		X		06.25	X		0.63	」 × ¬ ,	0.7	_ =	95.79	(77)
Southeast 0.9x	0.77	×	2.9	==	X		19.01	x x		0.63	」 × ¬ 、	0.7	┥ -	107.3	(77)
Southeast 0.9x	0.77	=	2.9		X		18.15]]		0.63	」 × ¬ ∵	0.7	_ =	106.52	= (77)
Southeast 0.9x	0.77	x	2.9		X		13.91	X		0.63	」 × ¬ ,	0.7	_ = -	102.7	(77)
Southeast 0.9x	0.77	x	2.9		X		04.39	X		0.63	」 × ¬ 、	0.7	┥ -	94.11	(77)
Southeast 0.9x	0.77	x	2.9	_	X		2.85	X		0.63	」 × ¬ ∵	0.7	_ =	83.71	$= \frac{1}{100} (77)$
Southeast 0.9x	0.77	x	2.9		X		9.27	X		0.63	」 × ¬ 、	0.7	╡ -	62.45	(77)
Southeast 0.9x	0.77	X	2.9	==	X		4.07	X		0.63	」 × ¬ 、	0.7	_ =	39.73	(77)
Southwest _{0.9x}	0.77	x	2.9	==	X		1.49	X		0.63	」 × ¬ .,	0.7	_ =	28.39	$= \frac{(77)}{(70)}$
Southwest _{0.9x}	0.77	X	1.7	===	X		6.79]]		0.63	X 	0.7	_ =	19.34	(79)
Southwest _{0.9x}	0.77	X	1.7		X		2.67] 1		0.63	X	0.7	_ =	32.94	(79)
Southwest _{0.9x}	0.77	X	1.7		Χ		5.75]]		0.63	X 	0.7	_ =	45.08	(79)
	0.77	X	1.7		X		06.25] 1		0.63	X	0.7	= =	55.85	(79)
Southwest _{0.9x} Southwest _{0.9x}	0.77	×	1.7	==	X		19.01] 1		0.63	X	0.7	_ =	62.56	(79)
Southwest _{0.9x}	0.77	X	1.7	==	X		18.15] 1		0.63	X	0.7	=	62.11	(79)
Southwest _{0.9x}	0.77	X	1.7		X		13.91			0.63	X	0.7		59.88	(79)
<u> </u>	0.77	×	1.7		X		04.39			0.63	X	0.7		54.87	(79)
Southwesto.e	0.77	×	1.7	=	X		2.85			0.63	X	0.7	╡ -	48.81	(79)
Southwest of	0.77	×	1.7		X		9.27			0.63	X	0.7	=	36.41	(79)
Southwest of	0.77	×	1.7		X		4.07			0.63	X	0.7	=	23.17	(79)
Southwest _{0.9x}	0.77	×	1.7	=	X		1.49]	_	0.63	×	0.7	_ =	16.55	(79)
Northwest 0.9x	0.77	×	5.7	\rightarrow	X		1.28	X I		0.63	X	0.7	_ =	19.69	(81)
Northwest 0.9x	0.77	×	5.7	==	X		2.97	X		0.63	X	0.7	=	40.08	(81)
Northwest 0.9x	0.77	X	5.7		X		1.38	X		0.63	×	0.7	_ =	72.21	(81)
Northwest 0.9x	0.77	X	5.7		X		7.96	X		0.63	×	0.7	=	118.59	(81)
Northwest 0.9x	0.77	X	5.7	=	X		1.35	X		0.63	×	0.7	=	159.4	(81)
Northwest 0.9x	0.77	X	5.7	==	X		7.38	X		0.63	×	0.7	=	169.94	(81)
Northwest 0.9x	0.77	X	5.7		X		91.1	X		0.63	×	0.7	=	158.98	(81)
Northwest 0.9x	0.77	X	5.7	==	X		2.63	X		0.63	×	0.7	=	126.74	(81)
Northwest 0.9x	0.77	X	5.7	===	X		0.42	X		0.63	×	0.7	_ =	87.99	(81)
Northwest 0.9x	0.77	X	5.7		X		8.07	X		0.63	×	0.7	_ =	48.98	(81)
Northwest 0.9x	0.77	X	5.7		X		4.2	X	_	0.63	×	0.7	_ =	24.77	(81)
Northwest _{0.9x}	0.77	X	5.7	1	X	9	9.21	X	(0.63	X	0.7	=	16.08	(81)
O de mareira de	-11	la latad	. ((00)		(7 4)	(00)				
Solar gains in $\sqrt{(83)}$ m= 72.2	129.53	194.6	270.23	329.26	$\overline{}$	38.57	321.55	(83)m 275		n(74)m 220.51	.(82)m 147.8	87.67	61.02	1	(83)
Total gains – in								213	.72 2	220.51	147.04	07.07	01.02		(00)
(84)m= 374.85	429.9	484.02	542.43	584.2	Ť	76.65	548.9	508	.64 4	162.41	407.15	366.9	355.11	7	(84)
` '										1		1		J	` '
7. Mean interr						araa f	rom Tok		Th4	(°C)				04	(QE)
Temperature	•				_			л е 9,	, 1111	(0)				21	(85)
Utilisation fact	Feb	Mar	Apr	a, n1,n May	Ť	ee ra Jun	bie 9a) Jul	Λ.	ug	Sep	Oct	Nov	Dec	1	
Jan	1 60	iviai	Λhι	iviay		Juii	Jul		uy	oeh	001	INUV	Dec	Т	

													•	
(86)m=	1	0.99	0.98	0.94	0.84	0.67	0.5	0.56	0.82	0.97	0.99	1		(86)
Mean	interna	l temper	ature in l	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	19.79	19.95	20.21	20.55	20.82	20.96	20.99	20.99	20.89	20.53	20.1	19.76		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, Ti	h2 (°C)					
(88)m=	19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.95	19.95		(88)
Utilisa	ation fac	tor for g	ains for r	est of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.93	0.79	0.58	0.39	0.44	0.74	0.95	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)	-	-		
(90)m=	18.33	18.56	18.94	19.43	19.78	19.94	19.96	19.96	19.87	19.42	18.79	18.3		(90)
•									f	LA = Livin	g area ÷ (4) =	0.6	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2			•		
(92)m=	19.21	19.4	19.7	20.1	20.41	20.55	20.58	20.58	20.49	20.09	19.58	19.18		(92)
Apply	adjustn	nent to t	he mean	internal	temper	ature fro	m Table	4e, whe	re appro	priate				
(93)m=	19.21	19.4	19.7	20.1	20.41	20.55	20.58	20.58	20.49	20.09	19.58	19.18		(93)
			uirement											
			ernal ter or gains l			ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
110 01	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>is</mark> a		$\overline{}$	ains, hm											
(94)m=	0.99	0.99	0.97	0.93	0.82	0.63	0.46	0.51	0.78	0.95	0.99	1		(94)
			, W = (9 ²		4)m									
	372.83	425.2	471.55	503.51	477.4	363.33	251.79	261.74	360.74	387.83	362.99	353.62		(95)
			rnal tem		_		100	40.4		40.0				(06)
(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)
(97)m=	980.91	951.48	an intern 864.53	725.04	562.44	380.68	254.66	266.71	- (96)m 409.93	612.98	809.63	976.02		(97)
` '			ement fo									070.02		(51)
(98)m=			292.38	159.5	63.27	0	0	0	0	167.51	321.58	463.07		
			ļ!			ļ.		Tota	l per year	(kWh/yeaı	·) = Sum(9	8) _{15,912} =	2273.38	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								40.72	(99)
9a End	erav rea	uiremer	nts – Indi	vidual h	eating s	vstems i	ncludina	micro-C	HP)					
	e heatir		no mai	viadai ii	oding o	y otorrio i	riolaanig	1111010 C	,					
-		_	at from se	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from ı	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heati	ng syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/supple	ementar	y heatin	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh	/year
Space			ement (c	· ·			Į.							-
	452.42	353.66	292.38	159.5	63.27	0	0	0	0	167.51	321.58	463.07		
(211)m	$= \frac{-}{\{[(98)]}$)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	484.39	378.65	313.04	170.77	67.74	0	0	0	0	179.35	344.31	495.79		
•								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}		2434.02	(211)
												•		

Space heating fuel (secondary), kWh/month							
$= \{[(98)m \times (201)]\} \times 100 \div (208)$ $(215)m = $	0 0	0 0	0	0	0	[
(213)111= 0 0 0 0 0	0 0	Total (kWh/yea	_			0	(215)
Water heating			, ,	715,1012			
Output from water heater (calculated above)							
	18.14 113.19	126.18 127.57	145.26	155.06	167.83		_
Efficiency of water heater	000		05.44	00.05	07.47	80.3	(216)
` '	80.3 80.3	80.3 80.3	85.41	86.85	87.47		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m							
	47.12 140.95	157.13 158.87	170.08	178.55	191.87		_
		Total = Sum(2				2017.2	(219)
Annual totals Space heating fuel used, main system 1			k\	Nh/year	•	kWh/year 2434.02	¬
							_
Water heating fuel used						2017.2	
Electricity for pumps, fans and electric keep-hot						1	
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						255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) =				4781.79	(338)
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP					
			- mino	ion fac	4	Emissions	
	Energy kWh/year		kg CO		tor	kg CO2/yea	
Space heating (main system 1)	(211) x		0.2	16	=	525.75	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2	16	=	435.72	(264)
Space and water heating	(261) + (262)	+ (263) + (264) =				961.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	38.93	(267)
Electricity for lighting	(232) x		0.5	19	=	132.64	(268)
Total CO2, kg/year		sum o	of (265)(2	271) =		1133.03	(272)
TER =						20.29	(273)

				User D	etails: _						
Assessor Name:					Strom	a Num	ber:				
Software Name:	Stroma FS	AP 2012			Softwa	are Ve	rsion:		Versio	on: 1.0.5.41	
				. ,	Address	1 Bed I	Mid - MF	=			
Address :	1 Bed Mid -	MF, Lond	don, TB	C							
Overall dwelling dime	ensions:			Aros	a(m²)		۸۷ ۵۰	ight(m)		Volume(m ³	١
Ground floor					` ,	(1a) x		2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)+	+ (1n		55.83	(4)]` ′		`
	α, ι (10) ι (10) ι	(14)1(10)	(11	'/	5.65)+(3c)+(3c	1)+(30)+	(3n) -		7 (5)
Dwelling volume						(Ja)+(Jb)+(30)+(30	1)+(36)+	.(311) =	139.58	(5)
2. Ventilation rate:	main	sec	condar	v	other		total			m³ per hou	r
Number of chimneye	heating		ating	, 7 + C		7 = [40 =	_	_
Number of chimneys	0	╡	0	╛╘	0]	0			0	(6a)
Number of open flues	0	+	0] + [0] = [0		20 =	0	(6b)
Number of intermittent fa	ins					L	2	X '	10 =	20	(7a)
Number of passive vents	3						0	X ·	10 =	0	(7b)
Number of flueless gas fi	ires						0	X 4	40 =	0	(7c)
									Air ok	nanges per ho	r
		(60)	, (Ch) , (7	(a) 1 (7b) 1 (75)			_			_
Infiltration due to chimne If a pressurisation test has be						continue fr	20 rom (9) to 1		÷ (5) =	0.14	(8)
Number of storeys in the			, , , , , , , , , , , , , , , , , , , ,				(0) (0)	, 0)		0	(9)
Additional infiltration								[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0						•	ruction			0	(11)
if both types of wall are padeducting areas of openia			onding to	the great	er wall are	a (after					
If suspended wooden to			d) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else	enter 0								0	(13)
Percentage of windows	s and doors dr	aught stri	pped							0	(14)
Window infiltration					0.25 - [0.2			. (45)		0	(15)
Infiltration rate Air permeability value,	aEO expresso	ad in cubic	n motro	e nor he	. , . ,	• • • •	12) + (13) ·	, ,	aroa	0	= (16)
If based on air permeabil				•	•	•	ielie oi e	ilivelope	alea	0.39	(17)
Air permeability value applie	-						is being u	sed		0.00	(.0)
Number of sides sheltered	ed									2	(19)
Shelter factor					(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	-				(21) = (18	x (20) =				0.33	(21)
Infiltration rate modified f		'	lun l	led	Λα	Con	Oct	Nov	Doo	1	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	
Monthly average wind sp (22)m= 5.1 5	4.9 4.4	e /	3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(<u></u> /		ı L	J.0	5.5	I	•	<u> </u>	I	I	J	
Wind Factor $(22a)m = (2a)m =$	2)m ÷ 4									1	
(22a)m= 1.27 1.25	1.23 1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	

lajustea miint	ation rat	e (allowi	ng 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		
Calculate effect If mechanica		_	rate for t	пе арріі	cable ca	ise						0	(2:
If exhaust air h			endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0	(2:
If balanced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(2:
a) If balance	ed mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	MV) (24b	m = (22)	2b)m + (23b)		•	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n				•					.5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n				•					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		(2
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (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		(2
3. Heat losse	s and he	eat loss i	naramet	or.									
LEMENT	Gros		Openin		Net Ar	rea	U-val	ue	AXU		k-value	9	ΑΧk
	area		n		Α,		W/m2		(W/I	K)	kJ/m²-		kJ/K
oors					3.57	х	1.2	=	4.284				(2
/in <mark>dows</mark> Type	1				5.71	x1	/[1/(1.4)+	0.04] =	7.57				(2
/indows Type	2				2.95	x1	/[1/(1.4)+	0.04] =	3.91				(2
/indows Type	3	'			1.72	x1	/[1/(1.4)+	0.04] =	2.28				(2
alls	44.9	98	13.9	5	31.03	3 x	0.18	=	5.59				(:
otal area of e	lements	s, m²			44.98	3							(;
arty wall					39.86	3 x	0	-	0			$\neg \vdash$	(:
arty floor					55.83	3							(:
arty ceiling					55.83	3				Ī		7 F	(:
ternal wall **					63.7					Ī		7 F	(;
for windows and include the area						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
abric heat los	s, W/K	= S (A x	U)				(26)(30) + (32) =				23.63	(;
eat capacity	Cm = S	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	5713.1	1 (:
nermal mass	parame	eter (TMF	o = Cm -	- TFA) ir	n kJ/m²K	,		Indica	tive Value	: Medium		250	(:
or design assess In be used inste				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
nermal bridge	es : S (L	x Y) cal	culated	using Ap	pendix	K						4.8	(
details of therma		are not kn	own (36) =	= 0.05 x (3	11)			(00)	(00)			Γ	
otal fabric he entilation hea		alas las	l 11 1	_					(36) =	(OE) (E)		28.43	(;
	T IOCC C	alculated	n monthl					(38)m	$= 0.33 \times ($	251m x (5))		

(38)m= 27.21	27.05	26.89	26.14	26	25.35	25.35	25.23	25.6	26	26.29	26.58		(38)
` '			20.14	20	25.55	25.55	25.25				20.36		(30)
Heat transfer of (39)m= 55.64	55.48	55.32	54.57	54.43	53.78	53.78	53.66	54.03	= (37) + (37) 54.43	54.71	55.01		
(00)111=	00.10	00.02	0 1.07	01.10	00.70	00.70	00.00			Sum(39) ₁		54.57	(39)
Heat loss para	meter (F	HLP), W/	m²K						= (39)m ÷				_
(40)m= 1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.97	0.97	0.98	0.99		_
Number of day	s in moi	nth (Tah	le 1a)					/	Average =	Sum(40) ₁	12 /12=	0.98	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ting ener	rgy requi	rement:								kWh/ye	ear:	
Assumed see	inanai. I	NI.											(40)
Assumed occu if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (1	ΓFA -13.		.86		(42)
if TFA £ 13.9	,											1	
Annual averag Reduce the annua									se target o		3.41	I	(43)
not more that 125	_				_	_			-				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m= 86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		_
Energy content of	hot water	used - cal	culated mo	onthly – 4	190 v Vd r	n v nm v [)Tm / 3600			m(44) ₁₁₂ =		940.97	(44)
(45)m= 127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
(43)111= 127.91	111.07	113.44	100.03	90.57	05.54	11.22	00.01			m(45) ₁₁₂ =		1233.75	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46			(10)112		. 2001. 0	` ′
(46)m= 19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
Water storage		منام برام منا			WILLDO		م ماطفاند					l	
Storage volum If community h	` ,					•		ame ves	sei		0	ı	(47)
Otherwise if no	•			_			. ,	ers) ente	er '0' in (47)			
Water storage			`					,	·				
a) If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature fa											0		(49)
Energy lost fro b) If manufact		•	•		or is not		(48) x (49)) =			0	I	(50)
Hot water stora			-								0		(51)
If community h	•			,		,							, ,
Volume factor											0		(52)
Temperature fa											0	 	(53)
Energy lost fro		-	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (. , .	•	or asch	month			((56)m = (55) ~ (41).	m		0		(55)
Water storage										I ^			(EC)
(56)m= 0 If cylinder contains	0 s dedicate	0 d solar sto	0 rage. (57)i	0 n = (56)m	0 x [(50) – (0 H11)l ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
	0	0	0	0	0	0	0	0	0	0	0		(57)
(57)m= 0	U	U	U	U	U	U	<u> </u>	U	U		l ⁰		(31)

Primary circuit loss (annual) from Table 3	0	(58)
Primary circuit loss calculated for each month (59)m = (58) \div 365 x (41)m		
(modified by factor from Table H5 if there is solar water heating and a cylinder therm	ostat)	1
(59)m= 0 0 0 0 0 0 0 0 0	0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m		
(61)m= 43.95 38.26 40.76 37.9 37.56 34.8 35.96 37.56 37.9 40.76	40.99 43.95	(61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m +	- (46)m + (57)m +	(59)m + (61)m
(62)m= 171.87 150.13 156.2 138.54 134.13 118.14 113.19 126.18 127.57 145.26	155.06 167.83	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution of the contr	ution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)		
(63)m= 0 0 0 0 0 0 0 0 0	0 0	(63)
Output from water heater	'	
(64)m= 171.87 150.13 156.2 138.54 134.13 118.14 113.19 126.18 127.57 145.26	155.06 167.83	1
Output from water heat	er (annual) ₁₁₂	1704.11 (64)
Heat gains from water heating, kWh/month $0.25 (0.85 \times (45)) + (61) + 0.8 \times (46)$	י n + (57)m + (59)m	1
(65)m= 53.52 46.76 48.57 42.94 41.5 36.41 34.67 38.85 39.29 44.94	48.18 52.18	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is		eating
	Troffi community fr	eating
5. Internal gains (see Table 5 and 5a):		_
Metabolic gains (Table 5), Watts	New Dee	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct (66)m= 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08	Nov Dec	(66)
	93.08 93.08	(00)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	1 40 05 1 44 07	(07)
(67)m= 14.47 12.85 10.45 7.91 5.92 4.99 5.4 7.01 9.41 11.95	13.95 14.87	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		
(68)m= 162.32 164.01 159.76 150.73 139.32 128.6 121.44 119.75 124 133.03	144.44 155.16	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		1
(69)m= 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31	32.31 32.31	(69)
Pumps and fans gains (Table 5a)	<u>, </u>	
(70)m= 3 3 3 3 3 3 3 3 3 3 3	3 3	(70)
Losses e.g. evaporation (negative values) (Table 5)		
(71)m= -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47	-74.47 -74.47	(71)
Water heating gains (Table 5)		
(72)m= 71.94 69.59 65.29 59.64 55.78 50.57 46.6 52.22 54.57 60.4	66.91 70.13	(72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m	71)m + (72)m	
(73)m= 302.65 300.37 289.43 272.2 254.94 238.09 227.35 232.91 241.9 259.31	279.23 294.09	(73)
6. Solar gains:		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applica-	able orientation.	
Orientation: Access Factor Area Flux g_	FF	Gains
Table 6d m ² Table 6a Table 6b	Table 6c	(W)
Southeast 0.9x 0.77 x 2.95 x 36.79 x 0.63 x	0.7 =	33.17 (77)
Southeast 0.9x 0.77 x 2.95 x 62.67 x 0.63 x	0.7 =	56.5 (77)
	l	

Southeast _{0.9x}	^ 77				v		- 7F] ,		2.62	ا پ	0.7		77.04	(77)
Southeast 0.9x	0.77	x	2.9	=	X		5.75	X		0.63	」 × ¬ 、	0.7	┥ -	77.31	= ' '
Southeast 0.9x	0.77	x	2.9		X		06.25	X		0.63	」 × ¬ ,	0.7	_ =	95.79	(77)
Southeast 0.9x	0.77	×	2.9	==	X		19.01	x x		0.63	」 × ¬ 、	0.7	┥ -	107.3	(77)
Southeast 0.9x	0.77	=	2.9		X		18.15]]		0.63	」 × ¬ ∵	0.7	_ =	106.52	= (77)
Southeast 0.9x	0.77	x	2.9		X		13.91	X		0.63	」 × ¬ ,	0.7	_ = -	102.7	(77)
Southeast 0.9x	0.77	x	2.9		X		04.39	X		0.63	」 × ¬ 、	0.7	┥ -	94.11	(77)
Southeast 0.9x	0.77	x	2.9	_	X		2.85	X		0.63	」 × ¬ ∵	0.7	_ =	83.71	= (77)
Southeast 0.9x	0.77	x	2.9		X		9.27	X		0.63	」 × ¬ 、	0.7	╡ -	62.45	(77)
Southeast 0.9x	0.77	X	2.9	==	X		4.07	X		0.63	」 × ¬ 、	0.7	_ =	39.73	(77)
Southwest _{0.9x}	0.77	x	2.9	==	X		1.49	X		0.63	」 × ¬ .,	0.7	_ =	28.39	$= \frac{(77)}{(70)}$
Southwest _{0.9x}	0.77	X	1.7	===	X		6.79]]		0.63	X 	0.7	_ =	19.34	(79)
Southwest _{0.9x}	0.77	X	1.7		X		2.67] 1		0.63	X	0.7	_ =	32.94	(79)
Southwest _{0.9x}	0.77	X	1.7		Χ		5.75]]		0.63	X 	0.7	_ =	45.08	(79)
	0.77	X	1.7		X		06.25] 1		0.63	X	0.7	= =	55.85	(79)
Southwest _{0.9x} Southwest _{0.9x}	0.77	×	1.7	==	X		19.01] 1		0.63	X	0.7	_ =	62.56	(79)
Southwest _{0.9x}	0.77	X	1.7	==	X		18.15] 1		0.63	X	0.7	=	62.11	(79)
Southwest _{0.9x}	0.77	X	1.7		X		13.91			0.63	X	0.7		59.88	(79)
<u> </u>	0.77	×	1.7		X		04.39			0.63	X	0.7		54.87	(79)
Southwesto.e	0.77	×	1.7	=	X		2.85			0.63	X	0.7	╡ -	48.81	(79)
Southwest of	0.77	×	1.7		X		9.27			0.63	X	0.7	=	36.41	(79)
Southwest of	0.77	×	1.7		X		4.07			0.63	X	0.7	=	23.17	(79)
Southwest _{0.9x}	0.77	×	1.7	=	X		1.49]	_	0.63	×	0.7	_ =	16.55	(79)
Northwest 0.9x	0.77	×	5.7	\rightarrow	X		1.28	X I		0.63	X	0.7	_ =	19.69	(81)
Northwest 0.9x	0.77	×	5.7	==	X		2.97	X		0.63	X	0.7	=	40.08	(81)
Northwest 0.9x	0.77	X	5.7		X		1.38	X		0.63	×	0.7	_ =	72.21	(81)
Northwest 0.9x	0.77	X	5.7		X		7.96	X		0.63	×	0.7	=	118.59	(81)
Northwest 0.9x	0.77	X	5.7	=	X		1.35	X		0.63	×	0.7	=	159.4	(81)
Northwest 0.9x	0.77	X	5.7	==	X		7.38	X		0.63	×	0.7	=	169.94	(81)
Northwest 0.9x	0.77	X	5.7		X		91.1	X		0.63	×	0.7	=	158.98	(81)
Northwest 0.9x	0.77	X	5.7	==	X		2.63	X		0.63	×	0.7	=	126.74	(81)
Northwest 0.9x	0.77	X	5.7	===	X		0.42	X		0.63	×	0.7	_ =	87.99	(81)
Northwest 0.9x	0.77	X	5.7		X		8.07	X		0.63	×	0.7	_ =	48.98	(81)
Northwest 0.9x	0.77	X	5.7		X		4.2	X	_	0.63	×	0.7	_ =	24.77	(81)
Northwest _{0.9x}	0.77	X	5.7	1	X	9	9.21	X	(0.63	X	0.7	=	16.08	(81)
O de mareira de	-11	la latad	. ((00)		(7 4)	(00)				
Solar gains in v		1			$\overline{}$	38 57				n(74)m		1 87 67	61.02	1	(83)
	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $														
(84)m= 374.85 429.9 484.02 542.43 584.2 576.65 548.9 508.64 462.41 407.15 366.9 355.11 (84)															
` '										1		1		J	` '
7. Mean interr						araa f	rom Tok		Th4	(°C)				04	(QE)
Temperature	•				_			л е 9,	, 1111	(0)				21	(85)
Utilisation fact	Feb	Mar	Apr	a, n1,n May	Ť	ee ra Jun	bie 9a) Jul	Λ.	ug	Sep	Oct	Nov	Dec	1	
Jan	1 60	iviai	Λhι	iviay		Juii	Jul		uy	oeh	001	INUV	Dec	Т	

(86)m=	1	0.99	0.98	0.92	0.78	0.58	0.43	0.48	0.75	0.95	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	20.04	20.19	20.43	20.72	20.92	20.99	21	21	20.95	20.69	20.31	20.01		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.09	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.1		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)					•	
(89)m=	1	0.99	0.97	0.9	0.73	0.51	0.34	0.39	0.67	0.93	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)	•			
(90)m=	18.81	19.03	19.37	19.79	20.03	20.11	20.11	20.11	20.08	19.75	19.21	18.77		(90)
							•		f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.55	19.73	20.01	20.35	20.56	20.64	20.65	20.65	20.6	20.32	19.88	19.52		(92)
Apply	adjustn	nent to t	he mear	interna	l temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	19.55	19.73	20.01	20.35	20.56	20.64	20.65	20.65	20.6	20.32	19.88	19.52		(93)
		ting requ												
		mean int		_		ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
uie ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g			IVICA	Juli	<u> </u>	/tug	ОСР	001	1101			
(94)m=	0.99	0.99	0.97	0.9	0.76	0.55	0.4	0.45	0.72	0.94	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m									
(95)m=	372.77	424.62	468.67	490.7	443.91	319.57	217.05	226.7	331.03	382.04	362.49	353.61		(95)
Month	nly aver	age exte	rnal tem	perature	from T	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		I	1	· ·	1		r - `		– (96)m				I	(07)
(97)m=	848.5	822.8	747.4	624.84	482.49	324.73	217.67	227.88	351.46	529.03	699.05	842.79		(97)
(98)m=	e neatin 353.94	g require 267.58	207.37	96.59	28.71	/vn/mon	$\ln = 0.02$	24 X [(97)m – (95 0)m] X (4 109.36	1)m 242.33	363.95		
(90)111=	333.94	207.50	207.57	90.09	20.71				l per year				1669.82	(98)
Casa	- h4:			L(\A/b) /100 3	2/			1010	ii pei yeai	(KVVII/yCai) = O din(3	O)15,912 —		= ``
·		g require											29.91	(99)
		•	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir ion of sr	_	nt from s	econdar	v/supple	mentary	system						0	(201)
	-	ace hea				mornary	-	(202) = 1 -	- (201) =				1	(202)
		tal heati		-	, ,				02) × [1 – ((203)] =				(204)
			•	-				(204) = (2	02) X [1	(200)] =			1	
Efficiency of main space heating system 1 93.4 Efficiency of secondary/supplementary heating system, % 0											(206)			
ETTICIE	ency of s			ementar ·	y neatin	g systen	า, % 					1	0	(208)
_	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	year
Space		g require								400.00	040.00	202.05	1	
(0.4.1)	353.94	267.58	207.37	96.59	28.71	0	0	0	0	109.36	242.33	363.95		(= : : :
(211)m)m x (20					_			117.00	250 45	200.07	1	(211)
	378.95	286.49	222.03	103.41	30.74	0	0	0 Tota	0 II (kWh/yea	117.09	259.45	389.67	4707.00	(211)
								1010	(ICVVIII) y GC	, — C uiii(2	- ' '/15,1012	!	1787.82	(211)

Space heating fuel (secondary), kWh/month									
$= \{[(98)m \times (201)] \} \times 100 \div (208)$ $(215)m = $	0	0	0	0	0	0	0		
(213)11- 0 0 0 0		0	-			215) _{15,1012}	_	0	(215)
Water heating						710,1012		•	」` ′
Output from water heater (calculated above)						•			
	118.14	113.19	126.18	127.57	145.26	155.06	167.83		_
Efficiency of water heater								80.3	(216)
(217)m= 86.83 86.49 85.77 84.16 81.91	80.3	80.3	80.3	80.3	84.35	86.17	86.95		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m									
` '	147.12	140.95	157.13	158.87	172.22	179.95	193.03		
	-		Tota	I = Sum(2	19a) ₁₁₂ =	-		2031.28	(219)
Annual totals					k\	Wh/year		kWh/year	7
Space heating fuel used, main system 1							ļ	1787.82	╛
Water heating fuel used								2031.28	
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								255.56	(232)
Total delivered energy for all uses (211)(221) +	+ (231)	+ (232).	(237b)	=				4149.66	(338)
12a. CO2 emissions – Individual heating system	ns inclu	iding mid	cro-CHP				L.		
		ergy h/year			kg CO	ion fac 2/kWh	tor	Em <mark>issio</mark> ns kg CO2/yea	
Space heating (main system 1)	(211) x			0.2	16	=	386.17	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	438.76	(264)
Space and water heating	(261) + (262) -	+ (263) + (264) =				824.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	38.93	(267)
Electricity for lighting	(232	?) x			0.5	19	=	132.64	(268)
Total CO2, kg/year				sum o	f (265)(2	271) =		996.49	(272)

TER =

(273)

17.85

Stroma Number: Stroma FSAP 2012 Software Version: Version: 1.0.5.41					User D	etails: _						
Address: 1 Bed Mid - TF, London, TBC 1. Overall dwelling dimensions. Area(m²)		Stroma F	SAP 201	2	0001 2	Strom				Versio	on: 1.0.5.41	
Area(m²) Av. Height(m) Volume(m³)				Р	roperty.	Address	: 1 Bed I	Mid - TF				
Area (m²) Av. Height(m) Volume(m²)	Address :	1 Bed Mid	- TF, Lon	don, TB	С							
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	1. Overall dwelling dime	ensions:										
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 139.58 (2. Ventilation rate: main heating heating heating Number of chimneys 0	Ground floor						(1a) x		• , ,	(2a) =		(3a)
Number of chimneys Number of chimneys	Total floor area TFA = (1	a)+(1b)+(1c)-	+(1d)+(1e	e)+(1r	n) 5	55.83	(4)					
Number of chimneys	Dwelling volume						(3a)+(3b)+(3c)+(3d	d)+(3e)+	.(3n) =	139.58	(5)
Number of chimneys Number of pen flues Number of intermittent fans Number of intermittent fans Number of passive vents Number of flueless gas fires 0	2. Ventilation rate:											
Number of intermittent fans 2	Number of chimneys	heating	<u>_h</u>	eating	-		7 = [x 4	40 =		i r (6a)
Number of intermittent fans 2	Number of open flues		╡ + ト	0	╡╻╞	0	 	0	x	20 =	0	
Number of passive vents 0	·						J [x	10 =		(7a)
Number of flueless gas fires Air changes per hour Infiltration due to chirnneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20							L		x	10 =		(7b)
Air changes per hour Infiltration due to chirmneys, flues and fans = (68)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.14 (11) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 (0) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (0) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.35 Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7							L				_	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	Number of fluciess gas i						L	0				
Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 (0) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (0) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.85 Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7							continue fr					(8)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7				α, ρισσσσ	u 10 (77),	<i>301101 W100 \</i>		0,11 (0) 10 (, , ,		0	(9)
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 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	Additional infiltration								[(9)	-1]x0.1 =	0	(10)
deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area							•	uction			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = Infiltration rate incorporating shelter factor (21) = (18) x (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	• • • • • • • • • • • • • • • • • • • •			ponding to	the great	er wall are	a (after					
Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) (0.39) (0.39) (0.39) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (0.33) (0.3	•	• / .		ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.00000000000000000000000000000000$	If no draught lobby, er	nter 0.05, else	enter 0								0	(13)
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = Infiltration rate incorporating shelter factor (21) = (18) x (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	Percentage of window	rs and doors o	lraught st	ripped							0	(14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	Window infiltration					•	· /	-			0	(15)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7											0	(16)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (11) = (18) x (20) = 0.33 (12) = (18) x (20) = 0.33 (13) = (18) x (20) = 0.33 (14) = (18) x (20) = 0.33 (15) = (18) x (20) = 0.33 (16) = (18) x (20) = 0.33 (17) = (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (18) x (20) = 0.33 (•				•	•	•	etre of e	envelope	area	5	(17)
Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (21) = (18) x (20) = 0.33 (21) = (18) x (20) = 0.33 (23) = (18) x (20) = 0.85 (24) = (18) x (20) = 0.33 (25) = (18) x (20) = 0.33 (27) = (18) x (20) = 0.33 (28) = (18) x (20) = 0.85 (29) = 1 - [0.075 x (19)] = 0.85 (20) = 1 - [0.075 x (19)] = 0.85 (21) = (18) x (20) = 0.33 (21) = (18) x (20) = 0.33 (22) = (18) x (20) = 0.85 (23) = (18) x (20) = 0.33 (24) = (18) x (20) = 0.33 (25) = (18) x (20) = 0.33 (26) = (18) x (20) = 0.33 (27) = (18) x (20) = 0.33 (28) x (28) x (20) = 0.33 (28) x (28) x (28) x (28) x (28) x (28) x (28) (28) x (28) x (28) x (28) x (28) x (28) x (28) x (28) (28) x (28) x (28) x (28) x (28) x (28) x (28) x (28) (28) x (28) x (28) x (28) x (28) x (28) x (28) x (28) (28) x (28) x (28) x (28) x (28) x (28) x (28) x (28) x (28) (28) x (28)	•	•							d		0.39	(18)
Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7			ion test nas	s been aor	ne or a deg	gree air pe	rmeability	is being us	sea		2	(19)
Infiltration rate incorporating shelter factor Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7		Ju				(20) = 1 -	[0.075 x (1	19)] =				(20)
Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	Infiltration rate incorpora	ting shelter fa	ctor			(21) = (18) x (20) =				0.33	(21)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7	·	•		l								
			· ·		Jul	Aug	Sep	Oct	Nov	Dec		
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	Monthly average wind sp	oeed from Tab	ole 7								-	
	(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Factor $(22a)m = (22)m \div 4$	Wind Factor (220)m - (2											
wind Factor $(22a)m = (22)m \div 4$ $(22a)m = 1.27 $			1 08	0.95	0.95	0.92	1	1.08	1 12	1 18	1	

djusted infiltr	ation rat	te (allowi	ing for sl	nelter an	nd 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]	
Calculate effect If mechanica		_	iate for t	пе арріі	capie ca	se						0	(2:
If exhaust air h			endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(2:
If balanced with	n heat reco	overy: effic	ciency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				0	(2:
a) If balance	ed mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2:	2b)m + (23b) × [1 – (23c)		`
.4a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	лV) (24t	m = (22)	2b)m + (23b)			
(4b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
c) If whole h		tract ver × (23b), t		•					.5 × (23b))		•	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
d) If natural		on or wh en (24d)		•	•				n 51	ı		J	
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	1	(2
Effective air	<u> </u>	rate - er			ļ		<u> </u>	ļ				J	
(5)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	(2
3. Heat losse					Not A		LI vol		A V I I		ر بام بر		A V I.
LEMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-value kJ/m²-		A X k kJ/K
oors					3.57	x	1.2	_ =	4.284				(2
/indows Type	e 1				5.71	x1.	/[1/(1.4)+	0.04] =	7.57	Ħ			(2
/indows Type	2				2.95	x1.	/[1/(1.4)+	0.04] =	3.91	Ħ			(:
indows Type	e 3				1.72		/[1/(1.4)+	0.04] =	2.28	5			(2
/alls	44.9	98	13.9	5	31.03	3 x	0.18	— i	5.59	Ħ r			(2
oof	55.8		0		55.83	=	0.13	=	7.26	=		╡╞	(;
otal area of e					100.8	=	0.10		7.20				(;
arty wall		,			39.86	=	0		0				(:
arty floor						=	0		0	L		╡ 누	(;
ternal wall **					55.83					L			
or windows and		lows usa e	offective wi	ndow I I-v	63.7		ı formula 1	/[/1/ ₋ val	د 0.41 (مراهر] as aiven in	naragrani		(;
include the area						atou using	i ioimula i	7[(17 0 - vaic	10)+0.0 1] 6	is given in	paragrapi	7 3.2	
abric heat los	ss, W/K	= S (A x	U)				(26)(30)) + (32) =				30.89	(
eat capacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	4540.6	is (:
nermal mass	parame	eter (TMF	= Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(:
or design assess In be used inste				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		_
hermal bridge	es : S (L	.xY) cal	culated	using Ap	pendix I	K						15.52	(:
details of therma		are not kn	nown (36) =	= 0.05 x (3	31)								
otal fabric he								. ,	(36) =			46.41	(;
entilation hea	r	i e	<u> </u>		1	1		- ` ` ` 	= 0.33 × ((25)m x (5)) 	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(20) 27.24	27.05	26.89	26.14	26	25.35	25.35	25.23	25.6	26	26.20	26.59		(38)
(38)m= 27.21			20.14	26	25.55	25.55	25.25	25.6	26	26.29	26.58		(30)
Heat transfer (39)m= 73.63	73.46	73.31	72.56	72.42	71.77	71.77	71.65	72.02	= (37) + (1 72.42	72.7	73		
(00)1112 70.00	75.40	70.01	72.00	72.72	71.77	71.77	7 1.00			Sum(39) ₁		72.56	(39)
Heat loss para	meter (F	HLP), W	m²K						= (39)m ÷				
(40)m= 1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.28	1.29	1.3	1.3	1.31		_
Number of day	rs in mor	nth (Tah	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.3	(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)
							l						
4. Water heat	ting ener	rgy requi	irement:								kWh/ye	ear:	
	_												
Assumed occu if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.86	ı	(42)
if TFA £ 13.9	•			`	,	•	, , <u>-</u>	,					
Annual average Reduce the annual									se target o		3.41	I	(43)
not more that 125	_				_	_							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot w <mark>ater u</mark> sage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m= 86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		_
Energy content of	hot water	used - cal	culated m	onthly – 4	190 v Vd r	n v nm v [)Tm / 3600			m(44) ₁₁₂ =		940.97	(44)
(45)m= 127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
(43)111= 127.91	111.07	113.44	100.03	90.57	05.54	11.22	00.01			m(45) ₁₁₂ =		1233.75	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46			(10)112		. 200 0	` ′
(46)m= 19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
Water storage		منام برام منا			WILLDO		م ماطفاند					l	()
Storage volum If community h	, ,		•			•		ame ves	sei		0		(47)
Otherwise if no	•			_			. ,	ers) ente	er '0' in (47)			
Water storage			`					,	·				
a) If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from b) If manufact		•	•		or is not		(48) x (49)) =			0	I	(50)
Hot water stor			-								0		(51)
If community h	_		on 4.3	•		-,							
Volume factor			0.1								0		(52)
Temperature f											0	I I	(53)
Energy lost fro Enter (50) or (-	, KVVh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
Water storage	. , .	•	for each	month			((56)m = (55) × (41)ı	m		U		(33)
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	-	-						_			_	ix H	(55)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
(5.)			L										(= -)

Primary circuit loss (annual) from Table 3	0	(58)
Primary circuit loss calculated for each month (59)m = (58) \div 365 x (41)m		
(modified by factor from Table H5 if there is solar water heating and a cylinder therm	ostat)	1
(59)m= 0 0 0 0 0 0 0 0 0	0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m		
(61)m= 43.95 38.26 40.76 37.9 37.56 34.8 35.96 37.56 37.9 40.76	40.99 43.95	(61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m +	- (46)m + (57)m +	(59)m + (61)m
(62)m= 171.87 150.13 156.2 138.54 134.13 118.14 113.19 126.18 127.57 145.26	155.06 167.83	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution of the contr	ution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)		
(63)m= 0 0 0 0 0 0 0 0 0	0 0	(63)
Output from water heater	'	
(64)m= 171.87 150.13 156.2 138.54 134.13 118.14 113.19 126.18 127.57 145.26	155.06 167.83	1
Output from water heat	er (annual) ₁₁₂	1704.11 (64)
Heat gains from water heating, kWh/month $0.25 (0.85 \times (45)) + (61) + 0.8 \times (46)$	י n + (57)m + (59)m	1
(65)m= 53.52 46.76 48.57 42.94 41.5 36.41 34.67 38.85 39.29 44.94	48.18 52.18	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is		eating
	Troffi community fr	eating
5. Internal gains (see Table 5 and 5a):		_
Metabolic gains (Table 5), Watts	New Dee	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct (66)m= 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08 93.08	Nov Dec	(66)
	93.08 93.08	(00)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	1 40 05 1 44 07	(07)
(67)m= 14.47 12.85 10.45 7.91 5.92 4.99 5.4 7.01 9.41 11.95	13.95 14.87	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		
(68)m= 162.32 164.01 159.76 150.73 139.32 128.6 121.44 119.75 124 133.03	144.44 155.16	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		1
(69)m= 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31 32.31	32.31 32.31	(69)
Pumps and fans gains (Table 5a)	<u>, </u>	
(70)m= 3 3 3 3 3 3 3 3 3 3 3	3 3	(70)
Losses e.g. evaporation (negative values) (Table 5)		
(71)m= -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47 -74.47	-74.47 -74.47	(71)
Water heating gains (Table 5)		
(72)m= 71.94 69.59 65.29 59.64 55.78 50.57 46.6 52.22 54.57 60.4	66.91 70.13	(72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m	71)m + (72)m	
(73)m= 302.65 300.37 289.43 272.2 254.94 238.09 227.35 232.91 241.9 259.31	279.23 294.09	(73)
6. Solar gains:		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applica-	able orientation.	
Orientation: Access Factor Area Flux g_	FF	Gains
Table 6d m ² Table 6a Table 6b	Table 6c	(W)
Southeast 0.9x 0.77 x 2.95 x 36.79 x 0.63 x	0.7 =	33.17 (77)
Southeast 0.9x 0.77 x 2.95 x 62.67 x 0.63 x	0.7 =	56.5 (77)
	l	

Southeast _{0.9x}	^ 77				v		- 7F] ,		2.62	ا پ	0.7		77.04	(77)
Southeast 0.9x	0.77	x	2.9	=	X		5.75	X		0.63	」 × ¬ 、	0.7	┥ -	77.31	= ' '
Southeast 0.9x	0.77	x	2.9		X		06.25	X		0.63	」 × ¬ ,	0.7	_ =	95.79	(77)
Southeast 0.9x	0.77	×	2.9	==	X		19.01	x x		0.63	」 × ¬ 、	0.7	┥ -	107.3	(77)
Southeast 0.9x	0.77	=	2.9		X		18.15]]		0.63	」 × ¬ ∵	0.7	_ =	106.52	$= \frac{1}{100} (77)$
Southeast 0.9x	0.77	x	2.9		X		13.91	X		0.63	」 × ¬ ,	0.7	_ = -	102.7	(77)
Southeast 0.9x	0.77	x	2.9		X		04.39	X		0.63	」 × ¬ 、	0.7	┥ -	94.11	(77)
Southeast 0.9x	0.77	x	2.9	_	X		2.85	X		0.63	」 × ¬ ∵	0.7	_ =	83.71	= (77)
Southeast 0.9x	0.77	x	2.9		X		9.27	X		0.63	」 × ¬ 、	0.7	╡ -	62.45	(77)
Southeast 0.9x	0.77	X	2.9	==	X		4.07	X		0.63	」 × ¬ 、	0.7	_ =	39.73	(77)
Southwest _{0.9x}	0.77	x	2.9	==	X		1.49	X		0.63	」 × ¬ .,	0.7	_ =	28.39	= (77)
Southwest _{0.9x}	0.77	×	1.7	===	X		6.79]]		0.63	X 	0.7	_ =	19.34	(79)
Southwest _{0.9x}	0.77	X	1.7		X		2.67] 1		0.63	X	0.7	_ =	32.94	(79)
Southwest _{0.9x}	0.77	X	1.7		Χ		5.75]]		0.63	X 	0.7	_ =	45.08	(79)
	0.77	X	1.7		X		06.25] 1		0.63	X	0.7	= =	55.85	(79)
Southwest _{0.9x} Southwest _{0.9x}	0.77	×	1.7	==	X		19.01] 1		0.63	X	0.7	_ =	62.56	(79)
Southwest _{0.9x}	0.77	X	1.7	==	X		18.15] 1		0.63	X	0.7	=	62.11	(79)
Southwest _{0.9x}	0.77	X	1.7		X		13.91			0.63	X	0.7		59.88	(79)
<u> </u>	0.77	×	1.7		X		04.39			0.63	X	0.7		54.87	(79)
Southwesto.e	0.77	×	1.7	=	X		2.85			0.63	X	0.7	╡ -	48.81	(79)
Southwest of	0.77	×	1.7		X		9.27			0.63	X	0.7	=	36.41	(79)
Southwest of	0.77	×	1.7		X		4.07			0.63	X	0.7	=	23.17	(79)
Southwest _{0.9x}	0.77	×	1.7	=	X		1.49]	_	0.63	×	0.7	_ =	16.55	(79)
Northwest 0.9x	0.77	×	5.7	\rightarrow	X		1.28	X I		0.63	X	0.7	_ =	19.69	(81)
Northwest 0.9x	0.77	×	5.7	==	X		2.97	X		0.63	X	0.7	=	40.08	(81)
Northwest 0.9x	0.77	X	5.7		X		1.38	X		0.63	×	0.7	=	72.21	(81)
Northwest 0.9x	0.77	X	5.7		X		7.96	X		0.63	×	0.7	=	118.59	(81)
Northwest 0.9x	0.77	X	5.7	=	X		1.35	X		0.63	×	0.7	=	159.4	(81)
Northwest 0.9x	0.77	X	5.7	==	X		7.38	X		0.63	×	0.7	=	169.94	(81)
Northwest 0.9x	0.77	X	5.7		X		91.1	X		0.63	×	0.7	=	158.98	(81)
Northwest 0.9x	0.77	X	5.7	==	X		2.63	X		0.63	×	0.7	=	126.74	(81)
Northwest 0.9x	0.77	X	5.7	===	X		0.42	X		0.63	×	0.7	_ =	87.99	(81)
Northwest 0.9x	0.77	X	5.7		X		8.07	X		0.63	×	0.7	_ =	48.98	(81)
Northwest 0.9x	0.77	X	5.7		X		4.2	X	_	0.63	×	0.7	_ =	24.77	(81)
Northwest _{0.9x}	0.77	X	5.7	1	X	9	9.21	X	(0.63	X	0.7	=	16.08	(81)
O de mareira de	-11	la latad	. ((00)		(7 4)	(00)				
Solar gains in v		1			$\overline{}$	38 57				n(74)m		1 87 67	61.02	1	(83)
	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $														
(84)m= 374.85 429.9 484.02 542.43 584.2 576.65 548.9 508.64 462.41 407.15 366.9 355.11 (84)															
` '										1		1		J	` '
7. Mean interr						araa f	rom Tok		Th4	(°C)				04	(QE)
Temperature	•				_			л е 9,	, 1111	(0)				21	(85)
Utilisation fact	Feb	Mar	Apr	a, n1,n May	Ť	ee ra Jun	bie 9a) Jul	Λ.	ug	Sep	Oct	Nov	Dec	1	
Jan	1 60	iviai	Λhι	iviay		Juii	Jul		uy	oeh	001	INUV	Dec	Л	

(86)m=	1	0.99	0.98	0.95	0.87	0.72	0.56	0.61	0.85	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.6	19.77	20.04	20.41	20.73	20.93	20.98	20.97	20.83	20.41	19.94	19.57		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.83	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.85	19.84	19.84	19.83		(88)
Utilisa	ation fac	tor for a	ains for r	rest of d	welling.	h2.m (se	ee Table	9a)			•		I	
(89)m=	1	0.99	0.98	0.94	0.82	0.62	0.42	0.48	0.77	0.96	0.99	1		(89)
Mean	interna	l temner	ature in	the rest	of dwelli	na T2 (f	ollow ste	ns 3 to	7 in Tahl	 _	Į.		J	
(90)m=	17.99	18.22	18.63	19.16	19.58	19.8	19.85	19.84	19.71	19.17	18.49	17.95		(90)
, ,							ļ	ļ	If	LA = Livin	g area ÷ (4	<u>1</u> 4) =	0.6	(91)
N 4 = = :=			-4 /6-	مارين مالا م	-11	II:\ _f	I A T 4	. /4 - £1	A) T O					`
(92)m=	18.96	19.15	ature (fo	19.91	20.28	20.48	20.53	+ (1 – TL 20.52	20.39	19.92	19.37	18.93		(92)
			he mean				<u> </u>	<u> </u>			19.57	10.93	l	(02)
(93)m=	18.96	19.15	19.48	19.91	20.28	20.48	20.53	20.52	20.39	19.92	19.37	18.93		(93)
			uirement											
			ernal ter		re obtair	ed at st	ep 11 of	Table 9l	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
			or gains											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm										ı	(0.1)
(94)m=	0.99	0.99	0.98	0.94	0.84	0.68	0.5	0.56	0.81	0.96	0.99	1		(94)
(95)m=		425.33	W = (94)	1)M X (84 508.77	4)m 493.43	389.44	275.57	284.82	375.61	390.09	363.1	353.55		(95)
			rnal tem				275.57	204.02	373.01	390.09	303.1	333.33	i	(55)
(96)m=		4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		for mea	an intern	al tempe	L erature.		[(39)m	x [(93)m		1	Į		l	
(97)m=		1047.22	951.52	799.05	621.12	422.01	282.14	295.46	452.73	675.03	891.8	1075.2		(97)
Spac	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		J	
(98)m=	525.8	417.91	356.33	209	95	0	0	0	0	212	380.67	536.91		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2733.61	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								48.96	(99)
9a. En	erav rec	ıuiremer	nts – Indi	vidual h	eating s	vstems i	ncludina	micro-C	CHP)					
	e heatir					,			,,,,					
-		_	at from se	econdar	y/supple	mentary	system						0	(201)
Fract	ion of sp	ace hea	nt from m	ain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fract	ion of to	tal heatii	ng from i	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heati	ing syste	em 1								93.4	(206)
	•	-	ry/supple			a system	ղ. %						0	(208)
						- ·		۸۰۰۵	Con	Oot	Nov	Doo	1	
Snac	Jan e heatin	Feb a require	Mar ement (c	Apr alculate	May d above	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	y c ai
Opac	525.8	417.91	356.33	209	95	0	0	0	0	212	380.67	536.91		
(211\n			(4)] } x 1										l	(211)
(<u>~ 1 1)</u> 11	562.96	447.44	381.5	223.76	101.71	0	0	0	0	226.98	407.57	574.85		(211)
				-					l (kWh/yea				2926.77	(211)
											, 1012			

Space heating fuel (secondary), kWh/month								
= {[(98)m x (201)] } x 100 ÷ (208)								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
		Tota	al (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating						•		_
Output from water heater (calculated above)	140 44 1 442	40 400 40	407.57	4.45.00	455.00	407.00		
171.87 150.13 156.2 138.54 134.13 7	118.14 113	.19 126.18	127.57	145.26	155.06	167.83	20.0	(216)
(217)m= 87.68 87.49 87.06 86.08 84.2	80.3 80	.3 80.3	80.3	86	87.22	87.77	80.3	(217)
Fuel for water heating, kWh/month	00.0 00	.5 00.5	00.5	00	07.22	07.77		(217)
(219) m = (64) m × $100 \div (217)$ m								
(219)m= 196.01 171.6 179.41 160.94 159.3	147.12 140		158.87	168.91	177.78	191.22		_
		Tota	al = Sum(2	19a) ₁₁₂ =			2009.23	(219)
Annual totals				k\	Wh/year		kWh/year	¬
Space heating fuel used, main system 1						ļ	2926.77	_
Water heating fuel used							2009.23	
Electricity for pumps, fans and electric keep-hot								
central heating pump:						30		(230c)
boi <mark>ler with a fan-assisted flue</mark>						45		(230e)
Total electricity for the above, kWh/year		sun	of (230a).	(230g) =			75	(231)
Electricity for lighting						_ i	255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (2	32)(237b)	=				5266.57	(338)
12a. CO2 emissions – Individual heating system	ns including	micro-CHI	2	_		·		
	Energy			Emiss	ion fac	tor	Emissio ns	
	kWh/ye			kg CO	2/kWh		kg CO2/yea	ar
Space heating (main system 1)	(211) x			0.2	16	= [632.18	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	433.99	(264)
Space and water heating	(261) + (2	262) + (263) +	(264) =				1066.18	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	38.93	(267)
Electricity for lighting	(232) x			0.5	19	=	132.64	(268)
Total CO2, kg/year			sum o	f (265)(2	271) =		1237.74	(272)
								_

TER =

(273)

22.17

				User D	etai <u>ls:</u>						
Assessor Name:	01. 53	AD 004	2		Strom					40544	
Software Name:	Stroma FS	AP 2012		roporty	Softwa Address				Versio	on: 1.0.5.41	
Address :	1 Bed Var -	EF. Lond			Address	i beu	var - Er				
1. Overall dwelling dime			,								
				Area	a(m²)		Av. He	ight(m)		Volume(m ³)
Ground floor				5	4.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e))+(1r	1) 5	54.08	(4)					
Dwelling volume						(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	135.2	(5)
2. Ventilation rate:											
	main heating		condar	У	other		total			m³ per hou	r
Number of chimneys	0	+ [0	+ [0	=	0	X 4	40 =	0	(6a)
Number of open flues	0	- + -	0	Ī + Ē	0	Ī - [0	x	20 =	0	(6b)
Number of intermittent fa	ins						2	x -	10 =	20	(7a)
Number of passive vents	;						0	x -	10 =	0	(7b)
Number of flueless gas fi	ires					F	0	X 4	40 =	0	(7c)
						L					
									Air ch	nanges per ho	our
Infiltration due to chimne							20		÷ (5) =	0.15	(8)
If a pressurisation test has b Number of storeys in t			d, procee	d to (17), (otherwise (ontinue fr	rom (9) to ((16)		0	(9)
Additional infiltration	ne awening (n	3)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel o	r timber f	rame or	0.35 fo	r masonı	y consti	ruction			0	(11)
if both types of wall are p			onding to	the great	er wall are	a (after					
deducting areas of openii If suspended wooden t			ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en		•	,	`	,,					0	(13)
Percentage of windows	s and doors dr	aught str	ipped							0	(14)
Window infiltration					0.25 - [0.2	. ,	_			0	(15)
Infiltration rate							12) + (13) -			0	(16)
Air permeability value, If based on air permeabil				•	•	•	etre of e	envelope	area	5	(17)
Air permeability value applie	-						is being u	sed		0.4	(18)
Number of sides sheltere				`	,	Í	J			2	(19)
Shelter factor					(20) = 1 -	0.075 x (19)] =			0.85	(20)
Infiltration rate incorporat	•				(21) = (18	x (20) =				0.34	(21)
Infiltration rate modified f		' 				_		·		1	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp				0.0		4	1 4 6	1 4 5	1 4 -	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	J	
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		

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4]	
Calculate effe		-	rate for t	he appli	cable ca	se						, 	
If mechanica			andin NL (C	10h) (00a	· \ / ·		N/5\\ _4b_) (00-)			0	(2
If exhaust air h) = (23a)			0	(2
If balanced with		•	-	_					21.) (001) [4 (00.)	0	(2
a) If balance	1	anicai ve	1	i	at recov	ery (MVI	HR) (248	$\frac{a)m = (22)}{a}$	2b)m + (0	23b) × [' ' '	i ÷ 100] I	(2
24a)m= 0	0	_	0	0							0	J	(2
b) If balance	ea mecha 0	anicai ve	entilation 0	without	neat red	covery (r	VIV) (240 1 0	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (22)$	2b)m + (. 0	23b) ₀	0	1	(2
											0	J	(2
c) If whole h			ntilation o then (24d	•	•				5 × (23h	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(2
d) If natural	ventilation	on or wh	nole hous	Lse positiv	ve input	ventilatio	on from	loft	ļ.	ļ.		J	
,			m = (22l)	•					0.5]				
24d)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(2
Effective air	change	rate - er) or (24k	o) or (24	c) or (24	ld) in bo	x (25)	-	-	-	-	
5)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(2
3. Heat losse	e and he	at loss I	naramet	or.									-
LEMENT	Gros		Openin		Net Ar	rea	U-val	ue	AXU		k-value	9	ΑΧk
	area		m		A ,r		W/m2		(W/	K)	kJ/m²·l		kJ/K
oors					3.57	X	1.2	= [4.284				(2
Vin <mark>dows</mark> Type) 1				1.24	x1	/[1/(1.4)+	0.04] =	1.64				(2
Vindows Type	2				4.17	x1	/[1/(1.4)+	0.04] =	5.53				(2
/indows Type	€ 3				0.72	x1	/[1/(1.4)+	0.04] =	0.95	5			(2
Vindows Type	e 4				3.82	x1	/[1/(1.4)+	0.04] =	5.06				(2
loor					13.85	5 X	0.13	i	1.8005				(2
/alls	62.5	5	13.5	2	48.98	=	0.18	=	8.82	Ħ i		7 7	(2
otal area of e					76.35	=							^` (;
arty wall		,			19.77	=	0		0				·
arty floor					40.23	=			· ·			-	(;
arty ceiling					54.08	=						\dashv \vdash	(;
nternal wall *	,					=				L		╡	
itorriai wali		OWS USO	offective w	ndow II	63.3		a formula 1	/[(1/ Lval	م ۵۱۱ (مر	es diven in	naraaranh		(3
for windows and						aleu using	j iorriula i	/[(1/ U- vaic	1 0)+0.04] a	is giveri iri	i parayrapi	1 3.2	
	\\///	= S (A x	U)				(26)(30) + (32) =				28.09	9 (
include the area	3S, VV/N :							((28)	(30) + (32	2) + (32a).	(32e) =	5921.1	17 (
include the area abric heat los		(A x k)											•
for windows and include the area abric heat lose eat capacity hermal mass	Cm = S(⊃ = Cm ÷	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	==
include the area abric heat lose eat capacity	Cm = S(parame sments wh	eter (TMF	etails of the	,			recisely the				able 1f	250	(:

Total fabric heat loss (33) + (36) =		7(27)
Total fabric heat loss $(33) + (36) =$ Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$	38.45	(37)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 26.46 26.3 26.14 25.4 25.26 24.61 24.49 24.86 25.26 25.54 25.83		(38)
Heat transfer coefficient, W/K $ (39)m = (37) + (38)m $,
(39)m= 64.9 64.74 64.58 63.84 63.7 63.06 63.06 62.94 63.31 63.7 63.98 64.28		
Average = Sum(39) ₁₁₂ /12=	63.84	(39)
Heat loss parameter (HLP), W/m ² K $ (40)m = (39)m \div (4) $		_
(40)m= 1.2 1.2 1.19 1.18 1.17 1.17 1.16 1.17 1.18 1.18 1.19		_
Average = Sum(40) ₁₁₂ /12= Number of days in month (Table 1a)	1.18	(40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
(41)m= 31 28 31 30 31 30 31 30 31 30 31		(41)
4. Water heating energy requirement: kWh/year:		
Assumed assumency N		(40)
Assumed occupancy, N $= 1.81$ if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)		(42)
if TFA £ 13.9, N = 1		
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of		(43)
not more that 125 litres per person per day (all water use, hot and cold)		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Hot water usage in litres per day for each month Vd , $m = factor from Table 1c x (43)$		
(44)m= 84.92 81.83 78.74 75.65 72.56 69.48 69.48 72.56 75.65 78.74 81.83 84.92		
Total = Sum(44) ₁₁₂ =	926.35	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)		
(45)m= 125.93 110.14 113.65 99.08 95.07 82.04 76.02 87.24 88.28 102.88 112.3 121.95		_
Total = $Sum(45)_{112}$ = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	1214.59	(45)
(46)m= 18.89 16.52 17.05 14.86 14.26 12.31 11.4 13.09 13.24 15.43 16.85 18.29		(46)
Water storage loss:		(10)
Storage volume (litres) including any solar or WWHRS storage within same vessel		(47)
If community heating and no tank in dwelling, enter 110 litres in (47)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)		
Water storage loss:		(40)
a) If manufacturer's declared loss factor is known (kWh/day): 0		(48)
Temperature factor from Table 2b Energy lost from water storage, kWh/year (48) x (49) = 0		(49)
Energy lost from water storage, kWh/year (48) x (49) = 0 b) If manufacturer's declared cylinder loss factor is not known:		(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)		(51)
If community heating see section 4.3		
Volume factor from Table 2a 0		(52)
Temperature factor from Table 2b		(53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ Enter (50) or (54) in (55)		(54)
Enter (50) or (54) in (55)		(55)

Water storage lo	oss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains of	dedicated	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit lo	oss (an	nual) fro	m Table	3							0		(58)
Primary circuit lo	oss cal	culated f	for each	month (59)m = ((58) ÷ 36	55 × (41)	m				•	
(modified by f	actor fr	om Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calc	ulated	for each	month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 43.27	37.66	40.12	37.31	36.98	34.26	35.4	36.98	37.31	40.12	40.35	43.27		(61)
Total heat requi	red for	water he	eating ca	alculated	I for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 169.2	147.8	153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		(62)
Solar DHW input ca	lculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	on to wate	er heating)	•	
(add additional I	lines if	FGHRS	and/or \	VWHRS	applies	, see Ap	pendix (3)			_		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from wat	ter hea	ter											
(64)m= 169.2	147.8	153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		
							Outp	out from wa	ater heate	r (annual) ₁	12	1677.64	(64)
Hea <mark>t gains from</mark>	water	heating,	kWh/mo	onth 0.2	5 [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m= 52.69	46.04	47.82	42.27	40.86	3 5.84	04.40	00.05	00.00	4404				(65)
` '	.0.0	77.02	42.21	40.66	33.64	34.13	38.25	38.68	44.24	47.43	51.37		(03)
in <mark>clude</mark> (57)m					_							eating	(03)
` '	in calc	culation	of (65)m	only if c	_							eating	(03)
include (57)m	in calc	culation o	of (65)m and 5a	only if c	_							eating	(00)
include (57)m 5. Internal gain	in calc	culation o	of (65)m and 5a	only if c	_							eating	(03)
include (57)m 5. Internal gain Metabolic gains	in calc ns (see (Table	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the d	dwelling	or hot w	ater is fr	om com	munity h	eating	(66)
include (57)m 5. Internal gain Metabolic gains Jan	ns (see (Table Feb 90.52	Table 5 5), Wat Mar 90.52	of (65)m 5 and 5a ts Apr 90.52	only if control is May 90.52	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	ater is fr	om com	munity h	eating	
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52	ns (see (Table Feb 90.52	Table 5 5), Wat Mar 90.52	of (65)m 5 and 5a ts Apr 90.52	only if control is May 90.52	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	ater is fr	om com	munity h	eating	
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m	ns (see (Table Feb 90.52 calcular 12.5	Table 5 5), Wat Mar 90.52 ted in Ap	of (65)m and 5a ts Apr 90.52 opendix 7.69	May 90.52 L, equati	Jun 90.52 ion L9 of	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	Sep 90.52 Table 5 9.15	Oct 90.52	Nov 90.52	Dec 90.52	eating	(66)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain	ns (see (Table Feb 90.52 calcular 12.5	Table 5 5), Wat Mar 90.52 ted in Ap	of (65)m and 5a ts Apr 90.52 opendix 7.69	May 90.52 L, equati	Jun 90.52 ion L9 of	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	Sep 90.52 Table 5 9.15	Oct 90.52	Nov 90.52	Dec 90.52	eating	(66)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain	rin calcular (Table Feb 90.52 calcular 12.5 as (calcular)	Table 5 5), Wat Mar 90.52 ted in Ap 10.16 ulated in	of (65)m 5 and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54	only if control of the control of th	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1:	Aug 90.52 Iso see 6.82 3a), also	Sep 90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34	Nov 90.52	Dec 90.52	eating	(66) (67)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain (68)m= 157.81	rin calcular (Table Feb 90.52 calcular 12.5 as (calcular)	Table 5 5), Wat Mar 90.52 ted in Ap 10.16 ulated in	of (65)m 5 and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54	only if control of the control of th	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1:	Aug 90.52 Iso see 6.82 3a), also	Sep 90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34	Nov 90.52	Dec 90.52	eating	(66) (67)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (rin calcular (Table Feb 90.52 calcular 12.5 as (calcular 159.45 calcular 32.05	Table 5 5), Wat Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05	May 90.52 L, equati 5.75 dix L, equati 135.45 L, equati	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a)	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34 5	Nov 90.52 13.56	Dec 90.52	eating	(66) (67) (68)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (69)m= 32.05	rin calcular (Table Feb 90.52 calcular 12.5 as (calcular 159.45 calcular 32.05	Table 5 5), Wat Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05	May 90.52 L, equati 5.75 dix L, equati 135.45 L, equati	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a)	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34 5	Nov 90.52 13.56	Dec 90.52	eating	(66) (67) (68)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 90.52 Lighting gains (667)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (69)m= 32.05 Pumps and fans	rin calcons (see (Table Feb 90.52 calcular 12.5 as (calcons 159.45 calcular 32.05 as gains 3	Table 5 5), Wat Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3	only if constructions: May 90.52 L, equation 5.75 dix L, equation 135.45 L, equation 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 iion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	eating	(66) (67) (68) (69)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (667)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (69)m= 32.05 Pumps and fans (70)m= 3 Losses e.g. eva	rin calcons (see (Table Feb 90.52 calcular 12.5 as (calcons 159.45 calcular 32.05 as gains 3	Table 5 5), Wat Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3	only if constructions: May 90.52 L, equation 5.75 dix L, equation 135.45 L, equation 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 iion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	eating	(66) (67) (68) (69)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (69)m= 32.05 Pumps and fans (70)m= 3 Losses e.g. eva	rin calcular 12.5 159.45 calcular 12.5 159.45 calcular 32.05 s gains 3 poratio	ted in Ap 32.05 (Table 5 3 on (negat	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3 tive valu	only if construction only if construction only if construction on the construction of the construction on the construction of the construction on the construction of the construction on the construction of	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85 32.05	eating	(66) (67) (68) (69) (70)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 90.52 Lighting gains (667)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (69)m= 32.05 Pumps and fans (70)m= 3 Losses e.g. eva (71)m= -72.41	rin calcular 12.5 159.45 calcular 12.5 159.45 calcular 32.05 s gains 3 poratio	ted in Ap 32.05 (Table 5 3 on (negat	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3 tive valu	only if construction only if construction only if construction on the construction of the construction on the construction of the construction on the construction of the construction on the construction of	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85 32.05	eating	(66) (67) (68) (69) (70)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fans (70)m= 3 Losses e.g. eva (71)m= -72.41 Water heating g	rin calce (Table Feb 90.52 calcular 12.5 as (calce 159.45 calcular 32.05 as gains 3 poratio -72.41 pains (T	ted in Ap 32.05 (Table 5 3 an (negation false 5) 64.27	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41	only if constructions only if constructions only if constructions on the construction of the construction	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	Nov 90.52 13.56 140.43 32.05 3	Dec 90.52 14.46 150.85 32.05 3	eating	(66) (67) (68) (69) (70)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains (69)m= 32.05 Pumps and fans (70)m= 3 Losses e.g. eva (71)m= -72.41 Water heating g (72)m= 70.82 Total internal g	rin calce (Table Feb 90.52 calcular 12.5 as (calce 159.45 calcular 32.05 as gains 3 poratio -72.41 pains (T	ted in Ap 32.05 (Table 5 3 an (negation false 5) 64.27	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41	only if constructions only if constructions only if constructions on the construction of the construction	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1: 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	Nov 90.52 13.56 140.43 32.05 3	Dec 90.52 14.46 150.85 32.05 3	eating	(66) (67) (68) (69) (70)

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

Orientation: Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x} 0.77	x	1.24	x	11.28	x	0.63	x	0.7	=	4.28	(75)
Northeast 0.9x 0.77	x	1.24	х	22.97	x	0.63	x	0.7	=	8.7	(75)
Northeast 0.9x 0.77	x	1.24	х	41.38	x	0.63	x	0.7	=	15.68	(75)
Northeast 0.9x 0.77	x	1.24	x	67.96	x	0.63	x	0.7] =	25.75	(75)
Northeast 0.9x 0.77	x	1.24	x	91.35	x	0.63	x	0.7	=	34.62	(75)
Northeast 0.9x 0.77	x	1.24	x	97.38	x	0.63	x	0.7] =	36.9	(75)
Northeast 0.9x 0.77	x	1.24	х	91.1	x	0.63	x	0.7	=	34.52	(75)
Northeast _{0.9x} 0.77	x	1.24	x	72.63	x	0.63	x	0.7	=	27.52	(75)
Northeast _{0.9x} 0.77	x	1.24	х	50.42	x	0.63	x	0.7	=	19.11	(75)
Northeast _{0.9x} 0.77	x	1.24	x	28.07	x	0.63	x	0.7	=	10.64	(75)
Northeast 0.9x 0.77	x	1.24	x	14.2	x	0.63	x	0.7	=	5.38	(75)
Northeast 0.9x 0.77	x	1.24	x	9.21	x	0.63	x	0.7	=	3.49	(75)
Southeast 0.9x 0.77	x	0.72	x	36.79	x	0.63	x	0.7	=	8.1	(77)
Southeast 0.9x 0.77	x	0.72	x	62.67	x	0.63	x	0.7	=	13.79	(77)
Southeast 0.9x 0.77	x	0.72	x	85.75	x	0.63	x	0.7	=	18.87	(77)
Southeast 0.9x 0.77	X	0.72	X	106.25	X	0.63	X	0.7	=	23.38	(77)
Southeast 0.9x 0.77	x	0.72	x	119.01	x	0.63	x	0.7	=	26.19	(77)
Southeast 0.9x 0.77	x	0.72	х	118.15] x	0.63	x	0.7	=	26	(77)
Southeast 0.9x 0.77	x	0.72	x	113.91	x	0.63	x	0.7	=	25.06	(77)
Southeast 0.9x 0.77	x	0.72	x	104.39	x	0.63	x	0.7	=	22.97	(77)
Southeast 0.9x 0.77	x	0.72	x	92.85	X	0.63	x	0.7	=	20.43	(77)
Southeast 0.9x 0.77	x	0.72	х	69.27	x	0.63	x	0.7	=	15.24	(77)
Southeast 0.9x 0.77	x	0.72	х	44.07	x	0.63	x	0.7	=	9.7	(77)
Southeast 0.9x 0.77	X	0.72	x	31.49	x	0.63	x	0.7	=	6.93	(77)
Southwest _{0.9x} 0.77	X	3.82	x	36.79]	0.63	X	0.7	=	42.95	(79)
Southwest _{0.9x} 0.77	X	3.82	x	62.67]	0.63	x	0.7	=	73.17	(79)
Southwest _{0.9x} 0.77	X	3.82	x	85.75]	0.63	X	0.7	=	100.11	(79)
Southwest _{0.9x} 0.77	X	3.82	x	106.25]	0.63	X	0.7	=	124.04	(79)
Southwest _{0.9x} 0.77	X	3.82	x	119.01]	0.63	X	0.7	=	138.94	(79)
Southwest _{0.9x} 0.77	X	3.82	X	118.15]	0.63	X	0.7	=	137.93	(79)
Southwest _{0.9x} 0.77	X	3.82	X	113.91]	0.63	X	0.7	=	132.98	(79)
Southwest _{0.9x} 0.77	X	3.82	x	104.39]	0.63	x	0.7	=	121.87	(79)
Southwest _{0.9x} 0.77	X	3.82	x	92.85]	0.63	X	0.7	=	108.4	(79)
Southwest _{0.9x} 0.77	X	3.82	x	69.27]	0.63	X	0.7	=	80.87	(79)
Southwest _{0.9x} 0.77	x	3.82	x	44.07]	0.63	x	0.7	=	51.45	(79)
Southwest _{0.9x} 0.77	x	3.82	x	31.49]	0.63	x	0.7	=	36.76	(79)
Northwest 0.9x 0.77	x	4.17	x	11.28	x	0.63	x	0.7	=	14.38	(81)
Northwest 0.9x 0.77	x	4.17	x	22.97	x	0.63	x	0.7	=	29.27	(81)
Northwest _{0.9x} 0.77	X	4.17	X	41.38	X	0.63	X	0.7	=	52.73	(81)

Northwest 0.9x 0.7	7 ×	4.1	17	x	67.96	X	0.	63	x	0.7	=	86.6	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	91.35	X	0.	63	x	0.7	=	116.41	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	97.38	x	0.	63	x	0.7	=	124.11	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	91.1	X	0.	63	x	0.7	=	116.1	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	72.63	x	0.	63	x	0.7	=	92.56	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	50.42	x	0.	63	x	0.7		64.26	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	28.07	x	0.	63	_ x [0.7	=	35.77	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	14.2	x	0.	63	_ x _	0.7	=	18.09	(81)
Northwest 0.9x 0.7	7 ×	4.1	17	x	9.21	x	0.	63	_ x [0.7	=	11.74	(81)
Solar gains in watts,	calculated	d for eac	h month			(83)m	n = Sum(74)m .	(82)m				
(83)m= 69.71 124.93	187.39	259.78	316.15	324.9	308.67	264	.92 21	2.19	142.51	84.62	58.92		(83)
Total gains – internal	and sola	r (84)m =	= (73)m ·	+ (83)	m , watts					-		_	
(84)m= 365.56 418.54	470.31	525.88	565.42	557.7	76 531.01	492	.73 44	18.78	396.09	357.64	346.43		(84)
7. Mean internal tem	perature	(heating	season)									
Temperature during	•	,		<i>'</i>	a from Ta	ble 9,	, Th1 ('	C)				21	(85)
Utilisation factor for	• .			_			•	,					
Jan Feb	Mar	Apr	May	Jui	<u> </u>	A	ug	Sep	Oct	Nov	Dec		
(86)m= 1 0.99	0.98	0.95	0.85	0.68	3 0.51	0.5).82	0.97	0.99	1		(86)
Mean internal tempe	rature in	living ar	oa T1 (fo	llow s	etene 3 to	7 in T	able 9	c)			1	1	
(87)m= 19.76 19.92	20.18	20.53	20.81	20.9		20.		0.88	20.52	20.08	19.73		(87)
						_	$\overline{}$, ,
Temperature during (88)m= 19.92 19.92	19.92	19.94	19.94	19.9		19.		9.94	19.94	19.93	19.93	1	(88)
							33 1	3.34	19.94	19.93	19.93		(00)
Utilisation factor for	-			-	` 	–						1	(00)
(89)m= 1 0.99	0.98	0.93	0.8	0.58	0.4	0.4	15 0).74	0.95	0.99	1		(89)
Mean internal tempe	rature in	the rest	of dwelli	ng T2	(follow ste	eps 3	to 7 in	Tabl	e 9c)			,	
(90)m= 18.28 18.52	18.9	19.39	19.75	19.9	2 19.94	19.	94 1	9.85	19.39	18.75	18.25		(90)
								f	LA = Livir	ng area ÷ (4	4) =	0.6	(91)
Mean internal tempe	erature (fo	r the wh	ole dwe	lling) :	= fLA × T1	+ (1	– fLA)	× T2					
(92)m= 19.16 19.35	19.66	20.07	20.38	20.5	4 20.57	20.	56 2	0.47	20.06	19.54	19.13		(92)
Apply adjustment to	the mear	interna	l temper	ature	from Table	e 4e,	where	appro	priate				
(93)m= 19.16 19.35	19.66	20.07	20.38	20.5	4 20.57	20.	56 2	0.47	20.06	19.54	19.13		(93)
8. Space heating red	quirement												
Set Ti to the mean in		•		ed at	step 11 of	Tabl	e 9b, s	o tha	t Ti,m=(76)m an	d re-cald	culate	
the utilisation factor	1	i .				T .			<u> </u>	1		1	
Jan Feb	Mar Mar	Apr 	May	Ju	n Jul	A	ug :	Sep	Oct	Nov	Dec	J	
Utilisation factor for (94)m= 0.99 0.99	0.97	0.93	0.82	0.64	0.47	0.5	52 ().78	0.95	0.99	1	1	(94)
Useful gains, hmGm				L 0.02	0.47	1 0.0	- -	0	0.00	1 0.09	<u>'</u>	J	(0.1)
(95)m= 363.52 413.89		488.91	464.79	355.6	3 247.03	256	.65 35	51.99	377.39	353.74	344.92]	(95)
Monthly average ex			l	l		1			L	1	I	J	\ -/
(96)m= 4.3 4.9	6.5	8.9	11.7	14.6		16.	.4 1	4.1	10.6	7.1	4.2]	(96)
Heat loss rate for me	ļ		 erature.			x [(9	 3)m– (9	96)m]	I .	I .	J	
(97)m= 964.71 935.71	Υ	712.82	553.02	374.3		262		2.96	602.61	796.13	959.87]	(97)
· L				<u> </u>								J	

8)m= 447.29	350.66	291.55	161.22	65.64	0	0	0	0	167.57	318.52	457.53		
					•		Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	2259.98	(98)
Space heating	g require	ement in	kWh/m²	/year							Ī	41.79	(99)
a. Energy rec	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heatir	_			ما مسامار							г		(20
Fraction of sp					mentary	•	(202) = 1 -	_ (201) _			Ĺ	0	(202
Fraction of sp Fraction of to			•	. ,			(202) = 1 (204) = (204)		(203)] =		Ĺ	1 1	(204
Efficiency of r		_	•				(201) – (20	02) X [1	(200)] -		Ĺ	93.4	(20)
Efficiency of s	•				a system	ո %					L T	0	(20)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	
Space heating		l	·		l	Jui	Aug	ОСР	1 001	1400	DCC	RVVII/yC	ai
447.29	350.66	291.55	161.22	65.64	0	0	0	0	167.57	318.52	457.53		
211)m = {[(98)m x (20	4)] } x 1	00 ÷ (20	(6)									(21
478.9	375.44	312.15	172.61	70.28	0	0	0	0	179.41	341.03	489.86		_
							Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	- L	2419.68	(21
Sp <mark>ace heatin</mark> {[(<mark>98)m</mark> x (20	-			month									
$\frac{1}{15} = 0$	0	00 + (20	0	0	0	0	0	0	0	0	0		
							Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(21
/at <mark>er he</mark> ating											_		
utput from wa	ater hea	ter (calc	ulated al	oove)	116.3	111.43	124.22	125.59	143.01	152.66	165.23		
fficiency of w			130.39	132.03	110.5	111.43	124.22	123.39	143.01	132.00	103.23	80.3	(21
17)m= 87.38	87.15	86.64	85.47	83.39	80.3	80.3	80.3	80.3	85.45	86.86	87.48		」 ` (21
uel for water	heating,	kWh/mo	onth		ļ.	l			<u> </u>	l			
(19)m = $(64)(19)$ m = (63)	m x 100 169.59) ÷ (217) 177.49	m 159.57	158.35	144.84	138.76	154.69	156.4	167.35	175.75	188.87		
193.03	109.59	177.49	139.37	130.33	144.04	130.70		I = Sum(2		173.73	100.07	1985.3	(21
nnual totals								·		Wh/year		kWh/yea	
pace heating	fuel use	ed, main	system	1						•		2419.68	
ater heating	fuel use	d									Ī	1985.3	
ectricity for p	umps, fa	ans and	electric	keep-ho	t						_		
entral heatin	g pump:	:									30		(23
poiler with a f	an-assis	sted flue									45		(23
otal electricity	for the	above, k	:Wh/yea	r			sum	of (230a).	(230g) =		 	75	(23
-		,	,								L [248.46	` (23
lectricity for li	grittiria												

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	522.65 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	428.82 (264)
Space and water heating	(261) + (262) + (263) + (264) =		951.48 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	128.95 (268)
Total CO2, kg/year	sum	of (265)(271) =	1119.35 (272)
TFR =			20.7 (273)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	n: 1.0.5.41	
Address :	1 Bed Var - MF,		i i	Address	. i beu	vai - ivir				
1. Overall dwelling dime	nsions:									
			Are	a(m²)	•	Av. He	ight(m)	_	Volume(m ³	_
Ground floor			5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	·(1e)+(1r	n)	54.08	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	135.2	(5)
2. Ventilation rate:										<u></u>
	main heating	secondar heating	У	other		total			m³ per hou	ır
Number of chimneys	0 +] + [0	= [0	X e	40 =	0	(6a)
Number of open flues	0 +	0	T + F	0	=	0	x	20 =	0	(6b)
Number of intermittent far	ns					2	x -	10 =	20	(7a)
Number of passive vents					F	0	x -	10 =	0	(7b)
Number of flueless gas fir	res				_ 	0	X ·	40 =	0	(7c)
					L					``′
								Air ch	nanges per ho	our
Infiltration due to chimney						20		÷ (5) =	0.15	(8)
If a pressurisation test has be Number of storeys in the		ended, procee	d to (17),	otherwise (continue fi	rom (9) to ((16)			7 (0)
Additional infiltration	ie dweiling (ris)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	.25 for steel or timb	per frame or	0.35 fo	r masoni	ry consti	ruction		•	0	(11)
if both types of wall are pr		orresponding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden f	• / .	sealed) or 0.	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	,	•	(000	, c.cc	00				0	(13)
Percentage of windows	s and doors draugh	nt stripped							0	(14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value,	•		•	•	•	etre of e	envelope	area	5	(17)
If based on air permeabili Air permeability value applies	•					is beina u	sed		0.4	(18)
Number of sides sheltere				g <i> </i>		is a sing a			2	(19)
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.34	(21)
Infiltration rate modified for		1		<u> </u>			·		1	
		ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp			2.0	1 2 7	1 4	1 40	1 45	4.7	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18		

o.43 calculate effect If mechanica If exhaust air he If balanced with a) If balanced 4a)m= 0 b) If balanced 4b)m= 0 c) If whole he	Il ventilation: eat pump using	nge rate for	0.36 the appli	0.32	0.32	0.31	0.34	0.36	0.38	0.4		
If mechanica If exhaust air he If balanced with a) If balanced 4a)m= 0 b) If balanced 4b)m= 0	Il ventilation: eat pump using			ouble ou	ise	-			•	•	•	
If balanced with a) If balanced 4a)m= 0 b) If balanced 4b)m= 0											0	(2
a) If balance- 4a)m= 0 b) If balance- 4b)m= 0	heat recovery:	Appendix N, (2	23b) = (23a	a) × Fmv (e	equation (l	N5)) , othe	rwise (23b) = (23a)			0	(2
4a)m= 0 b) If balance 4b)m= 0		efficiency in %	allowing f	for in-use f	actor (fron	n Table 4h	ı) =				0	(2
b) If balance	d mechanica	al ventilation	with he	at recov	ery (MV	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
4b)m= 0	0 0	0	0	0	0	0	0	0	0	0]	(2
	d mechanica	al ventilation	without	heat red	covery (I	MV) (24b	m = (22)	2b)m + (2	23b)		-	
c) If whole he	0 0	0	0	0	0	0	0	0	0	0]	(:
if (22b)m	ouse extract n < 0.5 × (23		•	•				5 × (23b))		_	
4c)m= 0	0 0	0	0	0	0	0	0	0	0	0]	(
d) If natural vif (22b)m	ventilation or n = 1, then (2		•	•				0.5]			_	
4d)m= 0.59	0.59 0.5	59 0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(
Effective air	change rate	- enter (24a	a) or (24b	o) or (24	c) or (24	ld) in bo	x (25)				_	
5)m= 0.59	0.59 0.5	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(
. Heat losses	and heat lo	ss paramet	er:							_		
LEMENT	Gross area (m²)	Openir		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value		A X k kJ/K
oors	J. J. (111)			3.57	_	1.2	=	4.284				(
indows Type	1			1.24	x1	/[1/(1.4)+	- 0.04] =	1.64	Ħ			
indows Type				4.17	- - 7.	/[1/(1.4)+	0.04] =	5.53	Ħ			
indows Type	3			0.72	x1	/[1/(1.4)+	0.04] =	0.95	片			(
indows Type				3.82	_{x1}	/[1/(1.4)+	· 0.04] =	5.06	=			(
alls	62.5	13.5	2	48.98	=	0.18	:	8.82	╡ ┌		\neg	```(
otal area of el				62.5	_	00		0.02				\` (
arty wall	,			19.77	=	0		0	[\neg	· · · · · · · · · · · · · · · · · · ·
arty floor				54.08	=						╡ ⊨	`
arty ceiling				54.08	=						룩 늗	(
ternal wall **				63.3	=				L		룩 늗	(
for windows and include the area				alue calcui		g formula 1	l/[(1/U-valı	ie)+0.04] a	L as given in	paragraph		\
abric heat los						(26)(30)) + (32) =				26.29	9 (
eat capacity (,	,					((28).	(30) + (32	2) + (32a).	(32e) =	5436.4	
ermal mass	,	•	÷ TFA) ir	n kJ/m²K	,		Indica	tive Value	: Medium		250	
r design assess n be used instea	ments where th	e details of the	,			recisely the	e indicative	values of	TMP in Ta	able 1f		
nermal bridge	es : S (L x Y)	calculated	using Ap	pendix l	K						6.37	. (
•	l hridaina are n	ot known (36)	= 0.05 x (3	31)								

Ventila	ation hea	at loss ca	alculated	l 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=	26.46	26.3	26.14	25.4	25.26	24.61	24.61	24.49	24.86	25.26	25.54	25.83		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m=	59.12	58.96	58.8	58.06	57.92	57.28	57.28	57.16	57.53	57.92	58.2	58.5		
Heat lo	oss para	meter (H	HLP), W	m²K						Average = = (39)m ÷	Sum(39) ₁ . (4)	12 /12=	58.06	(39)
(40)m=	1.09	1.09	1.09	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.08	1.08		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.07	(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)
Assum	ned occu	ıpancy, l		irement:	(-0.0003	349 x (TF	FA -13 9)2)] + 0 (0013 x (TFA -13		kWh/ye	ear:	(42)
if TF Annua Redu <mark>ce</mark>	A £ 13.9 I averag the annua	9, N = 1 le hot wa al average	ater usaç hot water	ge in litre usage by	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		7	7.2		(43)
not more									0	0.1	NI.			
Hot wate	Jan er usage ii	Feb	Mar	Apr ach month	May	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	84.92	81.83	78.74	75.65	72.56	69.48	69.48	72.56	75.65	78.74	81.83	84.92		
(44)111=	04.32	01.00	70.74	73.03	12.30	09.40	09.40	72.50			m(44) ₁₁₂ =	l	926.35	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600					0_0.00	` ′
(45)m=	125.93	110.14	113.65	99.08	95.07	82.04	76.02	87.24	88.28	102.88	112.3	121.95		
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1214.59	(45)
(46)m=	18.89	16.52	17.05	14.86	14.26	12.31	11.4	13.09	13.24	15.43	16.85	18.29		(46)
	storage													
_		, ,		ng any so			•		ame ves	sel		0		(47)
Otherv	-	stored		ink in dw er (this in	_			. ,	ers) ente	er '0' in (47)			
	•		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature fa	actor fro	m Table	2b								0		(49)
			_	, kWh/ye				(48) x (49) =			0		(50)
Hot wa	ater stora	age loss	factor fr	cylinder l com Tabl								0		(51)
	-	_	ee secti	on 4.3								1		(==)
		from Ta	bie 2a m Table	2b								0		(52) (53)
•				, kWh/ye	ar			(<u>4</u> 7) v (51) x (52) x (53) =				
٠.		m water (54) in (5	_	, rvii/ye	zai			(11) X (31	,	00 <i>)</i> =	-	0		(54) (55)
		. , .	•	for each	month			((56)m = (55) × (41)	m		•		(30)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
. ,		I	I	I		I	I	I	I	I	I	l		•

If cylinder con	tains dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary cire	cuit loss (ar	nual) fro	m Table	e 3	-	-	-				0		(58)
Primary cir	cuit loss cal	culated t	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
` —	by factor f			1	i	1			1			ı	,,
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 43.	27 37.66	40.12	37.31	36.98	34.26	35.4	36.98	37.31	40.12	40.35	43.27		(61)
Total heat	equired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 169	.2 147.8	153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		(62)
Solar DHW in	out calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add addition	nal lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)	,			•	
(63)m = 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output fron	n water hea	ter											
(64)m= 169	.2 147.8	153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		_
							Out	out from w	ater heate	r (annual)	12	1677.64	(64)
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m= 52.	69 46.04	47.82	42.27	40.86	35.84	34.13	38.25	38.68	44.24	47.43	51.37		(65)
in <mark>clude</mark> (57)m in cald	culation of	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Interna	l gains (see	Table 5	and 5a):									
Metabolic g	ains (Table	5). Wat	ts										
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 90.	52 90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52		(66)
Lighting ga	ins (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 14.	07 12.5	10.16	7.69	5.75	4.86	5.25	6.82	9.15	11.62	13.56	14.46		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	•	•		
(68)m= 157	81 159.45	155.32	146.54	135.45	125.02	118.06	116.42	120.55	129.34	140.43	150.85		(68)
Cooking ga	ins (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also se	ee Table	5	!	!		
(69)m= 32.	05 32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05		(69)
Pumps and	fans gains	(Table 5	<u> </u>									l	
(70)m= 3	$\overline{}$	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g	evaporatio	n (negat	tive valu	es) (Tab	le 5)			•	•				
		-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41		(71)
(71)m= -72.		<u> </u>		<u> </u>	<u> </u>	!	l	!	<u> </u>	ļ			
` /	ing gains (T	able 5)											
Water heat	- 	able 5) 64.27	58.71	54.91	49.78	45.87	51.41	53.72	59.46	65.87	69.04		(72)
Water heat (72)m= 70.	32 68.51	64.27	58.71	54.91				ļ.	ļ				(72)
Water heat (72)m= 70. Total inter	68.51	64.27		!	(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72))m		(72)
Water heat (72)m= 70. Total inter (73)m= 295	68.51 nal gains = 85 293.61	64.27	58.71	54.91				ļ.	ļ				
Water heat (72)m= 70. Total inter (73)m= 295 6. Solar ga	68.51 nal gains = 85 293.61	64.27	266.1	249.27	(66)	222.34	n + (68)m - 227.81	+ (69)m + 236.58	(70)m + (7 253.57	1)m + (72 273.02	287.51		

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northeast 0.9x	0.77	1 .	4.04	1 ,	44.00	1 ,	0.00	l v	0.7	1 _	4.00	(75)
Northeast 0.9x	0.77] X	1.24	X I	11.28] X]	0.63	X	0.7] =]	4.28	╡
Northeast 0.9x	0.77] X	1.24	X	22.97	l x	0.63	X	0.7] = _	8.7	(75) (75)
Northeast 0.9x	0.77] x] x	1.24	x x	41.38] x] x	0.63	x	0.7] =] =	15.68](75)
Northeast 0.9x	0.77] 1	1.24]]	67.96]]	0.63]]	0.7]]	25.75](75)
Northeast 0.9x	0.77] x] x	1.24	x x	91.35	l x	0.63	x	0.7] =] =	34.62](75)
Northeast 0.9x	0.77] ^] x	1.24	^ x	97.38] ^] _x	0.63	X	0.7]	36.9 34.52](75)
Northeast 0.9x	0.77] ^] x	1.24] ^] _x	72.63] ^] _x	0.63	X	0.7] -] =	27.52](75)
Northeast 0.9x	0.77] ^] x	1.24] ^ x	50.42] ^] _x	0.63	X	0.7]	19.11	(75)
Northeast 0.9x	0.77]	1.24] ^] x	28.07] ^] _x	0.63	x	0.7]] ₌	10.64	(75)
Northeast _{0.9x}	0.77]] x	1.24]]	14.2]] _x	0.63	X	0.7]] ₌	5.38	 (75)
Northeast _{0.9x}	0.77	X	1.24	l X	9.21]]	0.63	X	0.7]]	3.49	」(75)
Southeast 0.9x	0.77]]	0.72	l X	36.79]]	0.63	X	0.7] =	8.1	\(77)
Southeast _{0.9x}	0.77	X	0.72	X	62.67	X	0.63	x	0.7	, 	13.79	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.63	x	0.7	=	18.87	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.63	x	0.7	j =	23.38	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.63	x	0.7	=	26.19	(77)
Southeast 0.9x	0.77	x	0.72	X	118.15	Х	0.63	X	0.7		26	(77)
Southeast 0.9x	0.77	x	0.72	х	113.91	x	0.63	x	0.7	=	25.06	(77)
Southeast 0.9x	0.77	x	0.72	х	104.39	×	0.63	x	0.7	=	22.97	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.63	x	0.7	=	20.43	(77)
Southeast 0.9x	0.77] x	0.72	x	69.27	х	0.63	x	0.7	=	15.24	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	X	0.63	x	0.7	=	9.7	(77)
Southeast 0.9x	0.77	X	0.72	х	31.49	x	0.63	x	0.7	=	6.93	(77)
Southwest _{0.9x}	0.77	X	3.82	x	36.79]	0.63	x	0.7	=	42.95	(79)
Southwest _{0.9x}	0.77	x	3.82	x	62.67]	0.63	x	0.7	=	73.17	(79)
Southwest _{0.9x}	0.77	X	3.82	X	85.75]	0.63	x	0.7	=	100.11	(79)
Southwest _{0.9x}	0.77	X	3.82	X	106.25]	0.63	X	0.7	=	124.04	(79)
Southwest _{0.9x}	0.77	X	3.82	X	119.01]	0.63	X	0.7	=	138.94	(79)
Southwest _{0.9x}	0.77	X	3.82	X	118.15	ļ	0.63	X	0.7	=	137.93	(79)
Southwest _{0.9x}	0.77	X	3.82	X	113.91		0.63	X	0.7	=	132.98	(79)
Southwest _{0.9x}	0.77	X	3.82	X	104.39	ļ	0.63	X	0.7	=	121.87	(79)
Southwest _{0.9x}	0.77	X	3.82	X	92.85	ļ	0.63	X	0.7	=	108.4	(79)
Southwest _{0.9x}	0.77	X	3.82	X	69.27]	0.63	X	0.7	=	80.87	(79)
Southwest _{0.9x}	0.77	X	3.82	X	44.07]	0.63	X	0.7	=	51.45	(79)
Southwest _{0.9x}	0.77	X	3.82	X	31.49		0.63	X	0.7	=	36.76	(79)
Northwest 0.9x	0.77	X	4.17	X	11.28	X	0.63	X	0.7	=	14.38	(81)
Northwest 0.9x	0.77	X	4.17	X	22.97	X	0.63	X	0.7] = 1	29.27	(81)
Northwest 0.9x	0.77	X	4.17	X	41.38	X	0.63	X	0.7] = 1	52.73	(81)
Northwest 0.9x	0.77	X	4.17	X	67.96	X	0.63	X	0.7	=	86.6	(81)
Northwest 0.9x	0.77	X	4.17	X	91.35	X	0.63	X	0.7] =	116.41	(81)

Northwest _{0.9x}	0.77	× 4.	17	x	97.38	X		0.63	x	0.7	=	124.11	(81)
Northwest 0.9x	0.77	x 4.	17	x	91.1	X		0.63	x	0.7	=	116.1	(81)
Northwest _{0.9x}	0.77	x 4.	17	x	72.63	X		0.63	x	0.7	=	92.56	(81)
Northwest _{0.9x}	0.77	x 4.	17	x	50.42	X		0.63	x [0.7	=	64.26	(81)
Northwest _{0.9x}	0.77	x 4.	17	x	28.07	X		0.63	x	0.7	=	35.77	(81)
Northwest _{0.9x}	0.77	x 4.	17	x	14.2	X		0.63	x	0.7	=	18.09	(81)
Northwest 0.9x	0.77	x 4.	17	x	9.21	X		0.63	x [0.7	=	11.74	(81)
Solar gains in watt	s, calculate	d for eac	h month			(83)m	n = S	um(74)m .	(82)m			•	
(83)m= 69.71 124			316.15	324		264	1.92	212.19	142.51	84.62	58.92		(83)
Total gains – interr			`	·								1	
(84)m= 365.56 418	.54 470.31	525.88	565.42	557	.76 531.01	492	2.73	448.78	396.09	357.64	346.43		(84)
7. Mean internal t	emperature	e (heating	g season)									
Temperature duri	ng heating	periods i	n the livi	ng ar	ea from Tal	ble 9	, Th	1 (°C)				21	(85)
Utilisation factor f	or gains for	living ar	ea, h1,m	(see	Table 9a)								
Jan F	eb Mar	Apr	May	Jι	ın Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1 0.9	0.98	0.94	0.82	0.6	0.47	0.5	52	0.79	0.96	0.99	1		(86)
Mean internal ten	perature ir	living ar	ea T1 (fe	ollow	steps 3 to 7	7 in T	Γable	e 9c)					
(87)m= 19.91 20	06 20.31	20.63	20.87	20.	97 21	20.	.99	20.92	20.61	20.2	19.88		(87)
Temperature duri	ng heating	periods i	n rest of	dwel	lling from Ta	able	—— 9 TI	12 (°C)			•		
(88)m= 20.01 20		20.02	20.02	20.		20.		20.03	20.02	20.02	20.02		(88)
Utilisation factor f	or going for	root of d	welling	h2 m	/soc Toblo	(00)							
(89)m= 1 0.4		0.91	0.77	0.5		9a) 0.4	42	0.71	0.94	0.99	1		(89)
(**/													, ,
Mean internal ten (90)m= 18.55 18	·	19.6	of dwell	ing I 20.		20.		19.97	e 9 c)	18.99	18.52		(90)
(90)111= 16.55 16.	76 19.14	19.6	19.9	20.	02 20.03	20.	.03			ng area ÷ (4)	0.6	—
									L/ (- L//)	ig aroa . (., –	0.6	(91)
Mean internal ten	 		1		i	T È				1		1	(00)
(92)m= 19.36 19		20.21	20.48	20.		20.		20.54	20.19	19.71	19.33		(92)
Apply adjustment		20.21	20.48	ature		20.		re appro	·	10.71	19.33		(93)
` '			20.46	20.	59 20.61	20.	.01	20.54	20.19	19.71	19.33		(93)
8. Space heating Set Ti to the mea			re obtair	e har	it stan 11 of	Tahl	ام Ok	so tha	t Ti m-l	76)m an	d ro-calc	rulata	
the utilisation fact				icu a	it step 11 of	Tab	ie si), 30 tila	11,111—(, r O) iii aii	u ie-caic	Julate	
Jan F	eb Mar	Apr	May	Ju	ın Jul	А	ug	Sep	Oct	Nov	Dec		
Utilisation factor f	or gains, hr	m:			•					•			
(94)m= 0.99 0.9	9 0.97	0.92	0.79	0.0	6 0.43	0.4	48	0.75	0.95	0.99	1		(94)
Useful gains, hm	- i - `	<u> </u>	- 							1		Ī	
(95)m= 363.51 413			448.92	332		237	7.73	337.52	374.82	353.54	344.94		(95)
Monthly average		-i	1							1		İ	(00)
(96)m= 4.3 4.		8.9	11.7	14		16		14.1	10.6	7.1	4.2		(96)
Heat loss rate for (97)m= 890.43 863			erature, 508.43	Lm ,		X [(9:		- (96)m 370.38	555.66	734.14	885.13		(97)
(97)m= 890.43 863 Space heating re			L								000.13		(31)
(98)m= 392.02 302	`		44.28	VVN/N		24 X I	<u> </u>	m – (95 0)M] X (4 134.55	274.03	401.9		
302.02 302	240.04	1 124.33	1 -77.20				_	U	104.00	217.00	401.8		

					Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1917.73	(98)
Space heating requirement in	kWh/m²	/year							Ī	35.46	(99)
9a. Energy requirements – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:		ماممییمار	monton	, avatam					Г		7(204)
Fraction of space heat from se			mentary	-	(202) = 1 -	_ (201) _			Į	0	(201)
Fraction of space heat from m Fraction of total heating from a	-	` ,			(202) = 1 (204) = (2)	` '	(203)] =		Ĺ	1 1	(202)
Efficiency of main space heati	-				(204) - (2	02)	(200)] =		ļ	93.4	(206)
Efficiency of secondary/supple			n system	n %					Į [0	(208)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	
Space heating requirement (c	-		l	Jui	Aug	Оер	001	1400	Dec	KVVII/y	zai
392.02 302.32 243.64	124.99	44.28	0	0	0	0	134.55	274.03	401.9		
(211) m = {[(98)m x (204)] } x 1	00 ÷ (20	06)	_					_			(211)
419.73 323.68 260.86	133.82	47.41	0	0	0	0	144.05	293.4	430.3		_
					Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	F [2053.25	(211)
Space heating fuel (secondary $= \{[(98)m \times (201)]\} \times 100 \div (201)\}$	• •	month									
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	0	0	0	0	0	0	0	0		
					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Wat <mark>er he</mark> ating											
Output from water heater (calc	ulated a 136.39	oove) 132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		
Efficiency of water heater	130.39	132.05	110.3	111.43	124.22	125.59	143.01	152.00	100.23	80.3	(216)
(217)m= 87.1 86.81 86.2	84.83	82.62	80.3	80.3	80.3	80.3	84.9	86.51	87.2	00.0	(217)
Fuel for water heating, kWh/mo	onth		<u>I</u>	!	<u> </u>		!	<u>I</u>			
(219) m = (64) m x $100 \div (217)$ (219)m = 194.26 170.25 178.39	m 160.78	159.83	144.84	138.76	154.69	156.4	168.44	176.47	189.47		
219)111= 194.20 170.23 176.39	100.76	109.00	144.04	130.70		I = Sum(2		170.47	109.47	1992.58	(219)
Annual totals						•		Wh/year		kWh/yea	
Space heating fuel used, main	system	1						·	[2053.25	
Water heating fuel used										1992.58	
Electricity for pumps, fans and	electric	keep-ho	t						_		
central heating pump:									30		(2300
boiler with a fan-assisted flue									45		(230
Total electricity for the above, k	(Wh/yea	r			sum	of (230a).	(230g) =		 	75	(231)
Electricity for lighting	,									248.46	(232)
Total delivered energy for all us	ses (211)(221)	+ (231)	+ (232)	(237h)	=			L [4369.29	(338)
12a. CO2 emissions – Individ	`		` '	` ′	` ′				L	.555.25	``
TEAR O'SE OFFICIONO TO THAINING	aar rea t	<u>g </u>	En	ergy	5.0 5 1 11			ion fac	tor	Emissions	S

kWh/year

kg CO2/year

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	443.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	430.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =			873.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	128.95	(268)
Total CO2, kg/year	sum o	f (265)(271) =		1041.78	(272)

TER =

(273)

19.26

				User D	etails:								
Assessor Name: Software Name:	Stroma FS	Versio	on: 1.0.5.41										
Address :	1 Bed Var -	TF Long			Address	: 1 Bed	var - IF						
1. Overall dwelling dime		11, 2011	uon, 10										
				Area	a(m²)		Av. He	ight(m)		Volume(m ³	*)		
Ground floor				5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)		
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e))+(1r	n)	54.08	(4)			-				
Dwelling volume						(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	135.2	(5)		
2. Ventilation rate:										100.2	(-/		
2. Verillation rate.	main		condar	у	other		total			m³ per hou	r		
Number of chimneys	heating 0	+ [eating 0	7 + [0	7 = F	0	x 4	40 =	0	(6a)		
Number of open flues	0	╣╻┝	0	_ 	0]	0	x	20 =	0	(6b)		
Number of intermittent fa					0	J			10 =		╡`′		
	_					Ļ	2			20	(7a)		
Number of passive vents						Ĺ	0		10 =	0	(7b)		
Number of flueless gas fi	ires					L	0	X 4	40 =	0	(7c)		
	Air changes per hour												
Infiltration due to chimne	ve flues and f	ans - (6a	a)+(6b)+(7	7a)+(7h)+(7c) =	Г					(8)		
If a pressurisation test has b						continue fi	20 rom (9) to (÷ (5) =	0.15	(6)		
Number of storeys in the								ĺ		0	(9)		
Additional infiltration								[(9)	-1]x0.1 =	0	(10)		
Structural infiltration: 0						•	ruction			0	(11)		
if both types of wall are padeducting areas of openia			oonding to	the great	ter wall are	a (after							
If suspended wooden to			ed) or 0	.1 (seale	ed), else	enter 0				0	(12)		
If no draught lobby, en	ter 0.05, else	enter 0								0	(13)		
Percentage of windows	s and doors d	raught sti	ripped							0	(14)		
Window infiltration					0.25 - [0.2		_	(45)		0	(15)		
Infiltration rate		المارية المارات	:				12) + (13) -			0	(16)		
Air permeability value, If based on air permeabil					-	•	ietre oi e	envelope	area	5	(17)		
Air permeability value applie	-						is being u	sed		0.4	(10)		
Number of sides sheltere	ed									2	(19)		
Shelter factor					(20) = 1 -	[0.075 x (19)] =			0.85	(20)		
Infiltration rate incorporat	-				(21) = (18)) x (20) =				0.34	(21)		
Infiltration rate modified f		' '		T .	T .	l -	<u> </u>	T	<u> </u>	1			
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J			
Monthly average wind sp									·-	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	J			
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]			

0.43	<u>`</u>				i 	`´	(22a)m		0.00]	
Calculate effec	'	.41 0.37 nge rate for	0.36 the appli	0.32 cable ca	0.32 se	0.31	0.34	0.36	0.38	0.4		
If mechanica		•									0	(
If exhaust air he	eat pump using	g Appendix N, (23b) = (23a	a) × Fmv (e	equation (l	N5)) , othe	rwise (23b) = (23a)			0	(
If balanced with	heat recovery	r: efficiency in %	6 allowing f	for in-use f	actor (fron	n Table 4h	n) =				0	(
a) If balance	d mechanic	al ventilation	n with he	at recov	ery (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0	0	0 0	0	0	0	0	0	0	0	0		(
b) If balance	d mechanic	al ventilation	without	heat red	covery (I	MV) (24k	m = (22)	2b)m + (2	23b)			
24b)m= 0	0	0 0	0	0	0	0	0	0	0	0		(
c) If whole h if (22b)n		t ventilation 3b), then (24	•	•				.5 × (23b)			
24c)m= 0	0	0 0	0	0	0	0	0	0	0	0		(
d) If natural if (22b)n		or whole hou 24d)m = (22	•	•				0.5]				
24d)m= 0.59	0.59 0.	.59 0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(
Effective air	change rate	e - enter (24	a) or (24b	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.59	0.59 0.	.59 0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(
3. Heat losse	s and heat l	oss parame	er:							_	_	-
LEMENT	Gross area (m²	Openii		Net Ar A ,r		U-val W/m2		A X U (W/I	<)	k-value kJ/m²-l		A X k kJ/K
oors				3.57	х	1.2	=	4.284				(
Vin <mark>dows</mark> Type	: 1			1.24	_x 1	/[1/(1.4)+	- 0.04] =	1.64	Ħ			(
Vindows Type	2			4.17	x1	/[1/(1.4)+	- 0.04] =	5.53	Ħ			(
Vindows Type	3			0.72	x1	/[1/(1.4)+	- 0.04] =	0.95	5			(
Vindows Type	: 4			3.82	x1	/[1/(1.4)+	- 0.04] =	5.06	Ħ			(:
Valls	62.5	13.5	52	48.98	3 x	0.18		8.82	= [(
Roof	54.08			54.08	3 x	0.13		7.03	F i		7 F	(;
otal area of e	lements, m ²	2		116.5	8							(;
arty wall				19.77	7 X	0	=	0				(
arty floor				54.08	3							(
nternal wall **				63.3	=				Ī		 	(
for windows and * include the area					lated using	g formula 1	1/[(1/U-valu	ue)+0.04] a	ıs given in	paragraph	3.2	,`
	s, W/K = S	(A x U)				(26)(30) + (32) =				33.32	(
abric heat los	Cm = S(A v	k)					((28).	(30) + (32	2) + (32a).	(32e) =	4300.7	4 (
	5 – 5(A X						Indica	itive Value:	Medium		250	===
eat capacity	,	(TMP = Cm	÷ TFA) ir	n kJ/m²K			maica				250	(
eat capacity hermal mass or design assess	parameter (he details of th	•			recisely the				able 1f	230	(
abric heat los leat capacity hermal mass or design assess an be used instea hermal bridge	parameter (sments where to ad of a detailed	the details of the details of the	e construct	ion are no	t known pi	recisely the				able 1f	19.57	(

Ventila	tion hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	26.46	26.3	26.14	25.4	25.26	24.61	24.61	24.49	24.86	25.26	25.54	25.83		(38)
Heat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	79.35	79.19	79.03	78.29	78.15	77.51	77.51	77.39	77.75	78.15	78.43	78.73		
Heat lo	ss para	meter (H	HLP), W/	m²K						Average = = (39)m ÷		12 /12=	78.29	(39)
(40)m=	1.47	1.46	1.46	1.45	1.45	1.43	1.43	1.43	1.44	1.45	1.45	1.46		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.45	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
'											•			
4. Wa	ter heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
Assum	ed occu	ıpancy, I	N								1.	.81		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.	9)			
			ater usag							o toract o		7.2		(43)
			hot water person per			_	-	o acnieve	a water us	se target o	Ī			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
 Hot w <mark>ate</mark>			day for ea						Эер	Oct	1407	Dec		
(44)m=	<mark>8</mark> 4.92	81.83	78.74	75.65	72.56	69.48	69.48	72.56	75.65	78.74	81.83	84.92		
										Total = Su	1 1		926.35	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	Tm / 3600	kWh/mor	th (see Ta	bles 1b, 1	(c, 1d)		
(45)m=	125.93	110.14	113.65	99.08	95.07	82.04	76.02	87.24	88.28	102.88	112.3	121.95		_
lf instant	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Fotal = Su	m(45) ₁₁₂ =	=	1214.59	(45)
(46)m=	18.89	16.52	17.05	14.86	14.26	12.31	11.4	13.09	13.24	15.43	16.85	18.29		(46)
	storage	loss:												
Storag	e volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	-	-	ind no ta		-			. ,	\	(01: /	47)			
	rise it no storage		hot wate	er (tnis ir	iciuaes i	nstantar	ieous co	iiod idmi	ers) ente	er o in (47)			
	_		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature fa	actor fro	m Table	2b		•	• •					0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
			eclared o	-									1	
		_	factor fr		e 2 (kW	h/litre/da	ıy)					0		(51)
	-	eating s from Tal	ee section	on 4.3								0		(52)
			m Table	2b								0		(53)
•			storage		ear			(47) x (51)	x (52) x (53) =		0		(54)
		(54) in (5	-	, , ,				. / ()	. , (•	-	0		(55)
	` '	. , .	culated f	for each	month			((56)m = (55) × (41)ı	m			l	
56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
. ,				I	I		I	I			I		l	. ,

If cylinder con	tains dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary cire	cuit loss (ar	nual) fro	m Table	e 3	-	-	-				0		(58)
Primary cir	cuit loss cal	culated t	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
` —	by factor f			1	i	1			1			ı	,,
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 43.	27 37.66	40.12	37.31	36.98	34.26	35.4	36.98	37.31	40.12	40.35	43.27		(61)
Total heat	equired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 169	.2 147.8	153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		(62)
Solar DHW in	out calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add addition	nal lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)	,			•	
(63)m = 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output fron	n water hea	ter											
(64)m= 169	.2 147.8	153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		_
							Out	out from w	ater heate	r (annual)	12	1677.64	(64)
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m= 52.	69 46.04	47.82	42.27	40.86	35.84	34.13	38.25	38.68	44.24	47.43	51.37		(65)
in <mark>clude</mark> (57)m in cald	culation of	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Interna	l gains (see	Table 5	and 5a):									
Metabolic g	ains (Table	5). Wat	ts										
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 90.	52 90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52	90.52		(66)
Lighting ga	ins (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 14.	07 12.5	10.16	7.69	5.75	4.86	5.25	6.82	9.15	11.62	13.56	14.46		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	•	•		
(68)m= 157	81 159.45	155.32	146.54	135.45	125.02	118.06	116.42	120.55	129.34	140.43	150.85		(68)
Cooking ga	ins (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also se	ee Table	5	!	!		
(69)m= 32.	05 32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05	32.05		(69)
Pumps and	fans gains	(Table 5	<u> </u>									l	
(70)m= 3	$\overline{}$	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g	evaporatio	n (negat	tive valu	es) (Tab	le 5)			•	•				
		-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41	-72.41		(71)
(71)m= -72.		<u> </u>		<u> </u>	<u> </u>	!	l	!	<u> </u>	ļ			
` '	ing gains (T	able 5)											
Water heat	- 	able 5) 64.27	58.71	54.91	49.78	45.87	51.41	53.72	59.46	65.87	69.04		(72)
Water heat (72)m= 70.	32 68.51	64.27	58.71	54.91				ļ.	ļ				(72)
Water heat (72)m= 70. Total inter	68.51	64.27		!	(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72))m		(72)
Water heat (72)m= 70. Total inter (73)m= 295	68.51 nal gains = 85 293.61	64.27	58.71	54.91				ļ.	ļ				
Water heat (72)m= 70. Total inter (73)m= 295 6. Solar g	68.51 nal gains = 85 293.61	64.27	266.1	249.27	(66)	222.34	n + (68)m - 227.81	+ (69)m + 236.58	(70)m + (7 253.57	1)m + (72) 273.02	287.51		

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northeast 0.9x	0.77	1 .	4.04	1 ,	44.00	1 ,	0.00	l v	0.7	1 _	4.00	(75)
Northeast 0.9x	0.77] X	1.24	X I	11.28] X]	0.63	X	0.7] = 1	4.28	╡
Northeast 0.9x	0.77] X	1.24	X	22.97	l x	0.63	X	0.7] = _	8.7	(75) (75)
Northeast 0.9x	0.77] x] x	1.24	x x	41.38] x] x	0.63	x	0.7] =] =	15.68](75)
Northeast 0.9x	0.77] 1	1.24]]	67.96]]	0.63]]	0.7]]	25.75](75)
Northeast 0.9x	0.77] x] x	1.24	x x	91.35	l x	0.63	x	0.7] =] =	34.62](75)
Northeast 0.9x	0.77] ^] x	1.24	^ x	97.38] ^] _x	0.63	X	0.7]	36.9 34.52](75)
Northeast 0.9x	0.77] ^] x	1.24] ^] _x	72.63] ^] _x	0.63	X	0.7] -] =	27.52](75)
Northeast 0.9x	0.77] ^] x	1.24] ^ x	50.42] ^] _x	0.63	X	0.7]	19.11	(75)
Northeast 0.9x	0.77]	1.24] ^] x	28.07] ^] _x	0.63	x	0.7]] ₌	10.64	(75)
Northeast _{0.9x}	0.77]] x	1.24]]	14.2]] _x	0.63	X	0.7]] ₌	5.38	 (75)
Northeast _{0.9x}	0.77	X	1.24	l X	9.21]]	0.63	X	0.7]]	3.49	」(75)
Southeast _{0.9x}	0.77]]	0.72	l X	36.79]]	0.63	X	0.7] 	8.1	 ₍₇₇₎
Southeast _{0.9x}	0.77	X	0.72	X	62.67	X	0.63	x	0.7	, 	13.79	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.63	x	0.7	=	18.87	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.63	x	0.7	j =	23.38	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.63	x	0.7	=	26.19	(77)
Southeast 0.9x	0.77	x	0.72	X	118.15	Х	0.63	X	0.7		26	(77)
Southeast 0.9x	0.77	x	0.72	х	113.91	x	0.63	x	0.7	=	25.06	(77)
Southeast 0.9x	0.77	x	0.72	х	104.39	×	0.63	x	0.7	=	22.97	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.63	x	0.7	=	20.43	(77)
Southeast 0.9x	0.77] x	0.72	x	69.27	х	0.63	x	0.7	=	15.24	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	X	0.63	x	0.7	=	9.7	(77)
Southeast 0.9x	0.77	X	0.72	х	31.49	x	0.63	x	0.7	=	6.93	(77)
Southwest _{0.9x}	0.77	X	3.82	x	36.79]	0.63	x	0.7	=	42.95	(79)
Southwest _{0.9x}	0.77	x	3.82	x	62.67]	0.63	x	0.7	=	73.17	(79)
Southwest _{0.9x}	0.77	X	3.82	x	85.75]	0.63	x	0.7	=	100.11	(79)
Southwest _{0.9x}	0.77	X	3.82	X	106.25]	0.63	X	0.7	=	124.04	(79)
Southwest _{0.9x}	0.77	X	3.82	X	119.01	<u> </u>	0.63	X	0.7	=	138.94	(79)
Southwest _{0.9x}	0.77	X	3.82	X	118.15	ļ	0.63	X	0.7	=	137.93	(79)
Southwest _{0.9x}	0.77	X	3.82	X	113.91		0.63	X	0.7	=	132.98	(79)
Southwest _{0.9x}	0.77	X	3.82	X	104.39	ļ	0.63	X	0.7	=	121.87	(79)
Southwest _{0.9x}	0.77	X	3.82	X	92.85	ļ	0.63	X	0.7	=	108.4	(79)
Southwest _{0.9x}	0.77	X	3.82	X	69.27]	0.63	X	0.7	=	80.87	(79)
Southwest _{0.9x}	0.77	X	3.82	X	44.07]	0.63	X	0.7	=	51.45	(79)
Southwest _{0.9x}	0.77	X	3.82	X	31.49		0.63	X	0.7	=	36.76	(79)
Northwest 0.9x	0.77	X	4.17	X	11.28	X	0.63	X	0.7	=	14.38	(81)
Northwest 0.9x	0.77	X	4.17	X	22.97	X	0.63	X	0.7] = 1	29.27	(81)
Northwest 0.9x	0.77	X	4.17	X	41.38	X	0.63	X	0.7] = 1	52.73	(81)
Northwest 0.9x	0.77	X	4.17	X	67.96	X	0.63	X	0.7	=	86.6	(81)
Northwest 0.9x	0.77	X	4.17	X	91.35	X	0.63	X	0.7] =	116.41	(81)

Northwest 0.9x 0.77	X	4.1	7	X S	97.38	_ x [0.63	X	0.7	=	124.11	(81)
Northwest 0.9x 0.77	X	4.1	7	X	91.1] x [0.63	x	0.7	=	116.1	(81)
Northwest 0.9x 0.77	X	4.1	7	x 7	72.63] x [0.63	x	0.7	=	92.56	(81)
Northwest 0.9x 0.77	X	4.1	7	X E	50.42] x [0.63	x	0.7	=	64.26	(81)
Northwest 0.9x 0.77	X	4.1	7	x 2	28.07	_ x [0.63	x	0.7	=	35.77	(81)
Northwest 0.9x 0.77	x	4.1	7	x	14.2	×	0.63	x	0.7	=	18.09	(81)
Northwest 0.9x 0.77	x	4.1	7	X	9.21	İ×「	0.63	_ x [0.7	<u> </u>	11.74	(81)
Solar gains in watts, cal	culated	for eacl	n month			(83)m	= Sum(74)m	(82)m				
(83)m= 69.71 124.93	187.39	259.78	316.15	324.94	308.67	264.9	212.19	142.51	84.62	58.92		(83)
Total gains – internal an	d solar	(84)m =	: (73)m ·	+ (83)m	, watts							
(84)m= 365.56 418.54	470.31	525.88	565.42	557.76	531.01	492.7	73 448.78	396.09	357.64	346.43		(84)
7. Mean internal tempe	erature	(heating	season)								
Temperature during he	ating p	eriods ir	the livii	ng area	from Tal	ole 9,	Th1 (°C)				21	(85)
Utilisation factor for gai	ins for I	iving are	a, h1,m	(see Ta	ıble 9a)							
Jan Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(86)m= 1 0.99	0.99	0.96	0.89	0.76	0.6	0.66	0.87	0.97	0.99	1		(86)
Mean internal tempera	ture in	living are	a T1 (fo	ollow ste	ns 3 to 7	7 in Ta	hle 9c)	•	•			
(87)m= 19.42 19.59	19.88	20.27	20.64	20.88	20.97	20.9	<u> </u>	20.3	19.79	19.39		(87)
	oting p	oriodo in	root of	ducilina	from To	blo 0	Th2 (°C)					
Temperature during he (88)m= 19.71 19.71	19.72	19.73	19.73	19.74	19.74	19.7		19.73	19.72	19.72		(88)
` '							13.73	13.73	10.72	13.72		(00)
Utilisation factor for gai			-	<u> </u>		T	1 22	T		Ι		(00)
(89)m= 1 0.99	0.98	0.94	0.85	0.65	0.45	0.51	0.8	0.96	0.99	1		(89)
Mean internal tempera	ture in t	the rest	of dwelli	ng T2 (f	ollow ste	eps 3	to 7 in Tab	le 9 <mark>c)</mark>		, ,		
(90)m= 17.65 17.89	18.31	18.88	19.37	19.66	19.73	19.7		18.93	18.19	17.61		(90)
								fLA = Livir	ng area ÷ (4) =	0.6	(91)
Mean internal tempera	ture (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 -	- fLA) × T2					
(92)m= 18.71 18.9	19.25	19.71	20.12	20.39	20.47	20.4	5 20.27	19.74	19.14	18.67		(92)
Apply adjustment to the	e mean	internal	temper	ature fro	m Table	4e, v	here appr	opriate			ı	
(93)m= 18.71 18.9	19.25	19.71	20.12	20.39	20.47	20.4	5 20.27	19.74	19.14	18.67		(93)
8. Space heating requi												
Set Ti to the mean inte the utilisation factor for				ed at st	ep 11 of	Table	9b, so tha	at Ti,m=(76)m an	d re-calc	culate	
Jan Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
Utilisation factor for gai	!	•	ividy	Our	l oui	_ /\u	<u>9 OCP</u>	1 000	1407	_ DC0		
(94)m= 0.99 0.99	0.98	0.94	0.86	0.71	0.54	0.6	0.83	0.96	0.99	1		(94)
Useful gains, hmGm , \	W = (94	1)m x (84	4)m	ļ	!	!		<u>!</u>				
(95)m= 363.37 413.99	459.62	496.37	488.47	397.13	287.36	295.0	7 374.42	380.59	353.83	344.76		(95)
Monthly average exteri	nal 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 for mear	n intern	al tempe	erature,	Lm , W :	=[(39)m	x [(93)m- (96)m]				
` '	1007.32	846.29	658.4	448.47	299.57	313.6		714.53	944.69	1139.34		(97)
Space heating requirer							- i - ` -	í - `	r –		ı	
(98)m= 580.1 466.97	407.49	251.94	126.43	0	0	0	0	248.45	425.42	591.16		

					Tota	l per year	(kWh/year	r) = Sum(9	08) _{15,912} =	3097.96	(98)
Space heating requirement in	kWh/m²/	year								57.28	(99)
9a. Energy requirements – Ind	ividual he	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating:		/I							Г		¬,,,,,
Fraction of space heat from s	-		mentary	-	(202) 4	(204)			Į	0	(201)
Fraction of space heat from n	-	` '			(202) = 1	, ,	(202)]		Į	1 	(202)
Fraction of total heating from	•				(204) = (2	02) x [1 –	(203)] =		Į	1	(204)
Efficiency of main space heat	0 ,			- 0/						93.4	(206)
Efficiency of secondary/suppl						_				0	(208)
Jan Feb Mar Space heating requirement (c	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
580.1 466.97 407.49	251.94	126.43	0	0	0	0	248.45	425.42	591.16		
$(211)m = \{[(98)m \times (204)] \} \times 1$	100 ÷ (206	 6)									(211)
621.09 499.97 436.29	269.74	135.36	0	0	0	0	266.01	455.48	632.94		(= : :)
					Tota	l (kWh/yea	ar) =Sum(2	211) _{15,101}		3316.88	(211)
Space heating fuel (secondar	y), kWh/n	nonth									
$= \{[(98)m \times (201)]\} \times 100 \div (201)$						I					
(215)m= 0 0 0	0	0	0	0	O Tota	0 (k\\/\b/\/oc	0 ar) =Sum(2	0	0		7(045)
Water heating					Tota	ii (KVVII/yea	ar) =50m(2	13) _{15,101}	2 [0	(215)
Output from water heater (calc	ulated ab	ove)									
169.2 147.8 153.78	136.39	132.05	116.3	111.43	124.22	125.59	143.01	152.66	165.23		
Efficiency of water heater										80.3	(216)
(217)m= 87.9 87.75 87.39	86.58	84.94	80.3	80.3	80.3	80.3	86.43	87.49	87.98		(217)
Fuel for water heating, kWh/m (219) m = (64) m x $100 \div (217)$											
(219)m= 192.48 168.44 175.97	157.54	155.46	144.84	138.76	154.69	156.4	165.46	174.48	187.79		
	, ,				Tota	I = Sum(2	19a) ₁₁₂ =			1972.31	(219)
Annual totals							k\	Wh/yea	r	kWh/yea	<u>r</u>
Space heating fuel used, main	system 1									3316.88	╛
Water heating fuel used										1972.31	
Electricity for pumps, fans and	electric k	eep-hot	t								
central heating pump:									30		(2300
boiler with a fan-assisted flue									45		(230e
Total electricity for the above,	kWh/year				sum	of (230a).	(230g) =			75	(231)
Electricity for lighting										248.46	(232)
Total delivered energy for all u	ses (211)	(221)	+ (231)	+ (232).	(237b)	=				5612.65	(338)
12a. CO2 emissions – Individ	lual hea <u>tir</u>	ng syste	ms <u>incl</u>	uding mi	cro-CHF				L		
			En	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emission s	

Space heating (main system 1)	(211) x	0.216	=	716.45	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	426.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1142.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	128.95	(268)
Total CO2, kg/year	sum of	f (265)(271) =		1310.34	(272)

TER =

(273)

24.23

			User D	Details: _							
Assessor Name: Software Name:	Stroma Number: Stroma FSAP 2012 Software Version: Version: 1.0.5.4 Property Address: 2 Bed - EF 2 Bed - EF, London, TBC mensions:										
Address :	2 Bed - EF, Lon		торену	Audress	Z beu -	· EF					
1. Overall dwelling dime	nsions:										
0 10				a(m²)		Av. He	ight(m)	٦	Volume(m ³	_	
Ground floor				67.05	(1a) x	2	2.5	(2a) =	167.63	(3a)	
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)-	+(1e)+(1r	ገ) 6	37.05	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d	d)+(3e)+	.(3n) =	167.63	(5)	
2. Ventilation rate:				- 4l		4-4-1				-	
	main heating	secondar heating	ту 	other		total			m³ per hou	r 	
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	ns					2	X '	10 =	20	(7a)	
Number of passive vents						0	X ·	10 =	0	(7b)	
Number of flueless gas fin	res				Ī	0	X 4	40 =	0	(7c)	
Air changes											
		(2) (21) (5			_				nanges per no	_	
Infiltration due to chimney If a pressurisation test has be					continue fr	20		÷ (5) =	0.12	(8)	
Number of storeys in the		teriaea, procee	u 10 (17), 1	ourer wise (onunue n	Om (9) 10 (70)		0	(9)	
Additional infiltration							[(9)	-1]x0.1 =	0	(10)	
Structural infiltration: 0.					•	uction			0	(11)	
if both types of wall are pr deducting areas of openin		orresponding to	the great	ter wall are	a (after						
If suspended wooden f	• /	sealed) or 0	.1 (seale	ed), else	enter 0				0	(12)	
If no draught lobby, ent	ter 0.05, else ente	r 0							0	(13)	
Percentage of windows	s and doors draug	ht stripped							0	(14)	
Window infiltration				0.25 - [0.2	. ,	_			0	(15)	
Infiltration rate	.50	. 12		(8) + (10)					0	(16)	
Air permeability value, If based on air permeabili	•		•	•	•	etre of e	envelope	area	5	(17)	
Air permeability value applies	,					is being u	sed		0.37	(18)	
Number of sides sheltere				,		-			2	(19)	
Shelter factor				(20) = 1 -		19)] =			0.85	(20)	
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.31	(21)	
Infiltration rate modified for				Ι.				_	1		
	<u> </u>	1ay Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind sp		2 22		0.7	4	1 40	1.5	4.7	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 = $(22a)$ m =	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			

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37		
Calculate effec		•	rate for t	he appli	cable ca	se	•	•	•	•	•		 1.
If mechanica			anadin NL (O	ah) (00-	· \ / .		\) (00-)			0	(23a
If exhaust air h		0		, ,	,	. `	***	,) = (23a)			0	(23b
If balanced with		-	-	_								0	(230
a) If balance	i				·	, 	r ´`	í `	, 	, 	<u>`</u>) ÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a
b) If balance	1				ı —	, 	ЛV) (24k	í `	2b)m + (23b)		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h				•	•				_				
	i		hen (240		·	· ·	· · · · ·	i	· ·	i e		1	(0.4-
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(240
d) If natural if (22b)n			ole hous m = (22b	•					0.5]				
(24d)m = 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(240
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)					
(25)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. Heat losse	e and he	at lose r	naramet	or:									_
ELEMENT Doors	Gros area		Openin m		Net Ar A ,r 3.57	m²	U-val W/m2		A X U (W/l	K)	k-value kJ/m²-		A X k kJ/K (26)
Win <mark>dows</mark> Type	e 1				1.81	_x 1	/[1/(1.4)+	0.04] =	2.4	П			(27)
Windows Type	2				2.1	x1	/[1/(1.4)+	0.04] =	2.78	П			(27)
Windows Type	3				1.05	x1	/[1/(1.4)+	0.04] =	1.39	5			(27)
Windows Type	e 4				7.35	x1	/[1/(1.4)+	0.04] =	9.74	=			(27)
Floor					24.59) x	0.13	: - -	3.1967	=		¬ г	(28)
Walls	58.8	21	15.88		42.93	=	0.18	-	7.73	ન ¦		╡╞	(29)
Total area of e			13.00			=	0.10	[7.70				(31)
Party wall	iorriorito	,			83.4	=		<u> </u>		— r			`
•					50.53	=	0	= [0			၂ 누	(32)
Party floor					42.46	<u> </u>						╡	(32a
Party ceiling					67.05	5				Ĺ		⊣ ⊢	(32b
Internal wall **					87.34					L			(320
* for windows and ** include the area	as on both	sides of in	nternal wali			lated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	n 3.2 	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30) + (32) =				31.5	(33)
Heat capacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	7951	.83 (34)
Thermal mass	parame	ter (TMF	P = Cm ÷	-TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess can be used inste				constructi	ion are no	t known pi	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
-	- 0 //												
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	penaix i	K						13.3	36)

Total fabric hea	ıt loss							(33) +	(36) =		í	44.9	(37)
Ventilation heat		alculated	l monthly	/					` '	25)m x (5)		44.9	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 32.09	31.92	31.75	30.96	30.81	30.12	30.12	29.99	30.38	30.81	31.11	31.42		(38)
Heat transfer co	pefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m= 76.99	76.82	76.65	75.86	75.71	75.02	75.02	74.89	75.28	75.71	76.01	76.32		
Heat loss paran	neter (H	HLP), W/	′m²K			-			Average = = (39)m ÷	Sum(39) _{1.} (4)	12 /12=	75.85	(39)
(40)m= 1.15	1.15	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.13	1.14		
Number of days	s in mor	nth (Tab	le 1a)			-	-	,	Average =	Sum(40) _{1.}	12 /12=	1.13	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
					-		-						
4. Water heati	ng ener	gy requi	rement:								kWh/ye	ear:	
A													
Assumed occup if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)1 + 0.(0013 x (ΓFA -13.		17		(42)
if TFA £ 13.9		•	i. ovb	(0.0000	, 10 x (11	71 10.0	/_/] . 0.0) N 010 N (,	0)			
Annual average											5.8		(43)
Reduce the annual not more that 125 li					_	-	to achieve	a water us	se target o	†			
Jan	Feb	Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in			Apr ach month			-		Seh	Oct	INOV	Dec		
(44)m= 94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37		
` '								-	Γotal = Su	m(44) ₁₁₂ =	<u> </u>	1029.54	(44)
Energy content of h	not water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	th (see Ta	bles 1b, 1	c, 1d)		_
(45)m= 139.96	122.41	126.31	110.12	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		
If instantaneous wa			-f (h (4C		Γotal = Su	m(45) ₁₁₂ =	=	1349.89	(45)
If instantaneous wa	1										ı ı		
(46)m= 20.99 Water storage	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
Storage volume		includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community he	. ,					_					<u> </u>		()
Otherwise if no	•			•			` '	ers) ente	er '0' in (47)			
Water storage l	oss:												
a) If manufactu	ırer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature fa	ctor fro	m Table	2b								0		(49)
Energy lost from		_	-				(48) x (49)) =			0		(50)
b) If manufactured Hot water storage			-										(51)
If community he	-			C 2 (KVV)	ii/iiti c/uc	ху)					0		(51)
Volume factor fi	_										0		(52)
Temperature fa	ctor fro	m Table	2b							-	0		(53)
Energy lost from	n water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (5	54) in (5	55)									0		(55)

Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nual) fro	m Table	3							0		(58)
Primary circuit	•	,			59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)		_	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 48.09	41.86	44.59	41.46	41.1	38.08	39.35	41.1	41.46	44.59	44.85	48.09		(61)
Total heat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 188.05	164.26	170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63		(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additiona	I lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)				_	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter										_	
(64)m= 188.05	164.26	170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63		_
							Outp	out from wa	ater heate	r (annual)	112	1864.52	(64)
Hea <mark>t gains fro</mark>	m water	heating,	kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)n	1] + 0.8 >	([(46)m	+ (57)m	+ (59)m	1	
(65)m= 58.56	51.16	53.15	46.98	45.41	39.84	37.93	42.51	42.99	49.17	52.71	57.09		(65)
in <mark>clude</mark> (57)	m in calc	culation of	of (65)m	only if o	vlindor i								
			31 (00)111	Offiny if C	yiiiidei i	s in the o	dwelling	or hot w	ate <mark>r is fr</mark>	om com	munity h	eating	
5. Internal ga	ains (see				yiirideri	s in the d	dwelling	or hot w	ater is fr	om com	munity h	neating	
Internal gaMetabolic gair		Table 5	and 5a		yiirider is	s in the d	dwelling	or hot w	ater is fr	om com	munity h	neating	
		Table 5	and 5a		Jun	Jul	Aug	or hot w	ater is fr	Nov	Dec	neating	
Metabolic gair	s (Table	Table 5	and 5a):								neating	(66)
Metabolic gair	Feb 108.62	Table 5 5), Wat Mar 108.62	and 5a ts Apr 108.62	May 108.62	Jun 108.62	Jul 108.62	Aug 108.62	Sep 108.62	Oct	Nov	Dec	neating	(66)
Metabolic gair Jan (66)m= 108.62	Feb 108.62	Table 5 5), Wat Mar 108.62	and 5a ts Apr 108.62	May 108.62	Jun 108.62	Jul 108.62	Aug 108.62	Sep 108.62	Oct	Nov	Dec	neating	(66)
Metabolic gain Jan (66)m= 108.62 Lighting gains	Feb 108.62 (calcula	Table 5 5), Wat Mar 108.62 ted in Ap	Apr 108.62 opendix 9.28	May 108.62 L, equat 6.94	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5 11.04	Oct 108.62	Nov 108.62	Dec 108.62	neating	, ,
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97	res (Table Feb 108.62 (calcula 15.07 ins (calc	Table 5 5), Wat Mar 108.62 ted in Ap	Apr 108.62 opendix 9.28	May 108.62 L, equat 6.94	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5 11.04	Oct 108.62	Nov 108.62	Dec 108.62	neating	, ,
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga	res (Table Feb 108.62 (calcula 15.07 ins (calcula 192.29	Table 5 9 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31	Apr 108.62 ppendix 9.28 Appendix 176.72	May 108.62 L, equat 6.94 dix L, eq	Jun 108.62 ion L9 o 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta 145.38	Oct 108.62 14.02 ble 5 155.98	Nov 108.62	Dec 108.62	neating	(67)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32	res (Table Feb 108.62 (calcula 15.07 ins (calcula 192.29	Table 5 9 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31	Apr 108.62 ppendix 9.28 Appendix 176.72	May 108.62 L, equat 6.94 dix L, eq	Jun 108.62 ion L9 o 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta 145.38	Oct 108.62 14.02 ble 5 155.98	Nov 108.62	Dec 108.62	leating	(67)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains	res (Table Feb 108.62 (calcula 15.07 ins (calcula 192.29 (calcula 33.86	Mar 108.62 ted in Ap 12.26 ulated in 187.31 ated in A	Apr 108.62 opendix 9.28 Append 176.72 opendix 33.86	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a)	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 5 see Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	neating	(67) (68)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86	res (Table Feb 108.62 (calcula 15.07 ins (calcula 192.29 (calcula 33.86	Mar 108.62 ted in Ap 12.26 ulated in 187.31 ated in A	Apr 108.62 opendix 9.28 Append 176.72 opendix 33.86	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a)	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 5 see Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	neating	(67) (68)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fair	res (Table Feb 108.62 (calcula 15.07 ins (calcula 33.86 ins gains 3	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 tted in Ap 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	neating	(67) (68) (69)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3	res (Table Feb 108.62 (calcula 15.07 ins (calcula 33.86 ins gains 3	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 tted in Ap 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	neating	(67) (68) (69)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. ev	reportion (calcular section) (ca	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 tted in Ap 33.86 (Table 5 3 on (negation)	Apr 108.62 opendix 9.28 Append 176.72 opendix 33.86 5a) 3	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	leating	(67) (68) (69) (70)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fail (70)m= 3 Losses e.g. ev (71)m= -86.9	reportion (calcular section) (ca	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 tted in Ap 33.86 (Table 5 3 on (negation)	Apr 108.62 opendix 9.28 Append 176.72 opendix 33.86 5a) 3	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	neating	(67) (68) (69) (70)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. ev (71)m= -86.9 Water heating	res (Table Feb 108.62 (calcula 15.07 ins (calcula 192.29 (calcula 33.86 ns gains 3 vaporatio -86.9 gains (T	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation of the companion of the	Apr 108.62 opendix 9.28 Appendix 176.72 opendix 33.86 5a) 3 tive valu	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86 3	Oct 108.62 14.02 ble 5 155.98 5 33.86 3 -86.9	Nov 108.62 16.36 169.35 33.86 3 -86.9	Dec 108.62 17.44 181.92 33.86 3	neating	(67) (68) (69) (70) (71)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. ev (71)m= -86.9 Water heating (72)m= 78.71	res (Table Feb 108.62 (calcula 15.07 ins (calcula 192.29 (calcula 33.86 ns gains 3 vaporatio -86.9 gains (T	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation of the companion of the	Apr 108.62 opendix 9.28 Appendix 176.72 opendix 33.86 5a) 3	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86 3	Oct 108.62 14.02 ble 5 155.98 5 33.86 3 -86.9	Nov 108.62 16.36 169.35 33.86 3 -86.9	Dec 108.62 17.44 181.92 33.86 3	neating	(67) (68) (69) (70) (71)

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

Northeast 0.9x		cess Factor ble 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.8%	Northeast _{0.9x}	0.77	x	1.81	x	11.28	x	0.63	x	0.7	=	6.24	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	22.97	x	0.63	x	0.7	=	12.7	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.81	х	41.38	X	0.63	x	0.7	=	22.89	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	67.96	x	0.63	x	0.7] =	37.59	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.81	х	91.35	X	0.63	x	0.7	=	50.53	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	97.38	X	0.63	x	0.7	=	53.87	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	91.1	x	0.63	x	0.7	=	50.39	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	72.63	X	0.63	x	0.7	=	40.17	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	50.42	x	0.63	x	0.7	=	27.89	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	28.07	x	0.63	x	0.7	=	15.53	(75)
Southeast 0.9x	Northeast _{0.9x}	0.77	x	1.81	x	14.2	x	0.63	x	0.7	=	7.85	(75)
Southeast 0,9x	Northeast _{0.9x}	0.77	x	1.81	x	9.21	x	0.63	x	0.7	=	5.1	(75)
Southeast 0.9x	Southeast _{0.9x}	0.77	x	1.05	x	36.79	X	0.63	x	0.7	=	11.81	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.05	X	62.67	X	0.63	x	0.7	=	20.11	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	x	1.05	x	85.75	x	0.63	x	0.7	=	27.52	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.05	X	106.25	X	0.63	X	0.7	=	34.1	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.05	х	119.01	x	0.63	x	0.7	_	38.19	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	X	1.05	х	118.15	x	0.63	x	0.7	=	37.91	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	X	1.05	х	113.91	x	0.63	x	0.7	=	36.55	(77)
Southeast 0.9x 0.77 x 1.05 x 69.27 x 0.63 x 0.7 = 22.23 (77) Southeast 0.9x 0.77 x 1.05 x 44.07 x 0.63 x 0.7 = 14.14 (77) Southwest 0.9x 0.77 x 7.35 x 36.79 0.63 x 0.7 = 10.1 (77) Southwest 0.9x 0.77 x 7.35 x 62.67 0.63 x 0.7 = 140.78 (79) Southwest 0.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 140.78 (79) Southwest 0.9x 0.77 x 7.35 x 106.25 0.63 x 0.7 = 140.78 (79) Southwest 0.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 265.4 (79) Southwe	Southeast _{0.9x}	0.77	X	1.05	x	104.39	Х	0.63	x	0.7	=	33.5	(77)
Southeast 0.9x 0.77 x 1.05 x 44.07 x 0.63 x 0.7 = 14.14 (77) Southeast 0.9x 0.77 x 1.05 x 31.49 x 0.63 x 0.7 = 10.1 (77) Southwest0.9x 0.77 x 7.35 x 62.67 0.63 x 0.7 = 140.78 (79) Southwest0.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 140.78 (79) Southwest0.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 140.78 (79) Southwest0.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 238.67 (79) Southwest0.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwest0.	Southeast _{0.9x}	0.77	x	1.05	x	92.85	×	0.63	x	0.7	=	29.8	(77)
Southeast 0.9x 0.77 x 1.05 x 31.49 x 0.63 x 0.7 = 10.1 (77) Southwest0.9x 0.77 x 7.35 x 36.79 0.63 x 0.7 = 82.65 (79) Southwest0.9x 0.77 x 7.35 x 62.67 0.63 x 0.7 = 140.78 (79) Southwest0.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 192.62 (79) Southwest0.9x 0.77 x 7.35 x 106.25 0.63 x 0.7 = 238.67 (79) Southwest0.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 267.33 (79) Southwest0.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwest0.9x <td< td=""><td>Southeast 0.9x</td><td>0.77</td><td>X</td><td>1.05</td><td>х</td><td>69.27</td><td>X</td><td>0.63</td><td>x</td><td>0.7</td><td>=</td><td>22.23</td><td>(77)</td></td<>	Southeast 0.9x	0.77	X	1.05	х	69.27	X	0.63	x	0.7	=	22.23	(77)
Southwesto.9x 0.77 x 7.35 x 36.79 0.63 x 0.7 = 82.65 (79) Southwesto.9x 0.77 x 7.35 x 62.67 0.63 x 0.7 = 140.78 (79) Southwesto.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 192.62 (79) Southwesto.9x 0.77 x 7.35 x 106.25 0.63 x 0.7 = 238.67 (79) Southwesto.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 238.67 (79) Southwesto.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwesto.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 255.87 (79) Southwesto.9x 0.77	Southeast 0.9x	0.77	x	1.05	x	44.07	X	0.63	X	0.7	=	14.14	(77)
Southwesto.9x 0.77 x 7.35 x 62.67 0.63 x 0.7 = 140.78 (79) Southwesto.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 192.62 (79) Southwesto.9x 0.77 x 7.35 x 106.25 0.63 x 0.7 = 238.67 (79) Southwesto.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 238.67 (79) Southwesto.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwesto.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 255.87 (79) Southwesto.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwesto.9x 0.77	Southeast _{0.9x}	0.77	X	1.05	x	31.49	X	0.63	x	0.7	=	10.1	(77)
Southwesto.9x 0.77 x 7.35 x 85.75 0.63 x 0.7 = 192.62 (79) Southwesto.9x 0.77 x 7.35 x 106.25 0.63 x 0.7 = 238.67 (79) Southwesto.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 267.33 (79) Southwesto.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwesto.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 265.4 (79) Southwesto.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwesto.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 208.57 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	7.35	X	36.79		0.63	X	0.7	=	82.65	(79)
Southwesto.9x 0.77 x 7.35 x 106.25 0.63 x 0.7 = 238.67 (79) Southwesto.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 267.33 (79) Southwesto.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwesto.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 255.87 (79) Southwesto.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwesto.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 234.49 (79) Southwesto.9x 0.77 x 7.35 x 69.27 0.63 x 0.7 = 155.59 (79) Southwesto.9x 0.77	Southwest _{0.9x}	0.77	X	7.35	x	62.67		0.63	x	0.7	=	140.78	(79)
Southwest0.9x 0.77 x 7.35 x 119.01 0.63 x 0.7 = 267.33 (79) Southwest0.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwest0.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 255.87 (79) Southwest0.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwest0.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 208.57 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 155.59 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Northwest 0.9x 0.77	Southwest _{0.9x}	0.77	X	7.35	x	85.75		0.63	x	0.7	=	192.62	(79)
Southwest0.9x 0.77 x 7.35 x 118.15 0.63 x 0.7 = 265.4 (79) Southwest0.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 255.87 (79) Southwest0.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwest0.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 208.57 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Northwest0.9x 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest0.9x 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = <	Southwest _{0.9x}	0.77	X	7.35	X	106.25		0.63	x	0.7] =	238.67	(79)
Southwesto.9x 0.77 x 7.35 x 113.91 0.63 x 0.7 = 255.87 (79) Southwesto.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwesto.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 208.57 (79) Southwesto.9x 0.77 x 7.35 x 69.27 0.63 x 0.7 = 155.59 (79) Southwesto.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Southwesto.9x 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest 0.9x 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = 7.24 (81) Northwest 0.9x	Southwest _{0.9x}	0.77	X	7.35	X	119.01		0.63	x	0.7] =	267.33	(79)
Southwest0.9x 0.77 x 7.35 x 104.39 0.63 x 0.7 = 234.49 (79) Southwest0.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 208.57 (79) Southwest0.9x 0.77 x 7.35 x 69.27 0.63 x 0.7 = 155.59 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Southwest0.9x 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest 0.9x 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = 7.24 (81) Northwest 0.9x 0.77 x 2.1 x 22.97 x 0.63 x 0.7 = 14.74 (81)	Southwest _{0.9x}	0.77	X	7.35	X	118.15		0.63	X	0.7	=	265.4	(79)
Southwest0.9x 0.77 x 7.35 x 92.85 0.63 x 0.7 = 208.57 (79) Southwest0.9x 0.77 x 7.35 x 69.27 0.63 x 0.7 = 155.59 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Southwest0.9x 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest 0.9x 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = 7.24 (81) Northwest 0.9x 0.77 x 2.1 x 22.97 x 0.63 x 0.7 = 14.74 (81)	Southwest _{0.9x}	0.77	X	7.35	x	113.91		0.63	x	0.7	=	255.87	(79)
Southwest0.9x 0.77 x 7.35 x 69.27 0.63 x 0.7 = 155.59 (79) Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Southwest0.9x 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest 0.9x 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = 7.24 (81) Northwest 0.9x 0.77 x 2.1 x 22.97 x 0.63 x 0.7 = 14.74 (81)	Southwest _{0.9x}	0.77	X	7.35	x	104.39		0.63	x	0.7	=	234.49	(79)
Southwest0.9x 0.77 x 7.35 x 44.07 0.63 x 0.7 = 98.99 (79) Southwest0.9x 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest 0.9x 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = 7.24 (81) Northwest 0.9x 0.77 x 2.1 x 22.97 x 0.63 x 0.7 = 14.74 (81)	Southwest _{0.9x}	0.77	X	7.35	X	92.85		0.63	X	0.7	=	208.57	(79)
Southwest _{0.9x} 0.77 x 7.35 x 31.49 0.63 x 0.7 = 70.73 (79) Northwest _{0.9x} 0.77 x 2.1 x 11.28 x 0.63 x 0.7 = 7.24 (81) Northwest _{0.9x} 0.77 x 2.1 x 22.97 x 0.63 x 0.7 = 14.74 (81)	Southwest _{0.9x}	0.77	X	7.35	X	69.27		0.63	X	0.7	=	155.59	(79)
Northwest 0.9x	Southwest _{0.9x}	0.77	X	7.35	x	44.07		0.63	x	0.7	=	98.99	(79)
Northwest 0.9x	Southwest _{0.9x}	0.77	x	7.35	x	31.49]	0.63	x	0.7] =	70.73	(79)
	Northwest 0.9x	0.77	x	2.1	x	11.28	X	0.63	x	0.7] =	7.24	(81)
Northwest $0.9x$ 0.77 x 2.1 x 41.38 x 0.63 x 0.7 = 26.56 (81)	<u></u>	0.77	x	2.1	x	22.97	X	0.63	x	0.7] =	14.74	(81)
	Northwest _{0.9x}	0.77	X	2.1	X	41.38	X	0.63	X	0.7	=	26.56	(81)

Northwest _{0.9x}	0.77	X	2.	1	X	6	7.96	X		0.63	x	0.7	=	43.61	(81)
Northwest _{0.9x}	0.77	X	2.	1	X	9	1.35	X		0.63	x	0.7		58.62	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	7.38	X		0.63	Х	0.7	=	62.5	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	91.1	X		0.63	x	0.7	=	58.47	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	7	2.63	X		0.63	x	0.7	=	46.61	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	5	0.42	X		0.63	х	0.7	=	32.36	(81)
Northwest 0.9x	0.77	X	2.	1	x	2	8.07	x		0.63	x [0.7		18.01	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	1	14.2	X		0.63	x [0.7	=	9.11	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	9.21	X		0.63	x	0.7	=	5.91	(81)
Solar gains in y	vatts, ca	lculated	for eac	h month		_		(83)m	= Su	m(74)m .	(82)m			_	
(83)m= 107.94	188.34	269.59	353.97	414.67	4	19.68	401.28	354	.77	298.61	211.36	130.1	91.84		(83)
Total gains – ir	iternal ar	nd solar	(84)m =	= (73)m ·	+ (8	33)m ,	, watts					_		_	
(84)m= 452.51	530.42	599.18	663.8	704.57	69	90.23	659.56	619	.13	573.33	506.02	447.61	426.52	!	(84)
7. Mean interr	nal tempe	erature	(heating	season)										
Temperature	during he	eating p	eriods ir	the livi	ng :	area f	rom Tab	ole 9,	Th1	(°C)				21	(85)
Utilisation fact	tor for ga	ins for I	iving are	ea, h1,m	(se	ee Ta	ble 9a)								
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.94	0.84	(0.66	0.49	0.5	54	0.79	0.96	0.99	1		(86)
Mean internal	tempera	ture in l	living are	ea T1 (fo	ollo.	w stei	os 3 to 7	in T	able	(9c)			•		
(87)m= 19.83	20	20.26	20.59	20.84		0.96	20.99	20.		20.91	20.58	20.14	19.8		(87)
Temperature	during b	acting p	oriodo ir	root of	ما ا	م مناله	from To	blo (Th	2 (%C)					
(88)m= 19.96	19.96	19.97	19.98	19.98		9.99	19.99	19.	_	19.98	19.98	19.97	19.97	7	(88)
` '								<u> </u>		10.00	10.00	10.07	10.07		()
Utilisation fact	<u>_</u>	ı				`		<u> </u>	<u> T</u>	0.74	0.04	0.00		7	(90)
(89)m= 1	0.99	0.97	0.92	0.78		0.57	0.38	0.4		0.71	0.94	0.99	1		(89)
Mean internal		-			-	`		·			e 9c)	,		_	
(90)m= 18.41	18.67	19.04	19.5	19.82	1	9.96	19.98	19.	98	19.91	19.5	18.87	18.37		(90)
										f	LA = Livir	ng area ÷ (4	4) =	0.54	(91)
Mean internal	tempera	ture (fo	r the wh	ole dwe	lling	g) = fL	_A × T1	+ (1	– fL	A) × T2				_	
(92)m= 19.17	19.38	19.7	20.08	20.37	2	20.5	20.52	20.	52	20.45	20.07	19.55	19.13		(92)
Apply adjustm	ent to th	e mean	interna	temper	_		m Table	4e,	whe	e appro	priate	•		_	
(93)m= 19.17	19.38	19.7	20.08	20.37	2	20.5	20.52	20.	52	20.45	20.07	19.55	19.13		(93)
8. Space heat															
Set Ti to the n the utilisation					ed	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m=(76)m an	d re-ca	lculate	
Jan	Feb	Mar	Apr	May	Г	Jun	Jul	Δ	ug	Sep	Oct	Nov	Dec	7	
Utilisation fact		!		iviay		Juli	Jui		ug	Оер	Oct	1404	Dec		
(94)m= 0.99	0.99	0.97	0.92	0.8		0.62	0.44	0.4	19	0.75	0.94	0.99	1	٦	(94)
Useful gains,				L 4)m	<u> </u>			<u> </u>				<u> </u>	<u> </u>		
(95)m= 449.94	523.71	581.06	610.37	567.12	42	25.21	291.77	304	1.3	431.23	477.47	442.31	424.68		(95)
Monthly avera	ige exter	nal tem	perature	from T	able	е 8	I			!	I	1	1	_	
(96)m= 4.3	4.9	6.5	8.9	11.7	1	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	for mea	n intern	al tempe	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	(96)m]			_	
(97)m= 1144.92	1112.46	1011.47	848.11	656.13	44	42.52	294.37	308	.67	477.74	717.28	946.35	1139.7	7	(97)

Space heating red 8)m= 517.06 395		320.23	171.18	66.22	0	0.02	0	0	178.41	362.91	532.02		
011.00	<u> </u>	020.20	171110	00.22					(kWh/year	l		2543.67	(98)
Space heating red	uire	ement in	kWh/m²	/vear						,	, [37.94	⅃ ີ່ (99)
a. Energy require	•			•	vstems i	ncludina	micro-C	:HP)			<u>l</u>		J` ′
Space heating:	11011	to mai	vidual II	caming o	yotomo i	nordanig	TITIOTO C	/1 II <i>)</i>					
raction of space	hea	t from se	econdar	//supple	mentary	system						0	(20
raction of space	hea	t from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(20
Fraction of total he	eatir	ng from i	main sys	stem 1			(204) = (20	02) x [1 –	(203)] =			1	(20
Efficiency of main	spa	ce heati	ing syste	m 1								93.4	(20
Efficiency of seco	ndar	y/supple	ementar	y heating	g system	າ, %						0	(20
Jan F	eb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating red		`			·				l		<u>-</u> 1		
517.06 395	!	320.23	171.18	66.22	0	0	0	0	178.41	362.91	532.02		
(11) m = {[(98)m x) (553.6) 423		4)] } x 1	00 ÷ (20 183.27	6) 70.9	0	0	0	0	191.02	388.55	569.62		(21
555.6 425	59	342.00	103.21	70.9		0			ar) =Sum(2			2723.42	(21
Space heating fue	l (se	econdar	v) kWh/	month						715,1012	L	2125.42](
{[(98)m x (201)] }													
15)m= 0 0		0	0	0	0	0	0	0	0	0	0		
							Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}		0	(21
ater heating		, ,											
utput from water		er (calc 170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63		
fficiency of water	hea	ter										80.3	(21
17)m= 87.47 87.	18	86.61	85.36	83.19	80.3	80.3	80.3	80.3	85.34	86.92	87.57		(21
uel for water heat	0,												
(19)m = (64) m x (19)m = (214.99) 188	$\overline{}$	÷ (217) 197.33	m 177.59	176.42	160.97	154.22	171.92	173.82	186.23	195.2	209.69		
2100 1.00		107.00	117.00	170.12	100.01	101.22			19a) ₁₁₂ =	100.2	200.00	2206.8	(21
nnual totals										Wh/year	. L	kWh/year	٦,
pace heating fuel	use	d, main	system	1						•		2723.42	
ater heating fuel	use	d										2206.8	7
ectricity for pump	s, fa	ans and	electric	keep-ho	t						•		-
central heating pu	mp:										30		(23
ooiler with a fan-a											45		(23
otal electricity for			(Wh/vea	r			sum	of (230a).	(230g) =			75	`] ₍₂₃
ectricity for lighting			vii/yoa	•				(· - 3/] [](23
otal delivered ene	•	for -!!	/044	\ (004)	. (004)	. (000)	(0071-)				[[299.64	╣
	ranı		~~~ <i>(*)</i> 1 1	. 1.7771	エルンス11	エ・フィン	1:23/61	_				5304.85	(33

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	588.26 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	476.67 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1064.93 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519	155.51 (268)
Total CO2, kg/year	sum	n of (265)(271) =	1259.36 (272)
TER =			18.78 (273)

Stroma Name: Stroma FSAP 2012 Software Version: Version: 1,0.5.41			User E	Details:						
## Action		Stroma FSAP 2012		Softwa	are Ve	rsion:		Versic	on: 1.0.5.41	
Area(m²)	A dalage -	2 Pad ME Landan TPC	·	Address	: 2 Bed -	- MF				
Area(m²) Av. Height(m) Volume(m)		·								
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)			Are	a(m²)		Av. He	ight(m)		Volume(m ³)
Dwelling volume	Ground floor		(67.05	(1a) x	2	2.5	(2a) =	167.63	(3a)
2. Ventilation rate: main heating heati	Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+((1n) (1)	67.05	(4)			_		_
Number of chimneys	Dwelling volume				(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	167.63	(5)
Number of chimneys	2. Ventilation rate:									
Number of chimneys				other		total			m³ per hou	r
Number of intermittent fans 2	Number of chimneys			0	=	0	X 4	40 =	0	(6a)
Number of passive vents	Number of open flues	0 + 0	+ [0	= [0	x 2	20 =	0	(6b)
Number of flueless gas fires	Number of intermittent fa	ns				2	x .	10 =	20	(7a)
Air changes per hour	Number of passive vents				Ī	0	x ·	10 =	0	(7b)
Infiltration due to chirnneys, flues and fans = (68)+(6b)+(7a)+(7b)+(7c) = 20	Number of flueless gas fi	res			Ī	0	X 4	40 =	0	(7c)
Number of storeys in the dwelling (ns) Additional infiltration (9)-1]x0.1 = 0 (10)								Air ch	anges per ho	our
Number of storeys in the dwelling (ns) Additional infiltration (10) (10)								÷ (5) =	0.12	(8)
Additional infiltration			eed to (17),	otherwise (continue fr	om (9) to (16)		0	1 (9)
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 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 · [0.2 × (14) ÷ 100] = 0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 · [0.075 × (19)] = 0.85 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 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		io differential (116)					[(9)	-1]x0.1 =		—
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	Structural infiltration: 0.	.25 for steel or timber frame	or 0.35 fo	r masoni	y consti	uction			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration Unifiltration rate Window in permeability value, q50, expressed in cubic metres per hour per square metre of envelope area are permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Infiltration rate incorporating shelter factor Infiltration rate modified for monthly wind speed Infiltration rate modified for monthly wind speed Monthly average wind speed from Table 7 (22) m = 5.1	,	•	g to the grea	ter wall are	a (after					
If no draught lobby, enter 0.05, else enter 0	,	• /- /	0.1 (seale	ed), else	enter 0				0	(12)
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $(17) \div (17) \div (17) \div (17) \div (17) \div (18) + (18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered $(20) = 1 - [0.075 \times (19)] = 0.85$ (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.31$ (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= $(21) = (18) \times (20) = 0.31$ (21) Wind Factor $(22a)m = (22)m \div 4$	If no draught lobby, ent	ter 0.05, else enter 0	•	·					0	= '
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = O (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = O (16) 0.37 (18) 0.37 (18) Vind Factor (20) = 1 - [0.075 x (19)] = O (15) 0.46 0.37 (18) 0.37 (18) 0.37 (19) 0.85 (20) 1.5 0.85 (20) 1.6 0.37 (18) 0.37 (18) 0.37 (19) 2.1 0.85 (20) 1.6 0.37 (18) 0.37 (18) 2.1 0.85 (20) 1.6 0.37 (18) 2.1 0.85 (20) 1.7 0.85 (20) 1.8 0.85 (20) 1.9 0.85 (20) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.32 (22) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.31 (21) 0.32 (22) 0.31 (23) 0	Percentage of windows	s and doors draught stripped	i						0	(14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = $[(17) \div 20] + (8)$, otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)]$ = 0.85 (20) Infiltration rate incorporating shelter factor (21) = $(18) \times (20)$ = 0.31 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= $[5.1, 5, 4.9, 4.4, 4.3, 3.8, 3.8, 3.7, 4, 4.3, 4.5, 4.7, 4.7, 4.7, 4.7, 4.7, 4.7, 4.7, 4.7$	Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.85 (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 $(22)m = 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7$ Wind Factor $(22a)m = (22)m \div 4$									0	(16)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] = $ $(21) = (18) \times (20) = $ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = $ $(21) = (18) \times (20) = $ Onumber of sides sheltered $(21) = (18) \times (20) = $ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = $ Onumber of sides sheltered $(21) = (18) \times (20) = $ Infiltration rate modified for monthly wind speed $(21) = (18) \times (20) = $ Onumber of sides sheltered $(22) = (18) \times (20) = $ Onumber of sides sheltered $(22) = (18) \times (20) = $ Onumber of sides sheltered $(23) = (18) \times (20) = $ Onumber of sides sheltered $(24) = (18) \times (20) = $ Onumber of sides sheltered $(24) = (18) \times (20) = $ Onumber of sides sheltered $(24) = (18) \times (20) $	•	·			•	etre of e	nvelope	area	5	=
Number of sides sheltered $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (21) = (18) \times (20) = $ $ (22) = (18) \times (20) = $ $ (21) = (18) \times (20) = $ $ (22) = (18) \times (20) = $ $ (21) = (18) \times (20) = $ $ (21) = (18) \times (20) = $ $ (22) = (18) \times (20) = $ $ (22) = (18) \times (20) = $ $ (23) = (18) \times (20) = $ $ (24) = (18) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times (20) = $ $ (25) = (20) \times $	•	•				is being us	sed.		0.37	(18)
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.85 $		•	done or a de	gree an pe	тпеаышу	is being us	o c u		2	(19)
Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec				(20) = 1 -	[0.075 x (19)] =				⊣ ``
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorporat	ing shelter factor		(21) = (18) x (20) =				0.31	(21)
Monthly average wind speed from Table 7 (22)m= $\begin{bmatrix} 5.1 & 5 & 4.9 & 4.4 & 4.3 & 3.8 & 3.7 & 4 & 4.3 & 4.5 & 4.7 \end{bmatrix}$ Wind Factor (22a)m = (22)m \div 4	Infiltration rate modified for	or monthly wind speed								_
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Jan Feb	Mar Apr May Jur	n Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	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								
		` 	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infilt	ration rat	e (allowi	ing for sh	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37	1	
Calculate effe		_	rate for t	he appli	cable ca	se				!			
If mechanic			andiv NL (O	ah) (aa	a) Fan. (augtion (I	NEV otho	muiaa (22h	\ (220\			0	(23a)
If exhaust air h) = (23a)			0	(23b)
		-	-	_					26\m . /	22h) [:	1 (220)	0	(23c)
a) If balance (24a)m= 0			o lination	o with ne	0		$\frac{1}{1}$ $\frac{1}{0}$	$\frac{1}{1} = \frac{2}{2}$	0	230) x [0	1 - 100]]	(24a)
b) If balance	ļ.		ļ									J	(= 15)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If whole I		tract ver		or positiv		ventilatio	on from (L outside				J	,
,			then (24	•					5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural if (22b)			ole hous m = (22t	•					0.5]		•	•	
(24d)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)	-	-	-	-	
(25)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. Heat losse	es and he	eat loss	paramete	er:							_	_	
ELEMENT	Gros area	ss	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-		A X k kJ/K
Doors					3.57	x	1.2	= [4.284				(26)
Windows Typ	e 1				1.81	x1	/[1/(1.4)+	0.04] =	2.4	Ħ			(27)
Windows Typ	e 2				2.1	x1	/[1/(1.4)+	0.04] =	2.78	Ħ			(27)
Windows Typ	e 3	'			1.05	x1	/[1/(1.4)+	0.04] =	1.39	5			(27)
Windows Typ	e 4				7.35	x1	/[1/(1.4)+	0.04] =	9.74				(27)
Walls	58.8	31	15.88	В	42.93	3 x	0.18		7.73				(29)
Total area of	elements	s, m²			58.8	<u> </u>							(31)
Party wall					50.53	3 x	0	=	0				(32)
Party floor					67.05	5						-	(32a)
Party ceiling					67.05	5				Ī		7 F	(32b)
Internal wall *	*				87.34	=				ו			(32c)
* for windows and ** include the are						ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	n 3.2	
Fabric heat lo	ss, W/K	= S (A x	U)				(26)(30) + (32) =				28.33	(33)
Heat capacity	Cm = S	(A x k)						((28)	(30) + (32	2) + (32a).	(32e) =	7091.	18 (34)
Thermal mass	s parame	eter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design asses can be used inste				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridg	es : S (L	x Y) cal	culated i	using Ap	pendix I	<						5.75	(36)
if details of therm Total fabric he		are not kn	nown (36) =	= 0.05 x (3	31)			(22) -	(26) -				
	สเบอร์ร							(33) +	(36) =			34.09	9 (37)

Ventila	tion hea	at loss ca	alculated	l monthly	У				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.09	31.92	31.75	30.96	30.81	30.12	30.12	29.99	30.38	30.81	31.11	31.42		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	66.17	66	65.83	65.04	64.89	64.2	64.2	64.08	64.47	64.89	65.19	65.51		
Heat Id	ss para	meter (F	HLP), W/	′m²K				-		Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	65.04	(39)
(40)m=	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.97	0.97	0.98		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁ .	12 /12=	0.97	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ener	rgy requi	rement:								kWh/ye	ear:	
Assum	ed occu	ipancy, I	N								2	.17		(42)
if TF		9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.				(:=)
								(25 x N)				5.8		(43)
			not water person per				-	to achieve	a water us	se target o	Ť			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea						Оер	Oct	1404			
(44)m=	94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37		
											m(44) ₁₁₂ =		1029.54	(44)
								OTm / 3600						
(45)m=	139.96	122.41	126.31	110.12	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54	40.40.00	7(45)
If instant	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		10tai = Su	m(45) ₁₁₂ =	= [1349.89	(45)
(46)m=	20.99	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
	storage													
•		` ,					•	within sa	ame ves	sel		0		(47)
Otherw	ise if no	stored	nd no ta hot wate		•			(47) ombi boil	ers) ente	er '0' in (47)			
	storage anufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
,			m Table			`	3,					0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
			eclared o	-										
			factor fr ee section		e 2 (kWl	h/litre/da	ıy)					0		(51)
	-	from Tal		011 4.3								0		(52)
			m Table	2b							_	0		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
		(54) in (5	-	,					•			0		(55)
Water	storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)

If cylinder contain	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) - (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circu Primary circu (modified b	it loss cal	culated t	for each	month (,	` '	` '		r thermo		0		(58)
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
	loulotod	for each	month /	(61)m –	(60) · 20	L	l	<u> </u>	<u> </u>	<u> </u>	<u> </u>		
Combi loss ca (61)m= 48.09	41.86	44.59	41.46	41.1	38.08	39.35	41.1	41.46	44.59	44.85	48.09		(61)
` '						ļ	ļ				<u> </u>	J (59)m + (61)m	, ,
(62)m= 188.05	. 	170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63	(39)111 + (01)11]	(62)
Solar DHW input					l	l			L	<u> </u>			(/
(add additiona									ii continbut	ion to wat	or ricating)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from v	vater hea	ter			<u> </u>			!	<u> </u>	<u> </u>	<u> </u>	1	
(64)m= 188.05		170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63		
	1	l					Outp	out from w	ater heate	ı r (annual)₁	12	1864.52	(64)
Heat gains fro	om water	heating	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	า] + 0.8 :	x [(46)m	+ (57)m	+ (59)m		
(65)m = 58.56		53.15	46.98	45.41	39.84	37.93	42.51	42.99	49.17	52.71	57.09	Ĺ	(65)
include (57)m in calc	culation	of (65)m	only if c	ylinder is	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal g			, ,									9	
	Jan 15 (55)												
Metabolic dai	ns (Table	5) Wat	te							_	_	_	
Metabolic gai Jan				May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Jan (66)m= 108.62	Feb	5), Wat Mar 108.62	Apr 108.62	May 108.62	Jun 108.62	Jul	Aug 108.62	Sep 108.62	Oct 108.62	Nov 108.62	Dec 108.62		(66)
(66)m= Jan 108.62	Feb 108.62	Mar 108.62	Apr 108.62	108.62	108.62	108.62	108.62	108.62			-		(66)
Jan	Feb 108.62	Mar 108.62	Apr 108.62	108.62	108.62	108.62	108.62	108.62			-		(66) (67)
Jan (66)m= 108.62 Lighting gains	Feb 108.62 s (calcula 15.07	Mar 108.62 ted in Ap 12.26	Apr 108.62 opendix 9.28	108.62 L, equat 6.94	108.62 ion L9 or 5.86	108.62 r L9a), a 6.33	108.62 Iso see	108.62 Table 5	108.62	108.62	108.62		` '
Jan (66)m= 108.62 Lighting gains (67)m= 16.97	Feb 108.62 s (calcula 15.07 ains (calcula	Mar 108.62 ted in Ap 12.26	Apr 108.62 opendix 9.28	108.62 L, equat 6.94	108.62 ion L9 or 5.86	108.62 r L9a), a 6.33	108.62 Iso see	108.62 Table 5	108.62	108.62	108.62		` '
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga	Feb 108.62 s (calcula 15.07 ains (calcula 192.29	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Append 176.72	108.62 L, equat 6.94 dix L, eq 163.35	108.62 ion L9 of 5.86 uation L 150.78	108.62 r L9a), a 6.33 13 or L1 142.38	108.62 Iso see 8.22 3a), also	108.62 Table 5 11.04 see Ta	108.62 14.02 ble 5 155.98	108.62	17.44		(67)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32	Feb 108.62 s (calcula 15.07 ains (calcula 192.29	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Append 176.72	108.62 L, equat 6.94 dix L, eq 163.35	108.62 ion L9 of 5.86 uation L 150.78	108.62 r L9a), a 6.33 13 or L1 142.38	108.62 Iso see 8.22 3a), also	108.62 Table 5 11.04 see Ta	108.62 14.02 ble 5 155.98	108.62	17.44		(67)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A 33.86	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86	108.62 L, equat 6.94 dix L, eq 163.35 L, equat	108.62 ion L9 of 5.86 uation L 150.78 ion L15	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a	108.62 Iso see 8.22 3a), also 140.4	108.62 Table 5 11.04 See Ta 145.38	10 <mark>8.62</mark> 14.02 ble 5 155.98	108.62 16.36 169.35	108.62 17.44 181.92		(67) (68)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain (69)m= 33.86	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A 33.86	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86	108.62 L, equat 6.94 dix L, eq 163.35 L, equat	108.62 ion L9 of 5.86 uation L 150.78 ion L15	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a	108.62 Iso see 8.22 3a), also 140.4	108.62 Table 5 11.04 See Ta 145.38	10 <mark>8.62</mark> 14.02 ble 5 155.98	108.62 16.36 169.35	108.62 17.44 181.92		(67) (68)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 o see Ta 145.38 ee Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gains (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and factorial (70)m= 3	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 o see Ta 145.38 ee Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3 vaporatic -86.9	Mar 108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 3 on (negation) -86.9	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86	108.62 Iso see 8.22 3a), also 140.4 , also se 33.86	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69) (70)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3 vaporatic -86.9	Mar 108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 3 on (negation) -86.9	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86	108.62 Iso see 8.22 3a), also 140.4 , also se 33.86	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69) (70)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating (72)m= 78.71	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3 vaporatio -86.9 g gains (T	Mar 108.62 ted in Ap 12.26 sulated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.86.9) Table 5) 71.43	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86 3	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 Disee Ta 145.38 Disee Table 33.86 3 -86.9	108.62 14.02 ble 5 155.98 33.86	108.62 16.36 169.35 33.86 3 -86.9	108.62 17.44 181.92 33.86 3 -86.9		(67) (68) (69) (70) (71)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3 vaporatic -86.9 g gains (T 76.14 I gains =	Mar 108.62 ted in Ap 12.26 sulated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.86.9) Table 5) 71.43	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86 3	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 Disee Ta 145.38 Disee Table 33.86 3 -86.9	108.62 14.02 ble 5 155.98 5 33.86 3 -86.9	108.62 16.36 169.35 33.86 3 -86.9	108.62 17.44 181.92 33.86 3 -86.9		(67) (68) (69) (70) (71)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating (72)m= 78.71 Total interna	Feb 108.62 108.62 (calcula 15.07 ains (calcula 192.29 (calcula 33.86 ans gains 3 vaporatic -86.9 g gains (T 76.14 I gains =	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.43) Table 5) 71.43	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu -86.9	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab -86.9	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86 3 -86.9 50.98 m + (67)m	108.62 Iso see 8.22 3a), also 140.4), also se 33.86 3 -86.9	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86 3 -86.9 59.71 + (69)m +	108.62 14.02 ble 5 155.98 3 -86.9 66.09 (70)m + (7	108.62 16.36 169.35 33.86 3 -86.9 73.21 1)m + (72)	108.62 17.44 181.92 33.86 3 -86.9		(67) (68) (69) (70) (71) (72)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gains (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating (72)m= 78.71 Total interna (73)m= 344.58	Feb 108.62 5 (calcula 15.07 ains (calcula 192.29 5 (calcula 33.86 ans gains 3 vaporatio -86.9 g gains (T 76.14 I gains = 342.09	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.43) 71.43 1.43 1.43 1.43 1.44 1.44 1.45	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu -86.9 65.25	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab -86.9	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9 55.33 (66) 270.55	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86 3 -86.9 50.98 m + (67)m 258.27	108.62 Iso see 8.22 3a), also 140.4), also se 33.86 3 -86.9 57.14 1 + (68)m - 264.35	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86 3 -86.9 59.71 + (69)m + 274.71	108.62 14.02 ble 5 155.98 3 -86.9 66.09 (70)m + (7 294.66	108.62 16.36 169.35 33.86 3 -86.9 73.21 1)m + (72) 317.51	108.62 17.44 181.92 33.86 3 -86.9 76.73		(67) (68) (69) (70) (71) (72)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northoast o		1		1		1		1		1		7(75)
Northeast 0.9x	0.77	X	1.81	X	11.28	X	0.63	X	0.7] = 1	6.24	(75)
Northeast _{0.9x}	0.77	X	1.81	X	22.97	X	0.63	X	0.7] =	12.7	(75)
Northeast _{0.9x}	0.77	X	1.81	X	41.38	X	0.63	X	0.7] =	22.89	(75)
Northeast _{0.9x}	0.77	X	1.81	X	67.96	X	0.63	X	0.7	=	37.59	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.35	X	0.63	X	0.7	=	50.53	(75)
Northeast _{0.9x}	0.77	X	1.81	X	97.38	X	0.63	X	0.7] =	53.87	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.1	X	0.63	X	0.7	=	50.39	(75)
Northeast _{0.9x}	0.77	X	1.81	X	72.63	X	0.63	X	0.7	=	40.17	(75)
Northeast _{0.9x}	0.77	X	1.81	X	50.42	X	0.63	X	0.7	=	27.89	(75)
Northeast _{0.9x}	0.77	X	1.81	X	28.07	X	0.63	X	0.7	=	15.53	(75)
Northeast _{0.9x}	0.77	X	1.81	X	14.2	X	0.63	X	0.7	=	7.85	(75)
Northeast _{0.9x}	0.77	X	1.81	X	9.21	X	0.63	X	0.7	=	5.1	(75)
Southeast 0.9x	0.77	X	1.05	X	36.79	X	0.63	X	0.7	=	11.81	(77)
Southeast 0.9x	0.77	X	1.05	X	62.67	X	0.63	X	0.7	=	20.11	(77)
Southeast 0.9x	0.77	X	1.05	X	85.75	X	0.63	x	0.7	=	27.52	(77)
Southeast 0.9x	0.77	X	1.05	X	106.25	X	0.63	x	0.7	=	34.1	(77)
Southeast 0.9x	0.77	X	1.05	X	119.01	X	0.63	X	0.7	=	38.19	(77)
Southeast 0.9x	0.77	X	1.05	X	118.15	Х	0.63	X	0.7	=	37.91	(77)
Southeast 0.9x	0.77	x	1.05	х	113.91] x	0.63	x	0.7	=	36.55	(77)
Southeast 0.9x	0.77	x	1.05	х	104.39] x	0.63	x	0.7	=	33.5	(77)
Southeast 0.9x	0.77	x	1.05	X	92.85	x	0.63	x	0.7	=	29.8	(77)
Southeast 0.9x	0.77] x	1.05	x	69.27	Х	0.63	x	0.7	=	22.23	(77)
Southeast 0.9x	0.77	x	1.05	x	44.07	X	0.63	x	0.7	=	14.14	(77)
Southeast 0.9x	0.77	x	1.05	х	31.49	x	0.63	x	0.7	=	10.1	(77)
Southwest _{0.9x}	0.77	x	7.35	X	36.79]	0.63	x	0.7	=	82.65	(79)
Southwest _{0.9x}	0.77	X	7.35	X	62.67		0.63	x	0.7	=	140.78	(79)
Southwest _{0.9x}	0.77	X	7.35	X	85.75]	0.63	x	0.7	=	192.62	(79)
Southwest _{0.9x}	0.77	x	7.35	x	106.25]	0.63	x	0.7	=	238.67	(79)
Southwest _{0.9x}	0.77	x	7.35	X	119.01		0.63	x	0.7	=	267.33	(79)
Southwest _{0.9x}	0.77	x	7.35	X	118.15]	0.63	x	0.7	=	265.4	(79)
Southwest _{0.9x}	0.77	x	7.35	x	113.91		0.63	x	0.7	=	255.87	(79)
Southwest _{0.9x}	0.77	x	7.35	x	104.39]	0.63	X	0.7	=	234.49	(79)
Southwest _{0.9x}	0.77	x	7.35	x	92.85]	0.63	X	0.7	=	208.57	(79)
Southwest _{0.9x}	0.77	x	7.35	x	69.27		0.63	x	0.7	=	155.59	(79)
Southwest _{0.9x}	0.77	x	7.35	x	44.07]	0.63	x	0.7	=	98.99	(79)
Southwest _{0.9x}	0.77	x	7.35	x	31.49	ĺ	0.63	x	0.7	j =	70.73	(79)
Northwest _{0.9x}	0.77	x	2.1	x	11.28	x	0.63	x	0.7	=	7.24	(81)
Northwest _{0.9x}	0.77	×	2.1	x	22.97	x	0.63	x	0.7	j =	14.74	(81)
Northwest _{0.9x}	0.77	x	2.1	x	41.38	x	0.63	x	0.7	j =	26.56	(81)
Northwest _{0.9x}	0.77	x	2.1	x	67.96	x	0.63	x	0.7] =	43.61	(81)
Northwest _{0.9x}	0.77	×	2.1	x	91.35	x	0.63	x	0.7	j =	58.62	(81)
						•		ı		•		_

Northwest 0.9x	0.77	X	2.	1	X g	97.38	x		0.63	x	0.7	=	62.5	(81)
Northwest 0.9x	0.77	X	2.	1	x	91.1	_ x [0.63	x	0.7	=	58.47	(81)
Northwest 0.9x	0.77	X	2.	1	x	72.63	x [0.63	x	0.7	=	46.61	(81)
Northwest 0.9x	0.77	X	2.	1	x .	50.42	x [0.63	x	0.7	=	32.36	(81)
Northwest 0.9x	0.77	X	2.	1	x 2	28.07	x		0.63	x	0.7	=	18.01	(81)
Northwest _{0.9x}	0.77	x	2.	1	x	14.2	x		0.63	_ x [0.7		9.11	(81)
Northwest 0.9x	0.77	x	2.	1	х	9.21	x		0.63	_ x [0.7	<u> </u>	5.91	(81)
_							-							
Solar gains in	watts, ca	lculated	for eac	n month			(83)m	= Su	m(74)m .	(82)m				
(83)m= 107.94	188.34	269.59	353.97	414.67	419.68	401.28	354.	77	298.61	211.36	130.1	91.84		(83)
Total gains – ir	nternal a	nd solar	(84)m =	= (73)m ·	+ (83)m	, watts							•	
(84)m= 452.51	530.42	599.18	663.8	704.57	690.23	659.56	619.	13	573.33	506.02	447.61	426.52		(84)
7. Mean inter	nal temp	erature	(heating	season)									
Temperature	during h	eating p	eriods ir	the livii	ng area	from Tal	ole 9,	Th1	(°C)				21	(85)
Utilisation fac	tor for ga	ains for I	iving are	ea, h1,m	(see Ta	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ıg T	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.97	0.91	0.78	0.58	0.43	0.4	7	0.73	0.94	0.99	1		(86)
Mean internal	temper	atura in	living ar	22 T1 (fc	llow etc	ne 3 to 3	7 in T	ahla	9c)					
(87)m= 20.06	20.22	20.46	20.74	20.92	20.99	21	21		20.96	20.71	20.33	20.02		(87)
` '	als suita as la				alus a Hisa a	, fue as T	-1-1-0	TI	0 (00)					
Temperature (88)m= 20.09	20.1	eating p	20.11	20.11	20.12	20.12	20.1	$\overline{}$	2 (°C) 20.12	20.11	20.11	20.1		(88)
					<u> </u>				20.12	20.11	20.11	20.1		(00)
Utilisation fac					<u> </u>		T					1		(00)
(89)m= 1	0.99	0.96	0.89	0.73	0.51	0.34	0.38	8	0.65	0.92	0.99	1		(89)
Mean internal	tempera	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3	to 7	in Tabl	e 9 <mark>c)</mark>				
(90)m= 18.84	19.08	19.43	19.81	20.04	20.11	20.12	20.1	12	20.09	19.79	19.25	18.8		(90)
									f	LA = Livir	ig area ÷ (4) =	0.54	(91)
Mean internal	l tempera	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 -	– fL <i>A</i>	A) × T2					
(92)m= 19.49	19.69	19.98	20.31	20.51	20.58	20.59	20.5	59	20.55	20.29	19.83	19.45		(92)
Apply adjustn	nent to th	ne mean	internal	temper	ature fro	m Table	4e, v	wher	e appro	priate			•	
(93)m= 19.49	19.69	19.98	20.31	20.51	20.58	20.59	20.5	59	20.55	20.29	19.83	19.45		(93)
8. Space hea	ting requ	iirement												
Set Ti to the r					ed at st	ep 11 of	Table	e 9b	, so tha	t Ti,m=(76)m an	d re-calc	culate	
the utilisation	Feb				lun	11	Ι	Т	Con	Oct	Nov	Doo	1	
Jan Utilisation fac		Mar	Apr	May	Jun	Jul	Αι	ug [Sep	Oct	Nov	Dec		
(94)m= 0.99	0.99	0.96	0.9	0.75	0.55	0.39	0.43	3	0.69	0.93	0.99	1		(94)
Useful gains,														, ,
(95)m= 449.85	522.83	576.98	594.38	529.25	378.31	255.51	267.:	27	396.14	469.48	441.63	424.67		(95)
Monthly avera			perature		<u> </u>	·							I	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	for mea	an intern	al tempe	erature,	Lm , W	=[(39)m	x [(93	3)m–	· (96)m]				
(97)m= 1005.13	976.42	887.53	742.08	571.76	383.98	256.14	268.	43	416.07	628.55	829.7	999.19		(97)
Space heating	g require	ement fo	r each n	nonth, k	/Vh/mon	th = 0.02	24 x [((97)r	m – (95)m] x (4	1)m		- !	
(98)m= 413.13	304.81	231.05	106.35	31.63	0	0	0		0	118.35	279.41	427.45		

					Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1912.17	(98)
Space heating requirement in	kWh/m²/y	ear ear								28.52	(99)
9a. Energy requirements – Ind	ividual hea	ating sy	stems i	ncluding	micro-C	CHP)					
Space heating:									Г		
Fraction of space heat from s	-		nentary	-	(202) 4	(204)			[0	(201)
Fraction of space heat from n	•	` '			(202) = 1	, ,	(202)]		[1 	(202)
Fraction of total heating from	-				(204) = (2	02) x [1 –	(203)] =		 	1	(204)
Efficiency of main space heat				. 0/						93.4	(206)
Efficiency of secondary/suppl	<u> </u>					_			[0	(208)
Jan Feb Mar Space heating requirement (c	Apr	May Abovo	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
413.13 304.81 231.05	1	31.63	0	0	0	0	118.35	279.41	427.45		
$(211)m = \{[(98)m \times (204)] \} \times 1$	100 ÷ (206))									(211)
442.32 326.35 247.38		33.86	0	0	0	0	126.71	299.16	457.65		(= : : /
	!!				Tota	l (kWh/yea	ar) =Sum(2	211),15,101	=	2047.29	(211)
Space heating fuel (secondar	y), kWh/m	onth									
$= \{[(98)m \times (201)]\} \times 100 \div (201)$						I					
(215)m= 0 0 0	0	0	0	0	O Tota	0 I (kWh/yea	0	0	0		7(045)
Water heating					Tota	ii (KVVII/yea	ar) =50m(2	13) _{15,1012}	<u>-</u>	0	(215)
Output from water heater (calc	ulated abo	ove)									
188.05 164.26 170.91		146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63		
Efficiency of water heater										80.3	(216)
(217)m= 86.98 86.59 85.81		81.92	80.3	80.3	80.3	80.3	84.32	86.3	87.11		(217)
Fuel for water heating, kWh/m (219) m = (64) m x $100 \div (217)$											
(219)m= 216.2 189.71 199.17	T T	179.15	160.97	154.22	171.92	173.82	188.49	196.6	210.81		
					Tota	I = Sum(2	19a) ₁₁₂ =			2221.13	(219)
Annual totals							k\	Wh/yeaı	, ,	kWh/yea	r
Space heating fuel used, main	system 1									2047.29	_
Water heating fuel used										2221.13	
Electricity for pumps, fans and	electric ke	eep-hot									
central heating pump:									30		(2300
boiler with a fan-assisted flue									45		(230e
Total electricity for the above,	kWh/year				sum	of (230a).	(230g) =		[75	(231)
Electricity for lighting										299.64	(232)
Total delivered energy for all u	ses (211).	(221)	+ (231)	+ (232).	(237b)	=			Ī	4643.07	(338)
12a. CO2 emissions – Individ	lual <u>heatin</u>	g syste	ms <u>inclu</u>	udin <u>g mi</u>	cro <u>-CHF</u>				L		
			En	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emission kg CO2/ye	

Space heating (main system 1)	(211) x	0.216	=	442.21	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	479.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			921.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.51	(268)
Total CO2, kg/year	sum o	f (265)(271) =		1116.42	(272)
					_

TER =

(273)

16.65

			User D	Details: _							
Assessor Name: Software Name:	Stroma FSAF			Strom Softwa Address	are Ve	rsion:		Versic	rsion: 1.0.5.41		
Address :	2 Bed - TF, Lo		торену	Address	. z beu -	· IF					
1. Overall dwelling dime	nsions:										
0 10				a(m²)		Av. He	ight(m)	7	Volume(m ³	_	
Ground floor				67.05	(1a) x	2	2.5	(2a) =	167.63	(3a)	
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d	l)+(1e)+(1	n) (37.05	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d	d)+(3e)+	.(3n) =	167.63	(5)	
2. Ventilation rate:											
	main heating	seconda heating	ry 	other	_	total			m³ per hou	r 	
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	ns				Ī	2	x	10 =	20	(7a)	
Number of passive vents					Ī	0	x -	10 =	0	(7b)	
Number of flueless gas fir	res				F	0	X 4	40 =	0	(7c)	
					L						
								Air ch	nanges <mark>per</mark> ho	our	
Infiltration due to chimney						20		÷ (5) =	0.12	(8)	
If a pressurisation test has be Number of storeys in th		intended, procee	ed to (17),	otherwise (continue fr	om (9) to ((16)			— (0)	
Additional infiltration	ie dweiling (115)						[(9)	-1]x0.1 =	0	(9)	
Structural infiltration: 0.	25 for steel or tir	mber frame o	r 0.35 fo	r masonı	y constr	uction	1(3)	1	0	(11)	
if both types of wall are pr			o the great	ter wall are	a (after						
deducting areas of openin If suspended wooden fl	• / .		1 (seale	ed) else	enter 0				0	(12)	
If no draught lobby, ent	,	ŕ	(σσαιτ	, o.oo	0.1101 0				0	(13)	
Percentage of windows	and doors drau	ght stripped							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,			-	•	•	etre of e	envelope	area	5	(17)	
If based on air permeabili Air permeability value applies	•					is heina u	sad		0.37	(18)	
Number of sides sheltere		est rias been doi	ie or a de	gree an pe	пеаышу	is being us	seu		2	(19)	
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)	
Infiltration rate incorporati	ing shelter factor	•		(21) = (18	x (20) =				0.31	(21)	
Infiltration rate modified for	or monthly wind	speed				1	1	1	1		
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind spe		7				1	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			
Wind Factor (22a)m = (22	2)m ÷ 4										
	<u> </u>	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18			

0.4	ation rate	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37		
alculate effe							0.29	0.31	0.34	0.33	0.37		
If mechanica	al ventilat	ion:										0	(2
If exhaust air h	eat pump u	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (N5)) , othe	rwise (23b) = (23a)			0	(2
If balanced with	n heat recov	very: effic	iency in %	allowing t	for in-use f	actor (fror	n Table 4h) =				0	(2
a) If balance	d mecha	nical ve	ntilation	with he	at recov	ery (MV	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
b) If balance	d mecha	nical ve	ntilation	without	heat red	covery (I	MV) (24k	m = (22)	2b)m + (23b)			
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h	ouse extin < 0.5 ×			•	•				.5 × (23b	o)			
4c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n	ventilatio n = 1, the			•					0.5]				
4d)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(2
Effective air	change r	ate - er	nter (24a) or (24l	o) or (24	c) or (24	ld) in bo	x (25)					
5)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(:
B. Heat losse	s and he	at loss i	oaramete	er:							_	_	-
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/	K)	k-value kJ/m²-l		A X k kJ/K
oo <mark>rs</mark>					3.57	x	1.2	=	4.284				(
/in <mark>dows</mark> Type) 1				1.81	x1	/[1/(1.4)+	0.04] =	2.4				(
indows Type	2				2.1	x1	/[1/(1.4)+	0.04] =	2.78				(:
/indows Type	3				1.05	x1	/[1/(1.4)+	0.04] =	1.39				(:
/indows Type) 4				7.35	x1	/[1/(1.4)+	0.04] =	9.74				(
/alls	58.81	1	15.88	3	42.93	3 X	0.18	= i	7.73				(
oof	67.05	5	0		67.05	5 x	0.13	<u> </u>	8.72				(
otal area of e	lements,	m²			125.8	6							(;
arty wall					50.53	3 x	0		0				(:
arty floor					67.05	5						7 F	(:
ternal wall **	:				87.34	4				Ī		i i	(
or windows and include the area						l lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	, `
abric heat los	ss, W/K =	S (A x	U)				(26)(30) + (32) =				37.05	5 (
eat capacity	Cm = S(A)	4 x k)						((28).	(30) + (32	2) + (32a).	(32e) =	5683.1	13 (
nermal mass	paramet	er (TMF	ɔ = Cm -	- TFA) ir	n kJ/m²K			Indica	itive Value	: Medium		250	(
or design assess In be used inste				construct	tion are no	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
	es · S (I ·	x Y) cal	culated i	ısina Ar	pendix	K						19.7	
hermal bridge	00.0 (2.	, , , oa.		g								19.7	
nermal bridge details of therma otal fabric he	al bridging a	,		• .	•			/ >	· (36) =			19.7	\` 5

Ventila	tion hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.09	31.92	31.75	30.96	30.81	30.12	30.12	29.99	30.38	30.81	31.11	31.42		(38)
Heat tr	ansfer c	coefficier	nt, W/K			-	-	-	(39)m	= (37) + (3	38)m			
(39)m=	88.84	88.67	88.5	87.71	87.56	86.87	86.87	86.74	87.14	87.56	87.86	88.17		
Heat lo	ss para	meter (F	HLP), W/	′m²K			-	-		Average = = (39)m ÷	Sum(39) ₁ · (4)	12 /12=	87.71	(39)
(40)m=	1.32	1.32	1.32	1.31	1.31	1.3	1.3	1.29	1.3	1.31	1.31	1.32		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.31	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ener	gy requi	rement:								kWh/ye	ear:	
		ıpancy, I										.17		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.	.9)			
		•	ater usaç	ge in litre	s per da	ay Vd,av	erage =	(25 x N)	+ 36		88	5.8		(43)
			hot water person per			_	designed t	to achieve	a water us	se target o	f			
not more							· ·			0 /				
Hot wate	Jan er usage ii	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1 <mark>c x</mark>	Aug	Sep	Oct	Nov	Dec		
	,	,	1				_	7	04.00	07.54	00.04	94.37		
(44)m=	94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94 m(44) ₁₁₂ =		1029.54	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x E	OTm / 3600					1029.54	(++)
(45)m=	139.96	122.41	126.31	110 <mark>.12</mark>	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		_
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	=	1349.89	(45)
(46)m=	20.99	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
	storage	loss:												
Storag	e volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	•	•			•		litres in	` '			`			
	vise it no storage		not wate	er (this in	iciudes i	nstantar	neous co	liod idmo	ers) ente	er 'O' in (47)			
	_		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
•			m Table			`	, , ,					0		(49)
•			storage		ear			(48) x (49)) =			0		(50)
			eclared o			or is not		, , , ,				<u> </u>		()
		_	factor fr		e 2 (kW	h/litre/da	ay)					0		(51)
	-	leating s from Tal	ee secti	on 4.3										(50)
			oie ∠a m Table	2h							-	0		(52) (53)
			storage		ar			(47) x (51)) y (52) y (53) –				, ,
		m water (54) in (5	_	, KVVII/YE	zai			(1 1) X (31)	, A (OZ) X (JJ) =		0		(54) (55)
		. , .	culated f	or each	month			((56)m = (55) × (41):	m		<u> </u>		(30)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
(55)									L					(30)

If cylinder contain	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) - (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circu Primary circu (modified b	it loss cal	culated t	for each	month (,	` '	` '		r thermo		0		(58)
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(59)
	loulated	for each	month /	(61)m –	(60) · 20	L	l	<u> </u>	<u> </u>	<u> </u>	<u> </u>		
Combi loss ca (61)m= 48.09	41.86	44.59	41.46	41.1	38.08	39.35	41.1	41.46	44.59	44.85	48.09		(61)
` '						ļ	ļ				<u> </u>	J (59)m + (61)m	, ,
(62)m= 188.05	`	170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63	(39)111 + (01)11]	(62)
Solar DHW input					l	l			L	<u> </u>			(/
(add additiona									ii continbut	ion to wat	or ricating)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from v	vater hea	ter			<u> </u>			!	<u> </u>	<u> </u>	<u> </u>	1	
(64)m= 188.05		170.91	151.59	146.76	129.26	123.84	138.05	139.58	158.94	169.66	183.63		
	1	l					Outp	out from w	ater heate	ı r (annual)₁	12	1864.52	(64)
Heat gains fro	om water	heating	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	า] + 0.8 :	x [(46)m	+ (57)m	+ (59)m		
(65)m= 58.56		53.15	46.98	45.41	39.84	37.93	42.51	42.99	49.17	52.71	57.09	Í	(65)
include (57)m in calc	culation	of (65)m	only if c	ylinder is	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal g			, ,									3	
	James (SS)												
Metabolic dai	ne (Tahle	5) Wat	te							_	_	_	
Metabolic gai Jan				May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Jan (66)m= 108.62	Feb	5), Wat Mar 108.62	Apr 108.62	May 108.62	Jun 108.62	Jul	Aug 108.62	Sep 108.62	Oct 108.62	Nov 108.62	Dec 108.62		(66)
(66)m= Jan 108.62	Feb 108.62	Mar 108.62	Apr 108.62	108.62	108.62	108.62	108.62	108.62			-		(66)
Jan	Feb 108.62	Mar 108.62	Apr 108.62	108.62	108.62	108.62	108.62	108.62			-		(66) (67)
Jan (66)m= 108.62 Lighting gains	Feb 108.62 s (calcula 15.07	Mar 108.62 ted in Ap 12.26	Apr 108.62 opendix 9.28	108.62 L, equat 6.94	108.62 ion L9 or 5.86	108.62 r L9a), a 6.33	108.62 Iso see	108.62 Table 5	108.62	108.62	108.62		, ,
Jan (66)m= 108.62 Lighting gains (67)m= 16.97	Feb 108.62 s (calcula 15.07 ains (calcula	Mar 108.62 ted in Ap 12.26	Apr 108.62 opendix 9.28	108.62 L, equat 6.94	108.62 ion L9 or 5.86	108.62 r L9a), a 6.33	108.62 Iso see	108.62 Table 5	108.62	108.62	108.62		, ,
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga	Feb 108.62 s (calcula 15.07 ains (calcula 192.29	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Append 176.72	108.62 L, equat 6.94 dix L, eq 163.35	108.62 ion L9 of 5.86 uation L 150.78	108.62 r L9a), a 6.33 13 or L1 142.38	108.62 Iso see 8.22 3a), also	108.62 Table 5 11.04 see Ta	108.62 14.02 ble 5 155.98	108.62	17.44		(67)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32	Feb 108.62 s (calcula 15.07 ains (calcula 192.29	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Append 176.72	108.62 L, equat 6.94 dix L, eq 163.35	108.62 ion L9 of 5.86 uation L 150.78	108.62 r L9a), a 6.33 13 or L1 142.38	108.62 Iso see 8.22 3a), also	108.62 Table 5 11.04 see Ta	108.62 14.02 ble 5 155.98	108.62	17.44		(67)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A 33.86	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86	108.62 L, equat 6.94 dix L, eq 163.35 L, equat	108.62 ion L9 of 5.86 uation L 150.78 ion L15	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a	108.62 Iso see 8.22 3a), also 140.4	108.62 Table 5 11.04 See Ta 145.38	10 <mark>8.62</mark> 14.02 ble 5 155.98	108.62 16.36 169.35	108.62 17.44 181.92		(67) (68)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain (69)m= 33.86	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A 33.86	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86	108.62 L, equat 6.94 dix L, eq 163.35 L, equat	108.62 ion L9 of 5.86 uation L 150.78 ion L15	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a	108.62 Iso see 8.22 3a), also 140.4	108.62 Table 5 11.04 See Ta 145.38	10 <mark>8.62</mark> 14.02 ble 5 155.98	108.62 16.36 169.35	108.62 17.44 181.92		(67) (68)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 o see Ta 145.38 ee Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gains (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and factorial (70)m= 3	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 o see Ta 145.38 ee Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3 vaporatio -86.9	Mar 108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 3 on (negation) -86.9	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86	108.62 Iso see 8.22 3a), also 140.4 , also se 33.86	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69) (70)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9	Feb 108.62 s (calcula 15.07 ains (calcula 192.29 s (calcula 33.86 ans gains 3 vaporatio -86.9	Mar 108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 3 on (negation) -86.9	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86	108.62 Iso see 8.22 3a), also 140.4 , also se 33.86	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86	108.62 14.02 ble 5 155.98 5 33.86	108.62 16.36 169.35 33.86	108.62 17.44 181.92 33.86		(67) (68) (69) (70)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating (72)m= 78.71	Feb 108.62 s (calcula 15.07 ains (calcula 33.86 ans gains 3 vaporatio -86.9 g gains (T	Mar 108.62 ted in Ap 12.26 sulated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.86.9) Table 5) 71.43	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86 3	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 Disee Ta 145.38 Disee Table 33.86 3 -86.9	108.62 14.02 ble 5 155.98 33.86	108.62 16.36 169.35 33.86 3 -86.9	108.62 17.44 181.92 33.86 3 -86.9		(67) (68) (69) (70) (71)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating	Feb 108.62 5 (calcula 15.07 ains (calcula 192.29 5 (calcula 33.86 ans gains 3 vaporatic -86.9 g gains (T 76.14 I gains =	Mar 108.62 ted in Ap 12.26 sulated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.86.9) Table 5) 71.43	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86 3	108.62 Iso see 8.22 3a), also 140.4), also se 33.86	108.62 Table 5 11.04 Disee Ta 145.38 Disee Table 33.86 3 -86.9	108.62 14.02 ble 5 155.98 5 33.86 3 -86.9	108.62 16.36 169.35 33.86 3 -86.9	108.62 17.44 181.92 33.86 3 -86.9		(67) (68) (69) (70) (71)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gain (68)m= 190.32 Cooking gain (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating (72)m= 78.71 Total interna	Feb 108.62 108.62 (calcula 15.07 ains (calcula 33.86 ans gains 3 vaporatio -86.9 g gains (7 76.14 I gains = 342.09	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.43) Table 5) 71.43	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu -86.9	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab -86.9	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86 3 -86.9 50.98 m + (67)m	108.62 Iso see 8.22 3a), also 140.4), also se 33.86 3 -86.9	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86 3 -86.9 59.71 + (69)m +	108.62 14.02 ble 5 155.98 3 -86.9 66.09 (70)m + (7	108.62 16.36 169.35 33.86 3 -86.9 73.21 1)m + (72)	108.62 17.44 181.92 33.86 3 -86.9		(67) (68) (69) (70) (71) (72)
Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gains (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. e (71)m= -86.9 Water heating (72)m= 78.71 Total interna (73)m= 344.58	Feb 108.62 108.62 15.07 ains (calculated in 192.29) s (calculated in 192.29) s (calculated in 192.29) s (calculated in 192.29) s (calculated in 192.29) g gains (192.29) Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in Ap 33.86 (Table 5 3 on (negation 1.43) 71.43 1.43 1.43 1.43 1.44 1.44 1.45	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 3 tive valu -86.9 65.25	108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 3 es) (Tab -86.9	108.62 ion L9 or 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9 55.33 (66) 270.55	108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86 3 -86.9 50.98 m + (67)m 258.27	108.62 Iso see 8.22 3a), also 140.4), also se 33.86 3 -86.9 57.14 1 + (68)m - 264.35	108.62 Table 5 11.04 See Ta 145.38 See Table 33.86 3 -86.9 59.71 + (69)m + 274.71	108.62 14.02 ble 5 155.98 3 -86.9 66.09 (70)m + (7 294.66	108.62 16.36 169.35 33.86 3 -86.9 73.21 1)m + (72) 317.51	108.62 17.44 181.92 33.86 3 -86.9 76.73		(67) (68) (69) (70) (71) (72)	

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northoast o		1		1		1		1		1		7(75)
Northeast 0.9x	0.77	X	1.81	X	11.28	X	0.63	X	0.7] = 1	6.24	(75)
Northeast _{0.9x}	0.77	X	1.81	X	22.97	X	0.63	X	0.7	=	12.7	(75)
Northeast _{0.9x}	0.77	X	1.81	X	41.38	X	0.63	X	0.7] =	22.89	(75)
Northeast _{0.9x}	0.77	X	1.81	X	67.96	X	0.63	X	0.7	=	37.59	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.35	X	0.63	X	0.7	=	50.53	(75)
Northeast _{0.9x}	0.77	X	1.81	X	97.38	X	0.63	X	0.7] =	53.87	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.1	X	0.63	X	0.7	=	50.39	(75)
Northeast _{0.9x}	0.77	X	1.81	X	72.63	X	0.63	X	0.7	=	40.17	(75)
Northeast _{0.9x}	0.77	X	1.81	X	50.42	X	0.63	X	0.7	=	27.89	(75)
Northeast _{0.9x}	0.77	X	1.81	X	28.07	X	0.63	X	0.7	=	15.53	(75)
Northeast _{0.9x}	0.77	X	1.81	X	14.2	X	0.63	X	0.7	=	7.85	(75)
Northeast _{0.9x}	0.77	X	1.81	X	9.21	X	0.63	X	0.7	=	5.1	(75)
Southeast 0.9x	0.77	X	1.05	X	36.79	X	0.63	X	0.7	=	11.81	(77)
Southeast 0.9x	0.77	X	1.05	X	62.67	X	0.63	X	0.7	=	20.11	(77)
Southeast 0.9x	0.77	X	1.05	X	85.75	X	0.63	x	0.7	=	27.52	(77)
Southeast 0.9x	0.77	X	1.05	X	106.25	X	0.63	x	0.7	=	34.1	(77)
Southeast 0.9x	0.77	X	1.05	X	119.01	X	0.63	X	0.7	=	38.19	(77)
Southeast 0.9x	0.77	X	1.05	X	118.15	Х	0.63	X	0.7	=	37.91	(77)
Southeast 0.9x	0.77	x	1.05	х	113.91] x	0.63	x	0.7	=	36.55	(77)
Southeast 0.9x	0.77	x	1.05	х	104.39] x	0.63	x	0.7	=	33.5	(77)
Southeast 0.9x	0.77	x	1.05	X	92.85	x	0.63	x	0.7	=	29.8	(77)
Southeast 0.9x	0.77] x	1.05	x	69.27	Х	0.63	x	0.7	=	22.23	(77)
Southeast 0.9x	0.77	x	1.05	x	44.07	X	0.63	x	0.7	=	14.14	(77)
Southeast 0.9x	0.77	x	1.05	х	31.49	x	0.63	x	0.7	=	10.1	(77)
Southwest _{0.9x}	0.77	x	7.35	X	36.79]	0.63	x	0.7	=	82.65	(79)
Southwest _{0.9x}	0.77	X	7.35	x	62.67]	0.63	x	0.7	=	140.78	(79)
Southwest _{0.9x}	0.77	X	7.35	X	85.75]	0.63	x	0.7	=	192.62	(79)
Southwest _{0.9x}	0.77	x	7.35	x	106.25]	0.63	x	0.7	=	238.67	(79)
Southwest _{0.9x}	0.77	x	7.35	X	119.01		0.63	x	0.7	=	267.33	(79)
Southwest _{0.9x}	0.77	x	7.35	X	118.15]	0.63	x	0.7	=	265.4	(79)
Southwest _{0.9x}	0.77	x	7.35	x	113.91		0.63	x	0.7	=	255.87	(79)
Southwest _{0.9x}	0.77	x	7.35	x	104.39]	0.63	X	0.7	=	234.49	(79)
Southwest _{0.9x}	0.77	x	7.35	x	92.85]	0.63	x	0.7	=	208.57	(79)
Southwest _{0.9x}	0.77	x	7.35	x	69.27		0.63	x	0.7	=	155.59	(79)
Southwest _{0.9x}	0.77	x	7.35	x	44.07]	0.63	x	0.7	=	98.99	(79)
Southwest _{0.9x}	0.77	x	7.35	x	31.49]	0.63	x	0.7	j =	70.73	(79)
Northwest _{0.9x}	0.77	x	2.1	x	11.28	x	0.63	x	0.7] =	7.24	(81)
Northwest _{0.9x}	0.77	×	2.1	x	22.97	x	0.63	x	0.7	j =	14.74	(81)
Northwest _{0.9x}	0.77	x	2.1	x	41.38	x	0.63	x	0.7	j =	26.56	(81)
Northwest _{0.9x}	0.77	x	2.1	x	67.96	x	0.63	x	0.7] =	43.61	(81)
Northwest _{0.9x}	0.77	×	2.1	x	91.35	x	0.63	x	0.7	j =	58.62	(81)
						•		ı		•		_

Northwest _{0.9x}	0.77	X	2.1	1	x	97.38	X		0.63	x	0.7	=	62.5	(81)
Northwest 0.9x	0.77	х	2.	İ	x	91.1	X		0.63	x	0.7	=	58.47	(81)
Northwest _{0.9x}	0.77	x	2.	1	x	72.63	X		0.63	x	0.7	=	46.61	(81)
Northwest 0.9x	0.77	x	2.	1	х	50.42	X		0.63	_ x _	0.7	=	32.36	(81)
Northwest 0.9x	0.77	x	2.	1	x $\overline{}$	28.07	X		0.63	_ x [0.7	=	18.01	(81)
Northwest _{0.9x}	0.77	x	2.	1	х	14.2	X		0.63	x	0.7	_	9.11	(81)
Northwest 0.9x	0.77	x	2.	1	х	9.21	X		0.63	_ × [0.7	-	5.91	(81)
					_		_							
Solar gains in wa	atts, cal	culated	for each	n month			(83)m	n = Si	um(74)m .	(82)m				
(83)m= 107.94	188.34	269.59	353.97	414.67	419.	68 401.28	354	.77	298.61	211.36	130.1	91.84		(83)
Total gains – inte	ernal an	nd solar	(84)m =	: (73)m ·	+ (83	m , watts							•	
(84)m= 452.51 S	530.42	599.18	663.8	704.57	690.	23 659.56	619	.13	573.33	506.02	447.61	426.52		(84)
7. Mean interna	al tempe	erature ((heating	season)									
Temperature d			•			ea from Tal	ble 9	, Th	1 (°C)				21	(85)
Utilisation facto	_	•			•			•	()					`
Jan	Feb	Mar	Apr	May	Ju		Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.95	0.87	0.7	2 0.56	0.6	Ť	0.84	0.97	0.99	1		(86)
Me <mark>an internal t</mark>	omnoro	turo in I	iving or	oo T1 (fe	املا	ctone 2 to	7 in T		2 00)					
	19.78	20.06	20.42	20.73	20.9		20.		20.84	20.43	19.94	19.56		(87)
` '										20.10	10.01	10.00		(- /
Temperature d							$\overline{}$		<u> </u>	40.04	10.00	40.00		(00)
(88)m= 19.82	19.82	19.83	19.83	19.84	19.8	19.84	19.	.85	19.84	19.84	19.83	19.83		(88)
Util <mark>isatio</mark> n facto	r for ga	ins for r	est of d	welling,	h2,m	(see Table	9a)							
(89)m= 1	0.99	0.98	0.93	0.82	0.6	2 0.42	0.4	47	0.76	0.95	0.99	1		(89)
Mean internal t	empera	ture in t	he rest	of dwelli	ng T	2 (follow ste	eps 3	3 to 7	7 in Tabl	e 9 <mark>c)</mark>				
(90)m= 17.98	18.24	18.64	19.16	19.57	19.7	79 19.84	19.	.83	19.71	19.18	18.49	17.93		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.54	(91)
Mean internal t	empera	ture (fo	r the wh	ole dwe	lling)	= fLA × T1	+ (1	– fL	.A) × T2					
	19.06	19.4	19.83	20.19	20.	1	20.		20.31	19.85	19.27	18.81		(92)
Apply adjustme	ent to the	e mean	internal	temper	ature	from Table	4e,	whe	re appro	priate				
(93)m= 18.84	19.06	19.4	19.83	20.19	20.	4 20.45	20.	.44	20.31	19.85	19.27	18.81		(93)
8. Space heatir	ng requi	rement												
Set Ti to the me					ed a	step 11 of	Tab	le 9b	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
the utilisation fa						 					 		l	
Jan	Feb	Mar	Apr	May	Ju	n Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation facto	0.99	0.97	0.93	0.84	0.6	7 0.5	0.5	- I	0.8	0.95	0.99	1		(94)
Useful gains, h					0.0	7 0.5	0.0	55	0.6	0.95	0.99	l l		(34)
		583.14	619.54	592.56	464.	68 326.88	338	97	456.38	481.85	442.54	424.59		(95)
Monthly average							000		.00.00	.01.00	1			()
(96)m= 4.3	4.9	6.5	8.9	11.7	14.	1	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate f	or mear	n intern	al tempe	erature.	Lm , '	W =[(39)m	x [(9:	 3)m-	– (96)m	1	1	Į		
(97)m= 1292.13 1		1141.61	958.74	743.58	503.		350	_	541.48	809.88	1068.93	1287.81		(97)
Space heating	requirer	ment for	r each m	nonth, k	Wh/m	onth = 0.02	24 x	 [(97)	m – (95)m] x (4	1)m		1	
· -	491.62	415.5	244.22	112.36	0	0			0	244.05	451.01	642.23		
<u> </u>	-	-				•	•	-			•		•	

	Total	per year (kWh/year) = Sum(9	8) _{15,912} =	3227.63	(98)
Space heating requirement in kWh/m²/year				Ī	48.14	(99)
9a. Energy requirements – Individual heating systems incl	luding micro-Cl	HP)		_		
Space heating:				г		7
Fraction of space heat from secondary/supplementary sy		(201) –		Į	0	(201)
Fraction of space heat from main system(s)	(202) = 1 -	(201) = 2) × [1 – (203)] =		ļ	1	(202)
Fraction of total heating from main system 1 Efficiency of main space heating system 1	(204) = (20.	2) * [1 - (203)] =		Ĺ	1	(204)
Efficiency of main space heating system in Efficiency of secondary/supplementary heating system, 9	0/_			Ĺ	93.4	(208)
		Sep Oct	Nov	Doc	-	┙`
Jan Feb Mar Apr May Jun Space heating requirement (calculated above)	Jul Aug	Sep Oct	Nov	Dec	kWh/ye	aı
626.64 491.62 415.5 244.22 112.36 0	0 0	0 244.05	451.01	642.23		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		•				(211)
670.92 526.36 444.86 261.48 120.3 0	0 0	0 261.3	482.88	687.62		_
	Total	(kWh/year) =Sum(2	211) _{15,1012}	-	3455.71	(211)
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$						
$= \{ [(96) \text{III } \times (201)] \} \times 100 \div (208)$ $(215) \text{m} = 0 \qquad 0 \qquad 0 \qquad 0 \qquad 0$	0 0	0 0	0	0		
	Total	(kWh/year) =Sum(2	15) _{15,1012}	=	0	(215)
Water heating						_
Output from water heater (calculated above)	00.04 400.05	400 50 450 04	100.00	400.00		
188.05 164.26 170.91 151.59 146.76 129.26 1 Efficiency of water heater	23.84 138.05	139.58 158.94	169.66	183.63	80.3	(216)
	80.3 80.3	80.3 86.13	87.4	87.94	00.3	(217)
Fuel for water heating, kWh/month						
(219) m = (64) m x $100 \div (217)$ m (219)m= 214.06 187.43 195.99 175.76 173.91 160.97 1	154.22 171.92	172.02 104.54	104.12	200.04		
(219)m= 214.06 187.43 195.99 175.76 173.91 160.97 1		173.82 184.54 = Sum(219a) ₁₁₂ =	194.13	208.81	2195.56	(219)
Annual totals			Nh/year	. L	kWh/year	
Space heating fuel used, main system 1			,		3455.71	
Water heating fuel used				Ī	2195.56	Ī
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 o	of (230a)(230g) =			75	(231)
Electricity for lighting				Ī	299.64	(232)
Total delivered energy for all uses (211)(221) + (231) +	(232)(237b) =	=		ſ	6025.91	(338)
12a. CO2 emissions – Individual heating systems includi	ing micro-CHP			L		
		Emis-	on for	tor	Emissies	
Ener kWh/		kg CO2	ion fac 2/kWh	loi	Emissions kg CO2/yea	

Space heating (main system 1)	(211) x	0.216	=	746.43	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	474.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1220.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.51	(268)
Total CO2, kg/year	sum o	of (265)(271) =		1415.11	(272)

TER = 21.11 (273)



Be Lean

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2		roporty	Stroma Softwa Address	are Ve	rsion:	-	Versic	on: 1.0.5.41	
Address :	1 Bed End - GF,			Address	i beu i	Ena - Gr				
1. Overall dwelling dime	nsions:									
			Are	a(m²)		Av. He	ight(m)	,	Volume(m ³	_
Ground floor			5	55.94	(1a) x	2	2.5	(2a) =	139.85	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	·(1e)+(1r	1) 5	55.94	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	139.85	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns					0	X	10 =	0	(7a)
Number of passive vents					Ē	0	x	10 =	0	(7b)
Number of flueless gas fir	res				F	0	X e	40 =	0	(7c)
					L					
								Air ch	nanges <mark>per</mark> ho	ur
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in th		ended, procee	d to (17),	otherwise (continue fr	om (9) to ((16)		0	¬(o)
Additional infiltration	ie dweiling (113)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masonı	y constr	ruction		•	0	(11)
if both types of wall are pr		erresponding to	the great	ter wall are	a (after					
deducting areas of openin If suspended wooden fl	• / .	sealed) or 0	1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, ent	,	•	(000	, o.oo	0.1101 0				0	(13)
Percentage of windows	and doors draugh	nt stripped							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,	•		•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili Air permeability value applies	,					is being u	sad		0.1	(18)
Number of sides sheltere		rnas been dor	ie or a de	gree all pe	THEADIIITY	is being u	seu		2	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	ing shelter factor			(21) = (18	x (20) =				0.08	(21)
Infiltration rate modified for	or monthly wind sp	eed		1		1			1	
Jan Feb	Mar Apr M	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe				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		
Wind Factor (22a)m = (22	2)m ÷ 4									
	1.23 1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowii	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effe		_	rate for t	he appli	cable ca	se						ı	
If mechanic				ah) (aa-	· \		IC/\		\ (00-\			0.5	(23a
If exhaust air h) = (23a)			0.5	(23b
If balanced with		-	-	_								75.65	(23c
a) If balance						- ` 	- ^ ` ` - 	ŕ	 	- 	<u>`</u>	· ÷ 100] I	(240
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(24a
b) If balance	1							``	r Ó T			1	(O.4h
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h	nouse ex n < 0.5 ×			•	•				5 v (23h	,)			
(24c)m = 0	0.5 x	0	0	0	0	0	0	0	0	0	0		(240
d) If natural			,										(= .0
,	n = 1, the				•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change	rate - en	iter (24a	or (24k	o) or (24	c) or (24	d) in box	· (25)		•	•	•	
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
2		21 1000	0.000										
3. Heat losse	s and ne				Net Ar	00	U-valı	10	AXU		k-value		λΧk
ELEMENT	area		Openin m		A,r		W/m2		(W/I	K)	kJ/m ² ·l		J/K
Doors					3.57	x	1	= [3.57				(26)
Windows Type	e 1				7.35	x .	1/[1/(1)+	0.04] =	7.07	Ħ			(27)
Windows Type	e 2				3.8	x	1/[1/(1)+	0.04] =	3.65	Ħ			(27)
Windows Type	e 3				2.21	x	1/[1/(1)+	0.04] =	2.13	5			(27)
Floor					55.94	=	0.13		7.2722	<u></u>	75	419	
Walls	64.9	13	16.93	$\overline{}$	48		0.18	╡ :	8.64	닄 ;	14	67:	= ` '
Total area of e			10.3		120.8	^	0.10		0.04		14		(31)
Party wall		,				=		— I					``
•					19.92	=	0	=	0		20	398	== `
Party ceiling	•				55.94	=				Ĺ	30	1678	==
Internal wall **			· · · ·	, ,,	63.63			/F/4/11 1	1 0 0 4	. <u>.</u>	9	572.	67 (320
* for windows and ** include the are						ated using	tormula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapr	1 3.2	
Fabric heat los				,			(26)(30)) + (32) =				32.33	(33)
Heat capacity		,	,					((28)	(30) + (32	2) + (32a).	(32e) =	7516.77	(34)
Thermal mass	,	,	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			134.37	(35)
For design asses	sments wh	ere the de	tails of the	,			ecisely the	e indicative	values of	TMP in Ta	able 1f	1	\``
Thermal bridg				using Ap	pendix ł	<						11.84	(36)
if details of therma Total fabric he	al bridging	,			•			(33) +	(36) =				(37)
Ventilation he		عاديناعهما	monthly	,					$= 0.33 \times ($	'25)m v (5)	\ \	44.17	(37)
	Feb	Mar			lun	Jul	Λιια				1	1	
Jan	Гер	ividi	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(20)	40.50	10.40	0.00	0.04	0.05	0.05	0.05	0.54	0.04	10.00	40.00		(38)
(38)m= 10.62	10.52	10.42	9.93	9.84	9.35	9.35	9.25	9.54	9.84	10.03	10.23		(36)
Heat transfer c	54.69	nt, VV/K 54.59	54.1	54.01	53.52	53.52	53.42	(39)m 53.71	= (37) + (54.01	38)m 54.2	54.4		
(39)111= 34.79	34.09	34.59	34.1	34.01	33.32	33.32	33.42			Sum(39) ₁	<u> </u>	54.08	(39)
Heat loss para	meter (I	HLP), W	m²K				_		= (39)m ÷				 _`
(40)m= 0.98	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.96	0.97	0.97	0.97		_
Number of day	s in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	0.97	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
		•					•			•			
4. Water heat	ing ene	rgy requi	irement:								kWh/ye	ar:	
Assumed occu	nancy	N								1	.86		(42)
if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.00		(42)
Annual average	e hot wa										3.49		(43)
Reduce the annua not more that 125	_				_	_	to achieve	a water us	se target o	f			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in				,				Эер	Oct	1404	Dec		
(44)m= 86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34		
										m(44) ₁₁₂ =	L	941.88	(44)
Energy content of		used - cal			190 x Vd,r	n x nm x E	OTm / 3600	kWh/mon		bles 1b, 1	c, 1d)		
(45)m= 128.04	111.98	115.56	100.75	96.67	83.42	77.3	88.7	89.76	104.61	114.19	124	4004.05	(4E)
If instantaneous w	ater heati	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46		lotal = Su	m(45) ₁₁₂ =	- [1234.95	(45)
(46)m= 19.21	16.8	17.33	15.11	14.5	12.51	11.59	13.31	13.46	15.69	17.13	18.6		(46)
Water storage													
Storage volum	` '		•			•		ame ves	sel		0		(47)
If community h Otherwise if no	_			_			. ,	ers) ente	er '0' in <i>(</i>	47)			
Water storage			(,		, ,			
a) If manufacti	urer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature fa											0		(49)
Energy lost from b) If manufaction		_	-		or is not		(48) x (49)) =			0		(50)
Hot water stora			-								0		(51)
If community h	•		on 4.3										
Volume factor			O.b.							—	0		(52)
Temperature fa							(43) (54)	(50) (- 0)		0		(53)
Energy lost fro Enter (50) or (_	, KVVN/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
Water storage	, ,	•	for each	month			((56)m = (55) × (41)r	m		<u> </u>		(00)
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	-							_				×Н	. ,
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
L		•					•		•	•			

Primary circuit loss (annual) from Table 3				0]	(58)
Primary circuit loss calculated for each month	i (59)m = (58) ÷ 36	65 × (41)m			•	
(modified by factor from Table H5 if there is	s solar water heati	ing and a cylinde	er thermostat)	_	_	
(59)m= 0 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)m	= (60) ÷ 365 × (41)m				
(61)m= 14.02 12.65 13.98 13.5 13.93	- 	13.91 13.48	13.96 13.54	14.01	1	(61)
Total heat required for water heating calculate	ed for each month	$1.(62)$ m = $0.85 \times$	(45)m + (46)m -		ı · (59)m + (61)m	
(62)m= 142.06 124.63 129.54 114.24 110.59		102.61 103.24	118.56 127.73	-]	(62)
Solar DHW input calculated using Appendix G or Append					1	
(add additional lines if FGHRS and/or WWHR			a. 002 u	10. 1.0ag/		
(63)m= 0 0 0 0 0	0 0	0 0	0 0	0	1	(63)
Output from water heater	1 1	<u> </u>	1		1	
(64)m= 142.06 124.63 129.54 114.24 110.59	9 96.87 91.19	102.61 103.24	118.56 127.73	138.01	1	
(6.7)	0 00.01		vater heater (annual		1399.28	(64)
Heat gains from water heating, kWh/month 0.	25 ' [0 85 v (45)m					
(65)m= 46.08 40.4 41.92 36.87 35.62	 	32.97 33.21	38.27 41.35	44.73	']]	(65)
` '		<u> </u>		<u> </u>]	(00)
include (57)m in calculation of (65)m only if	cylinder is in the	dwelling or hot v	vater is from cor	nmunity r	ieating	
5. Internal gains (see Table 5 and 5a):			_			
Met <mark>abolic</mark> gains (Table 5), Watts					1	
Jan Feb Mar Apr Mar		Aug Sep	Oct Nov	Dec		
(66)m= 93.24 93.24 93.24 93.24 93.24	93.24 93.24	93.24 93.24	93.24 93.24	93.24		(66)
Ligh <mark>ting gains (calculated in Appen</mark> dix L, equ	ation L9 or L9a), a	also see Table 5		_	,	
(67)m= 14.5 12.88 10.47 7.93 5.93	5 5.41	7.03 9.43	1 <mark>1.97 13.98</mark>	14.9		(67)
Appliances gains (calculated in Appendix L, e	equation L13 or L1	3a), also see Ta	able 5		_	
(68)m= 162.6 164.29 160.04 150.99 139.50	6 128.82 121.65	119.96 124.21	133.26 144.69	155.43		(68)
Cooking gains (calculated in Appendix L, equ	ation L15 or L15a), also see Table	e 5		-	
(69)m= 32.32 32.32 32.32 32.32 32.32	32.32 32.32	32.32 32.32	32.32 32.32	32.32		(69)
Pumps and fans gains (Table 5a)		•	•	•	•	
(70)m= 3 3 3 3 3	3 3	3 3	3 3	3	1	(70)
Losses e.g. evaporation (negative values) (Ta	able 5)	•	•		1	
(71)m= -74.59 -74.59 -74.59 -74.59 -74.59	- 	-74.59 -74.59	-74.59 -74.59	-74.59	1	(71)
Water heating gains (Table 5)			<u> </u>	1	ı	
(72)m= 61.93 60.11 56.34 51.21 47.88	43.19 39.21	44.32 46.13	51.44 57.43	60.12	1	(72)
Total internal gains =		n + (68)m + (69)m +	ļļ		J	
(73)m= 293.01 291.25 280.82 264.1 247.3		225.28 233.75	250.65 270.07	<u>′</u>	1	(73)
6. Solar gains:	230.99 220.24	223.20 233.73	230.03	204.43		(10)
Solar gains are calculated using solar flux from Table 6	a and associated equa	ations to convert to t	he applicable orient	ation.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	9_ Table 6b			(W)	
Southeast 0.9x 0.77 x 3.8	x 36.79	x 0.3	x 0.7		20.35	(77)
		-](77)
Southeast 0.9x 0.77 x 3.8	× 62.67	X 0.3	X 0.7	=	34.66	۱٬٬٬

Utilisation fac	tor for ga Feb	ins for Mar	living are Apr	ea, h1,n May	Ť	ee Ta Jun	ble 9a) Jul	A	ug S	Бер	Oct	Nov	Dec			
Temperature	7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)															
` '						.50.5	717.01	J 334	.20 30	0.09	U+1.20	323.0	JZ 1.02			(04)
Total gains – ir (84)m= 337.26		nd sola 400.09	r (84)m = 429.72	449.14	<u> </u>	33)m ,	417.31	394	26 36	8.89	341.20	323.8	321.82	7		(84)
(83)m= 44.25		119.26	165.62	201.8		07.51	197.07	168	.99 13	5.14	90.61	53.73	37.4			(83)
Solar gains in					$\overline{}$	1			= Sum(7			1		7		(00)
	0.77	^			^		,.∠ I	」 ^	U.,	<u> </u>	」^	U.7	=		3.00	(01)
Northwest 0.9x	0.77	x			X).21	x x	0.3		」 × □ ×	0.7	_ =		15.19 9.86	(81)
Northwest 0.9x	0.77	×			X		8.07	X	0.3		」 × ¬ 、	0.7	=		30.02	(81)
Northwest 0.9x	0.77	x			X		0.42	X	0.3		X	0.7	╡ =		53.93	(81)
Northwest 0.9x	0.77	×			X		2.63	X	0.3		X	0.7	=		77.69	(81)
Northwest _{0.9x}	0.77	x	7.3	5	X	9	91.1	X	0.3	3	X	0.7	=		97.45	(81)
Northwest _{0.9x}	0.77	×	7.3	5	X	9	7.38	X	0.3	3	X	0.7	=		104.17	(81)
Northwest _{0.9x}	0.77	x	7.3	35	x	9	1.35	x	0.3	3	X	0.7	=		97.71	(81)
Northwest _{0.9x}	0.77	x	7.3	5	x	6	7.96	x	0.3	3	X	0.7	=		72.69	(81)
Northwest _{0.9x}	0.77	×	7.3	5	x	4	1.38	x	0.3	3	x	0.7	_ =		44.26	(81)
Northwest 0.9x	0.77	×	7.3	5	х	2	2.97	x	0.3	3	X	0.7			24.57	(81)
Northwest _{0.9x}	0.77	x	7.3	5	x	1	1.28	X	0.3	3	X	0.7			12.07	(81)
Southwest _{0.9x}	0.77	×	2.2	21	x	3	1.49		0.3	3	X	0.7			10.13	(79)
Southwest _{0.9x}	0.77	×			x		4.07	7	0.:		X	0.7	=		14.17	(79)
Southwest _{0.9x}	0.77	×	2.2	_	х	_	9.27		0.:		X	0.7	╡ -		22.28	(79)
Southwest _{0.9x}	0.77	×	2.2	_	х		2.85		0.:		X	0.7	=		29.86	(79)
Southwest _{0.9x}	0.77	×			X		04.39		0.:		X	0.7			33.57	(79)
Southwest _{0.9x}	0.77	$=$ \hat{x}	2.2		x		13.91]]	0.:		」 ^ □ x	0.7	- -		36.64	(79)
Southwest _{0.9x}	0.77	$=$ $\frac{1}{x}$	2.2		x		19.01 18.15]]	0.3		」 ^ □ x	0.7	$\dashv $		38.28	(79)
Southwest _{0.9x}	0.77	x			x		06.25]]	0.3		」 × □ x	0.7	=		34.17	(79)
Southwest _{0.9x}	0.77	×			X		5.75]]	0.3		」 × ¬ ,	0.7	=		27.58	(79)
Southwesto s	0.77	×			X		2.67] 1	0.3		X	0.7	ᆗ =		20.16	(79)
Southwest _{0.9x}	0.77	×	2.2		X		6.79		0.3	3	X	0.7	=		11.83	(79)
Southeast 0.9x	0.77	×	3.0	3	X	3	1.49	X	0.3	3	X	0.7	=		17.41	(77)
Southeast 0.9x	0.77	×	3.8	3	X	4	4.07	x	0.3	3	X	0.7	=		24.37	(77)
Southeast 0.9x	0.77	х	3.8	3	X	6	9.27	X	0.3	3	X	0.7	=		38.31	(77)
Southeast 0.9x	0.77	х	3.8	3	X	9	2.85	X	0.3	3	X	0.7	=		51.35	(77)
Southeast 0.9x	0.77	x	3.8	3	X	10)4.39	X	0.3	3	X	0.7	=		57.73	(77)
Southeast 0.9x	0.77	х	3.8	3	X	11	13.91	x	0.3	3	X	0.7	=		62.99	(77)
Southeast 0.9x	0.77	Х	3.8	3	X	11	18.15	X	0.3	3	X	0.7	=		65.34	(77)
Southeast 0.9x	0.77	X	3.8	3	X	11	19.01	x	0.3	3	X	0.7	=		65.81	(77)
Southeast 0.9x	0.77	x	3.8	3	x	10	06.25	x	0.3	3	X	0.7	=		58.76	(77)
Southeast 0.9x	0.77			3	X		5.75		0.3		X	0.7	=		47.42	(77)

(86)m=	0.98	0.97	0.95	0.91	0.82	0.68	0.53	0.58	0.78	0.93	0.97	0.98		(86)
Mean ii	nternal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.37	19.55	19.86	20.26	20.63	20.87	20.96	20.95	20.77	20.31	19.77	19.33		(87)
Tempe	rature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	 h2 (°C)				•	
(88)m=	20.1	20.1	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.11		(88)
Utilisati	ion fact	or for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)					•	
(89)m=	0.98	0.97	0.95	0.89	0.79	0.61	0.44	0.48	0.73	0.91	0.97	0.98		(89)
Mean ii	nternal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to	7 in Tabl	e 9c)			ı	
	17.92	18.17	18.62	19.2	19.7	20.01	20.09	20.09	19.89	19.28	18.5	17.86		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean ii	nternal	temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) x T2			!		
(92)m=	18.8	19.01	19.37	19.84	20.26	20.53	20.62	20.61	20.42	19.9	19.27	18.75		(92)
Apply a	adjustm	ent to the	ne mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate	Į.			
(93)m=	18.65	18.86	19.22	19.69	20.11	20.38	20.47	20.46	20.27	19.75	19.12	18.6		(93)
8. Spac	ce heat	ing requ	uirement											
						ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utili		Feb	Ť	using Ta		lup	lul	Aug	Son	Oct	Nov	Doo		
_ Utilisati	Jan ion fact	$\overline{}$	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	NOV	Dec		
	0.97	0.96	0.93	0.88	0.79	0.63	0.48	0.52	0.74	0.9	0.96	0.97		(94)
_	gains, I	nmGm .	W = (94	4)m x (84	4)m									
	327.42	355.34	373.99	379.38	352.97	276.84	198.26	204.59	272.51	306.88	309.79	313.69		(95)
Monthly	y avera	ge 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 lo	ss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	Г	ī	ı	
` ′	786.03	763.24	694.19	583.87	454.17	309.26	206.95	216.61	331.57	494.31	651.55	783.35		(97)
	Ť)m – (95	<u> </u>		040.40	I	
(98)m=	341.21	274.11	238.23	147.23	75.3	0	0	0	0	139.45	246.07	349.43		(OO)
								lota	l per year	(kwh/yeai	') = Sum(9	8)15,912 =	1811.03	(98)
Space	heating	require	ement in	kWh/m²	/year								32.37	(99)
9a. Ener	rgy requ	uiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space		_			ما مسمار									(204)
						mentary	-	(000) 4	(004)				0	(201)
				nain syst	` ,			(202) = 1		(0.00)			1	(202)
			_	main sys				(204) = (2	02) x [1 – ((203)] =			1	(204)
	•	•		ing syste									90.5	(206)
Efficien	ncy of s	econda	ry/suppl	ementar	y heating	g system	າ, %					_	0	(208)
L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
· -	Ť			alculate									I	
_	341.21	274.11	238.23	147.23	75.3	0	0	0	0	139.45	246.07	349.43		
(211)m =								ı			1	ı	ı	(211)
Ľ	377.03	302.89	263.24	162.69	83.2	0	0	0	0	154.09	271.9	386.11		— , .
								lota	l (kWh/yea	ıı) =5um(2	(11) _{15,1012}	=	2001.13	(211)

Space heating fuel (secondary), kWh/month								
$= \{[(98) \text{m x } (201)]\} \times 100 \div (208)$								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
	-	Total (k	kWh/year)	=Sum(2	15) _{15,1012}	F	0	(215)
Water heating								
Output from water heater (calculated above) 142.06 124.63 129.54 114.24 110.59 9	96.87 91.19	102.61 1	103.24 1	118.56	127.73	138.01		
Efficiency of water heater	30.07	102.01	100.24	110.50	127.75	100.01	87.3	(216)
· · · · · · · · · · · · · · · · · · ·	87.3 87.3	87.3	87.3	89	89.38	89.57	0.10	」` (217)
Fuel for water heating, kWh/month	ļ			!				
$(219)m = (64)m \times 100 \div (217)m$		T= T .						
(219)m= 158.66 139.29 144.98 128.26 124.87 1	10.96 104.45		118.26 1 Sum(219a	133.22	142.9	154.08	4577.40	7(240)
Annual totals		Total =	Sum(2196		Vh/year		1577.48 kWh/year	(219)
Space heating fuel used, main system 1				N.V	vii/yeai		2001.13	7
Water heating fuel used							1577.48	Ī
Electricity for pumps, fans and electric keep-hot						'		
mechanical ventilation - balanced, extract or pos	sitive input fror	m outside				153.56		(230a)
central heating pump:						30		(230c)
boi <mark>ler wi</mark> th a fan-assisted flue						45		(230e)
Total electricity for the above, kWh/year		sum of	(230a)((2 30g) =			228.56	(231)
Electricity for lighting							256.01	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)	(237b) =					4063.17	(338)
12a. CO2 emissions – Individual heating system	s including mi	icro-CHP						
	Energy		F	- mieei	on fac	tor	Emissions	
	kWh/year			g CO2		to:	kg CO2/yea	
Space heating (main system 1)	(211) x			0.21	6	=	432.24	(261)
Space heating (secondary)	(215) x			0.51	9	=	0	(263)
Water heating	(219) x			0.21	6	=	340.73	(264)
Space and water heating	(261) + (262)	+ (263) + (264	4) =				772.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.51	9	=	118.62	(267)
Electricity for lighting	(232) x			0.51	9	=	132.87	(268)
Total CO2, kg/year			sum of (2	265)(2	. 7 1) =		1024.47	(272)
Dwelling CO2 Emission Rate			(272) ÷ ((4) =			18.31	(273)

El rating (section 14)

				User D	etails:						
Assessor Name: Software Name:	Strom	na FSAP 2	2012	0001 2	Strom Softwa				Versio	on: 1.0.5.41	
				<u> </u>	Address	: 1 Bed I	End - TF				
Address :		End - TF, I	London, TE	3C							
1. Overall dwelling dime	ensions:			۸ro	o/m²\		Av. Ho	ight(m)		Volume(m ³	11
Ground floor					a(m²) 55.94	(1a) x		2.5	(2a) =	139.85	(3a)
Total floor area TFA = (1	a)+(1b)+	(1c)+(1d)+	(1e)+(1ı	ገ)	55.94	(4)					
Dwelling volume						(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	139.85	(5)
2. Ventilation rate:											
Number of chimneys	ma hea	ain ating 0 +	secondar heating	ry +	other 0] = [total 0	x 4	40 =	m³ per hou	(6a)
Number of open flues		0 +	0		0] ₌ [0	x	20 =	0	一 (6b)
Number of intermittent fa	L ans					_ 	0	x	10 =	0	(7a)
Number of passive vents	3					L	0	x	10 =	0	(7b)
Number of flueless gas f						F	0	X 4	40 =	0	(7c)
Training of the factors gas						L	0		Air ch	nanges per ho	
Infiltration due to chimne						Ţ	0		÷ (5) =	0	(8)
If a pressurisation test has a Number of storeys in t			ended, procee	ed to (17),	otherwise (continue tr	om (9) to ((16)		0	(9)
Additional infiltration		(1.10)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: ().25 for st	teel or timb	er frame o	0.35 fo	r masoni	ry constr	uction			0	(11)
if both types of wall are p			rresponding to	the great	ter wall are	a (after					
deducting areas of open. If suspended wooden			ealed) or 0	.1 (seale	ed). else	enter 0				0	(12)
If no draught lobby, er		•	•	(,,					0	(13)
Percentage of window										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, exp	oressed in o	cubic metre	es per ho	our per s	quare m	etre of e	nvelope	area	2	(17)
If based on air permeabi	•									0.1	(18)
Air permeability value appli		surisation test	has been do	ne or a de	gree air pe	rmeability	is being u	sed			– , .
Number of sides shelter Shelter factor	ea				(20) = 1 -	[0.075 x (1	19)1 =			2	(19)
Infiltration rate incorpora	tina shelt	er factor			(21) = (18	`	/,1			0.85	(20)
Infiltration rate modified	•		eed		, , (.0	,				0.08	(21)
Jan Feb	1	Apr Ma	1	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp		· · ·	-, 00.11	1	1 , , , ,	1 500	1 300	1	1 200	I	
(22)m= 5.1 5	i	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
					1	ı	1	ı		ı	
Wind Factor (22a)m = (2				Π_	T _		Π.	Ι.	Ι.	1	
(22a)m= 1.27 1.25	1.23	1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowii	na for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effect		_	ate for t	he appli	cable ca	se							
If mechanica			andia N. (O	ah) (aa-	· \		IC/\		\ (00-\			0.5	(23a
If exhaust air he) = (23a)			0.5	(23b
If balanced with		-	-	_								75.65	(230
a) If balance	ı —					- `	- ^ ` ` - 	ŕ	 		<u>`</u>	÷ 100] I	(0.4-
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(24a
b) If balance	i					<u> </u>		``	r Ó T		ı	1	(0.11
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24h
c) If whole h				•	•				F (00)	,			
<u> </u>	i	(23b), tl	,	, ,		· ·	ŕ	ŕ –	<u> </u>		Ι ,	1	(246
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural if (22b)n		on or who en (24d)ı		•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change	rate - en	ter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
3. Heat losse	s and he	eat loss n	aramet	or.					_		_		
ELEMENT	Gros		Openin		Net Ar	ea	U-val	IE.	AXU		k-value	. A	λΧk
	area		m		A ,r		W/m2		(W/I	K)	kJ/m²·l		J/K
Doo <mark>rs</mark>					3.57	x	1	= [3.57				(26)
Win <mark>dows</mark> Type	1				7.35	x .	1/[1/(1)+	0.04] =	7.07	Ħ			(27)
Windows Type	2				3.8	7 x	1/[1/(1)+	0.04] =	3.65	Ħ			(27)
Windows Type	3				2.21	-	1/[1/(1)+	0.04] =	2.13	5			(27)
Walls	64.9	13	16.93	$\overline{}$	48	x	0.18		8.64	=	14	67:	 : :
Roof	55.9				55.94	=	0.10	 	6.15	륵 ¦	0	503.	= `
Total area of e			0				0.11		0.15		9	503.	
	iemenis	, 111-			120.8	=							(31)
Party wall					19.92	2. X	0	=	0		20	398	== `
Party floor					55.94					Į	40	223	7.6 (32a
Internal wall **					63.63					L	9	572.	67 (320
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ıe)+0.04] <i>६</i>	as given in	paragraph	3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				31.21	(33)
Heat capacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	4384.13	(34)
Thermal mass	parame	ter (TMP) = Cm ÷	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			78.37	(35)
For design assess can be used inste				construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L	x Y) cald	culated u	using Ap	pendix ł	<						15.6	(36)
if details of therma	al bridging	,		• .	•			(33) +	(36) =				
		مامينامهم	monthly	,						25\m v (F)	\	46.8	(37)
Ventilation hea	i				1	11	Λ		= 0.33 × (1]	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	

	1	•										l	
(38)m= 10.62	10.52	10.42	9.93	9.84	9.35	9.35	9.25	9.54	9.84	10.03	10.23		(38)
Heat transfer								· · · ·	= (37) + (38)m	ī	ı	
(39)m= 57.43	57.33	57.23	56.74	56.64	56.15	56.15	56.05	56.35	56.64	56.84	57.03		¬(00)
Heat loss para	ameter (I	HLP), W	/m²K						Average = = (39)m ÷	Sum(39)₁ · (4)	12 /12=	56.71	(39)
(40)m= 1.03	1.02	1.02	1.01	1.01	1	1	1	1.01	1.01	1.02	1.02		_
Number of da	ve in mo	nth (Tah	lo 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)
	Į						ļ			ļ			
4. Water hea	ting ene	rav reaui	irement:								kWh/ye	ear:	
			irement.								ICVVIII y C	Jui.	
Assumed occi if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (ΓFA -13.		.86		(42)
Annual average	,	ater usad	ge in litre	s per da	ay Vd,av	erage =	(25 x N)	+ 36		78	3.49		(43)
Reduce the annu	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o				` '
not more that 125	o litres per	person per	r day (all w	ater use, i	not and co	ia)						l	
Jan Hot water usage	Feb	Mar	Apr	May	Jun	Jul Table 10 Y	Aug	Sep	Oct	Nov	Dec		
(44)m= 86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34	244.00	
Energy content o	f hot wa <mark>ter</mark>	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		941.88	(44)
(45)m= 128.04	111.98	115.56	100.75	96.67	83.42	77.3	88.7	89.76	104.61	114.19	124		
If instantone aug.	water beati	na ot noint	of upo (no	, bot water	t otorogo)	antar O in	haves (46		Γotal = Su	m(45) ₁₁₂ =	=	1234.95	(45)
If instantaneous v		· ·								l		1	(40)
(46)m= 19.21 Water storage	16.8 ! loss:	17.33	15.11	14.5	12.51	11.59	13.31	13.46	15.69	17.13	18.6		(46)
Storage volum) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community I	neating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						, ,
Otherwise if n	_			_			, ,	ers) ente	er '0' in (47)			
Water storage												1	
a) If manufac				or is kno	wn (kWh	n/day):					0		(48)
Temperature t											0		(49)
Energy lost from b) If manufact		_	-		or io not		(48) x (49)	=			0		(50)
Hot water stor			-								0		(51)
If community I	J			`		,							· ,
Volume factor	from Ta	ble 2a									0		(52)
Temperature t	factor fro	m Table	2b								0		(53)
Energy lost fro		•	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or	. , .	•									0		(55)
Water storage	loss cal	culated t	for each	month			((56)m = (55) × (41)r	n				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3				0]	(58)
Primary circuit loss calculated for each month	i (59)m = (58) ÷ 36	65 × (41)m			•	
(modified by factor from Table H5 if there is	s solar water heati	ing and a cylinde	er thermostat)	_	_	
(59)m= 0 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)m	= (60) ÷ 365 × (41)m				
(61)m= 14.02 12.65 13.98 13.5 13.93	- 	13.91 13.48	13.96 13.54	14.01	1	(61)
Total heat required for water heating calculate	ed for each month	$1.(62)$ m = $0.85 \times$	(45)m + (46)m -		ı · (59)m + (61)m	
(62)m= 142.06 124.63 129.54 114.24 110.59		102.61 103.24	118.56 127.73	-]	(62)
Solar DHW input calculated using Appendix G or Append					1	
(add additional lines if FGHRS and/or WWHR			a. 002 u	10. 1.0ag/		
(63)m= 0 0 0 0 0	0 0	0 0	0 0	0	1	(63)
Output from water heater	1 1	<u> </u>	1		1	
(64)m= 142.06 124.63 129.54 114.24 110.59	9 96.87 91.19	102.61 103.24	118.56 127.73	138.01	1	
(6.7)	0 00.01		vater heater (annual		1399.28	(64)
Heat gains from water heating, kWh/month 0.	25 ' [0 85 v (45)m					
(65)m= 46.08 40.4 41.92 36.87 35.62	 	32.97 33.21	38.27 41.35	44.73	']]	(65)
` '		<u> </u>		<u> </u>]	(00)
include (57)m in calculation of (65)m only if	cylinder is in the	dwelling or hot v	vater is from cor	nmunity r	ieating	
5. Internal gains (see Table 5 and 5a):			_			
Met <mark>abolic</mark> gains (Table 5), Watts					1	
Jan Feb Mar Apr Mar		Aug Sep	Oct Nov	Dec		
(66)m= 93.24 93.24 93.24 93.24 93.24	93.24 93.24	93.24 93.24	93.24 93.24	93.24		(66)
Ligh <mark>ting gains (calculated in Appen</mark> dix L, equ	ation L9 or L9a), a	also see Table 5		_	,	
(67)m= 14.5 12.88 10.47 7.93 5.93	5 5.41	7.03 9.43	1 <mark>1.97 13.98</mark>	14.9		(67)
Appliances gains (calculated in Appendix L, e	equation L13 or L1	3a), also see Ta	able 5		_	
(68)m= 162.6 164.29 160.04 150.99 139.50	6 128.82 121.65	119.96 124.21	133.26 144.69	155.43		(68)
Cooking gains (calculated in Appendix L, equ	ation L15 or L15a), also see Table	e 5		-	
(69)m= 32.32 32.32 32.32 32.32 32.32	32.32 32.32	32.32 32.32	32.32 32.32	32.32		(69)
Pumps and fans gains (Table 5a)		•	•	•	•	
(70)m= 3 3 3 3 3	3 3	3 3	3 3	3	1	(70)
Losses e.g. evaporation (negative values) (Ta	able 5)	•	•		1	
(71)m= -74.59 -74.59 -74.59 -74.59 -74.59	 	-74.59 -74.59	-74.59 -74.59	-74.59	1	(71)
Water heating gains (Table 5)			<u> </u>	1	ı	
(72)m= 61.93 60.11 56.34 51.21 47.88	43.19 39.21	44.32 46.13	51.44 57.43	60.12	1	(72)
Total internal gains =		n + (68)m + (69)m +	ļļ		J	
(73)m= 293.01 291.25 280.82 264.1 247.3		225.28 233.75	250.65 270.07	<u>′</u>	1	(73)
6. Solar gains:	230.99 220.24	223.20 233.73	230.03	204.43		(10)
Solar gains are calculated using solar flux from Table 6	a and associated equa	ations to convert to t	he applicable orient	ation.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	9_ Table 6b			(W)	
Southeast 0.9x 0.77 x 3.8	x 36.79	x 0.3	x 0.7		20.35	(77)
		-](77)
Southeast 0.9x 0.77 x 3.8	× 62.67	X 0.3	X 0.7	=	34.66	۱٬٬٬

Utilisation fac	tor for ga Feb	ins for Mar	living are Apr	ea, h1,n May	Ť	ee Ta Jun	ble 9a) Jul	A	ug S	Бер	Oct	Nov	Dec			
Temperature	7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)															
` '						.50.5	717.01	J 334	.20 30	0.09	U+1.20	323.0	JZ 1.02			(04)
Total gains – ir (84)m= 337.26		nd sola 400.09	r (84)m = 429.72	449.14	<u> </u>	33)m ,	417.31	394	26 36	8.89	341.20	323.8	321.82	7		(84)
(83)m= 44.25		119.26	165.62	201.8		07.51	197.07	168	.99 13	5.14	90.61	53.73	37.4			(83)
Solar gains in					$\overline{}$	1			= Sum(7			1		7		(00)
	0.77	^			^		,.∠ I	」 ^	U.,	<u> </u>	」^	U.7	=		3.00	(01)
Northwest 0.9x	0.77	x			X).21	x x	0.3		」 × □ ×	0.7	_ =		15.19 9.86	(81)
Northwest 0.9x	0.77	×			X		8.07	X	0.3		」 × ¬ 、	0.7	=		30.02	(81)
Northwest 0.9x	0.77	x			X		0.42	X	0.3		X	0.7	╡ =		53.93	(81)
Northwest 0.9x	0.77	×			X		2.63	X	0.3		X	0.7	=		77.69	(81)
Northwest _{0.9x}	0.77	x	7.3	5	X	9	91.1	X	0.3	3	X	0.7	=		97.45	(81)
Northwest _{0.9x}	0.77	×	7.3	5	X	9	7.38	X	0.3	3	X	0.7	=		104.17	(81)
Northwest _{0.9x}	0.77	x	7.3	35	x	9	1.35	x	0.3	3	X	0.7	=		97.71	(81)
Northwest _{0.9x}	0.77	x	7.3	5	x	6	7.96	x	0.3	3	X	0.7	=		72.69	(81)
Northwest _{0.9x}	0.77	×	7.3	5	x	4	1.38	x	0.3	3	x	0.7	_ =		44.26	(81)
Northwest 0.9x	0.77	×	7.3	5	х	2	2.97	x	0.3	3	X	0.7			24.57	(81)
Northwest _{0.9x}	0.77	x	7.3	5	x	1	1.28	X	0.3	3	X	0.7			12.07	(81)
Southwest _{0.9x}	0.77	×	2.2	21	x	3	1.49		0.3	3	X	0.7			10.13	(79)
Southwest _{0.9x}	0.77	×			x		4.07	7	0.:		X	0.7	=		14.17	(79)
Southwest _{0.9x}	0.77	×	2.2	_	х	_	9.27		0.:		X	0.7	╡ -		22.28	(79)
Southwest _{0.9x}	0.77	×	2.2	_	х		2.85		0.:		X	0.7	=		29.86	(79)
Southwest _{0.9x}	0.77	×			X		04.39		0.:		X	0.7			33.57	(79)
Southwest _{0.9x}	0.77	$=$ \hat{x}	2.2		x		13.91]]	0.:		」 ^ □ x	0.7	- -		36.64	(79)
Southwest _{0.9x}	0.77	$=$ $\frac{1}{x}$	2.2		x		19.01 18.15]]	0.3		」 ^ □ x	0.7	$\dashv $		38.28	(79)
Southwest _{0.9x}	0.77	x x			x		06.25]]	0.3		」 × □ x	0.7	=		34.17	(79)
Southwest _{0.9x}	0.77	×			X		5.75]]	0.3		」 × ¬ ,	0.7	=		27.58	(79)
Southwesto s	0.77	×			X		2.67] 1	0.3		X	0.7	ᆗ =		20.16	(79)
Southwest _{0.9x}	0.77	×	2.2		X		6.79		0.3	3	X	0.7	=		11.83	(79)
Southeast 0.9x	0.77	×	3.0	3	X	3	1.49	X	0.3	3	X	0.7	=		17.41	(77)
Southeast 0.9x	0.77	×	3.8	3	X	4	4.07	x	0.3	3	X	0.7	=		24.37	(77)
Southeast 0.9x	0.77	х	3.8	3	X	6	9.27	X	0.3	3	X	0.7	=		38.31	(77)
Southeast 0.9x	0.77	х	3.8	3	X	9	2.85	X	0.3	3	X	0.7	=		51.35	(77)
Southeast 0.9x	0.77	x	3.8	3	X	10)4.39	X	0.3	3	X	0.7	=		57.73	(77)
Southeast 0.9x	0.77	х	3.8	3	X	11	13.91	x	0.3	3	X	0.7	=		62.99	(77)
Southeast 0.9x	0.77	Х	3.8	3	X	11	18.15	X	0.3	3	X	0.7	=		65.34	(77)
Southeast 0.9x	0.77	X	3.8	3	X	11	19.01	x	0.3	3	X	0.7	=		65.81	(77)
Southeast 0.9x	0.77	x	3.8	3	x	10	06.25	x	0.3	3	X	0.7	=		58.76	(77)
Southeast 0.9x	0.77			3	X		5.75		0.3		X	0.7	=		47.42	(77)

,												•	ı	
(86)m=	0.95	0.93	0.9	0.85	0.76	0.64	0.51	0.55	0.73	0.87	0.93	0.95		(86)
Mean	interna	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	18.53	18.77	19.19	19.75	20.28	20.69	20.87	20.84	20.53	19.86	19.1	18.48		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.06	20.06	20.06	20.07	20.07	20.08	20.08	20.08	20.08	20.07	20.07	20.07		(88)
Utilisa	tion fac	tor for a	ains for	rest of d	welling,	h2,m (se	e Table	9a)				-	•	
(89)m=	0.94	0.92	0.89	0.83	0.73	0.58	0.43	0.47	0.68	0.85	0.92	0.95		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (fa	ollow ste	ens 3 to	7 in Tabl	e 9c)				
(90)m=	16.74	17.08	17.69	18.5	19.23	19.77	19.98	19.95	19.58	18.66	17.57	16.66		(90)
			<u> </u>			<u> </u>			f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Moon	intornal	tompor	ature (fo	r the wh	ala dwa	lling) – fl	Λ ν Τ1	⊥ (1 _ fl	۸) ی T2					
(92)m=	17.82	18.1	18.59	19.25	19.87	20.32	20.52	20.49	20.15	19.39	18.5	17.76		(92)
				<u> </u>		<u> </u>		<u> </u>	ere appro		10.0			
(93)m=	17.67	17.95	18.44	19.1	19.72	20.17	20.37	20.34	20	19.24	18.35	17.61		(93)
8. Spa	ace hea	ting requ	uirement											
						ed at ste	ep 11 of	Table 9l	b, so tha	t Ti <u>,</u> m=(76)m an	d re-calc	ulate	
the ut			or gains									_	ı	
1.1611	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.92	0.9	ains, hm 0.86	0.8	0.71	0.58	0.45	0.49	0.67	0.82	0.9	0.93		(94)
			, W = (94			0.56	0.43	0.49	0.07	0.82	0.9	0.93		(04)
(95)m=		332.93	345.99	345.92	320.09	255.78	189.61	193.58	247.86	280.72	289.87	297.69		(95)
		age exte	rnal tem	perature		able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	ļ.	Į.	l	
(97)m=	767.66	747.96	683.49	578.99	454.15	312.88	211.5	220.73	332.67	489.23	639.18	764.56		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mont	h = 0.02	24 x [(97)m – (95)m] x (4	1)m		ı	
(98)m=	340.78	278.9	251.1	167.81	99.75	0	0	0	0	155.13	251.51	347.35		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1892.32	(98)
Space	e heating	g require	ement in	kWh/m²	/year								33.83	(99)
9a. En	ergy red	uiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•												
Fracti	on of sp	ace hea	at from so	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 r	nain spa	ace heat	ing syste	em 1								90.5	(206)
Efficie	ency of s	seconda	ry/supple	ementar	y heatin	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
Space	e heating	g require	ement (c	<u> </u>										
	340.78	278.9	251.1	167.81	99.75	0	0	0	0	155.13	251.51	347.35		
(211)m	= {[(98)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	376.55	308.17	277.46	185.43	110.22	0	0	0	0	171.42	277.91	383.82		
•								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	- <u> </u>	2090.96	(211)
												•		

Chara hasting fuel (accordant) I/Mh/month					
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$					
(215)m= 0 0 0 0 0	0 0 0	0 0 0	0		
	Tota	al (kWh/year) =Sum(215) _{15,10}	₁₂ =	0	(215)
Water heating					_
Output from water heater (calculated above) 142.06 124.63 129.54 114.24 110.59 9	06.87 91.19 102.61	103.24 118.56 127.73	138.01]	
Efficiency of water heater	0.07 91.19 102.01	103.24 110.30 127.73	130.01	87.3	(216)
	87.3 87.3 87.3	87.3 89.09 89.4	89.57	07.0	(217)
Fuel for water heating, kWh/month	L				
$(219)m = (64)m \times 100 \div (217)m$	40.00 404.45 447.54	140.00 400.00 440.00	154.00	1	
(219)m= 158.67 139.27 144.92 128.11 124.56 1	10.96 104.45 117.54	118.26 133.09 142.88 al = Sum(219a) ₁₁₂ =	154.09	1576 70	7(240)
Annual totals	700	kWh/yea	ır	1576.79 kWh/yea i	(219)
Space heating fuel used, main system 1		KVIII y CC		2090.96	
Water heating fuel used				1576.79	Ħ
Electricity for pumps, fans and electric keep-hot					
mechanical ventilation - balanced, extract or posi-	itive input from outsid	e	153.56		(230a)
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sun	n of (230a)(230g) =		228.56	(231)
Electricity for lighting				256.01	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b)) =		4152.32	(338)
12a. CO2 emissions – Individual heating systems	s including micro-CHI				
	Energy	Emission fac	ctor	Emissions	;
	kWh/year	kg CO2/kWh		kg CO2/ye	ar
Space heating (main system 1)	(211) x	0.216	=	451.65	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	340.59	(264)
Space and water heating	(261) + (262) + (263) +	(264) =		792.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	118.62	(267)
Electricity for lighting	(232) x	0.519	=	132.87	(268)
Total CO2, kg/year		sum of (265)(271) =		1043.72	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.66	(273)
					_

El rating (section 14)

(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Mid - EF, L		i i	Address	i beu i	viia - EF				
1. Overall dwelling dime	nsions:									
0 10				a(m²)		Av. He	ight(m)	٦	Volume(m³	_
Ground floor				55.83	(1a) x	2	2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+((1e)+(1r	ገ) 5	55.83	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	d)+(3e)+	.(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	Ī + Ē	0	Ī - [0	x 2	20 =	0	(6b)
Number of intermittent far	ns					0	x -	10 =	0	(7a)
Number of passive vents					F	0	x ·	10 =	0	(7b)
Number of flueless gas fir	es				F	0	X 4	40 =	0	(7c)
					L					
								Air ch	nanges <mark>per</mark> ho	ur
Infiltration due to chimney	s, flues and fans =	(6a)+(6b)+(7	7 a)+(7 b)+(7c) =		0		÷ (5) =	0	(8)
If a pressurisation test has be		nded, procee	d to (17),	otherwise (continue fr	om (9) to ((16)			_
Number of storeys in the Additional infiltration	ie dweiling (ns)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or timbe	er frame or	0.35 fo	r masonı	y constr	uction	1(0)	ijko: i =	0	(11)
if both types of wall are pr	esent, use the value cor				•					`
deducting areas of opening If suspended wooden fl	• / .	aalad) or O	1 (coale	معام (امد	antar N				0	(12)
If no draught lobby, ent	•	•	. i (Scale	ou), else	enter o				0	(13)
Percentage of windows	•								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,	•		•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili	•					ia haina	and		0.1	(18)
Air permeability value applies Number of sides sheltere		nas been dor	ie or a de	gree air pe	тпеавшц	is being us	seu		2	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	ing shelter factor			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for	or monthly wind spe	ed				•	•	•	,	
Jan Feb	Mar Apr Ma	y Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7								1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

djusted infiltra	ation rate	(allowi	ing for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
a <i>lculate effed If</i> mechanica		-	rate for t	пе арріі	саріе са	ise					Г	0.5	
If exhaust air he		-	endix N, (2	3b) = (23a	a) × Fmv (equation (N5)) , othe	rwise (23b) = (23a)		L [0.5	
If balanced with	heat recov	ery: effic	ciency in %	allowing t	for in-use f	actor (fror	n Table 4h	ı) =				75.65	<u> </u>
a) If balance	d mecha	nical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2)	2b)m + (23b) × [۱ (23c) – 1		`
1a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22	•	(
b) If balance	d mecha	nical ve	entilation	without	heat red	covery (MV) (24k	m = (22)	2b)m + (23b)			
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
c) If whole h	ouse exti า < 0.5 ×			•	•				.5 × (23k	D)			
4c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
d) If natural if (22b)n	ventilation = 1, the			•					0.5]				
4d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
Effective air	change r	ate - er	nter (24a	or (24l	o) or (24	c) or (24	ld) in bo	x (25)					
i)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(
. Heat losse	s and hea	at loss i	paramet	er:							_		
EMENT	Gross area (S	Openin m	gs	Net Ar A ,ı		U-val W/m2		A X U (W/		k-value kJ/m²·k		A X k J/K
oors					3.57	x	1	=	3.57				(
in <mark>dows</mark> Type	: 1				7.35	x	1/[1/(1)+	0.04] =	7.07				(
indows Type	2				3.8	x	1/[1/(1)+	0.04] =	3.65	П			(
indows Type	3	'			2.21	x	1/[1/(1)+	0.04] =	2.13				(
oor					13.8	5 x	0.13	=	1.8005	<u>=</u> 5	75	1038	.75
alls	44.98	3	16.9	3	28.0	5 x	0.18	=	5.05		14	392	.7
tal area of e	lements,	m²	·		58.83	3							
arty wall					39.86	3 x	0	=	0		20	797	.2
arty floor					41.98	3					40	1679	9.2
arty ceiling					55.83	3					30	1674	1.9
ernal wall **					63.7						9	573.	39
or windows and Include the area						lated using	g formula 1	I/[(1/U-valu	ıe)+0.04] a	as given ir	n paragraph	3.2	
bric heat los	ss, W/K =	S (A x	U)				(26)(30) + (32) =			[23.27	
at capacity	Cm = S(A)	Axk)						((28).	(30) + (3	2) + (32a)	(32e) =	6156.14	
ermal mass	paramet	er (TMF	= Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			110.27	
r design assess n be used instea	ad of a deta	ailed calc	ulation.				recisely the	e indicative	e values of	TMP in T	able 1f		
ermal bridge	•	•		• .	•	K						11.09	
letails of therma	al bridging a at loss	are not kn	nown (36) =	= 0.05 x (3	31)				(36) =		_		

Ventila	ition hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21		(38)
Heat tr	ansfer c	coefficier	nt, W/K					•	(39)m	= (37) + (37)	38)m		•	
(39)m=	44.96	44.86	44.76	44.27	44.17	43.68	43.68	43.59	43.88	44.17	44.37	44.57		
Heat Ic	oss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	44.25	(39)
(40)m=	0.81	0.8	0.8	0.79	0.79	0.78	0.78	0.78	0.79	0.79	0.79	0.8		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	0.79	(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)
Assum	ed occu	ıpancy, l			(-0.0003	349 x (TF	-A -13.9)2)] + 0.(0013 x (⁻	ΓFA -13.		kWh/ye	ear:	(42)
if TF Annual Reduce	A £ 13.9 I averag the annua	9, N = 1 e hot wa al average	ater usaç	ge in litre	es per da 5% if the d	ay Vd,av	erage = designed	(25 x N) to achieve	+ 36		78	3.41		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea						Seb	Oct	INOV	Dec		
(44)m=	86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		
Energy (content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		940.97	(44)
(45)m=	127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
, ,								<u>. </u>		Total = Su	m(45) ₁₁₂ =	=	1233.75	(45)
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)					
(46)m=	19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
	storage		includin	na anv eo	alar or M	/M/HRS	etorana	within sa	ama vas	دما		0	1	(47)
If comr Otherw Water	munity h vise if no storage	eating a stored loss:	ind no ta hot wate	ink in dw er (this in	velling, e ncludes i	nter 110 nstantar	litres in				47)	0		
,			eclared l		JI IS KIIO	WII (KVVI	i/uay).					0		(48)
•			m Table					(40) (40				0		(49)
• • • • • • • • • • • • • • • • • • • •			storage eclared o	-		or is not		(48) x (49) =			0		(50)
Hot wa	iter stora	age loss	factor fr	om Tabl								0		(51)
	-	from Ta										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)
0,	(50) - (51) - (55)													(55)
• • • • • • • • • • • • • • • • • • • •	nergy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 Enter (50) or (54) in (55)													
Enter	. ,	. , .	55) culated f	for each	month			((56)m = (55) × (41)	m		0		(55)

If cylinder conta	ins dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	uit loss (ar	nnual) fro	m Table	 - 3				•			0		(58)
Primary circ	,	,			59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified	by factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 14.02	12.65	13.98	13.5	13.93	13.45	13.89	13.91	13.48	13.96	13.54	14.01		(61)
Total heat re	quired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 141.9	4 124.52	129.42	114.15	110.5	96.79	91.11	102.53	103.15	118.46	127.62	137.89		(62)
Solar DHW inpo	ut calculated	using App	endix G oı	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	nal lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	iter											
(64)m= 141.9	4 124.52	129.42	114.15	110.5	96.79	91.11	102.53	103.15	118.46	127.62	137.89		_
							Outp	out from wa	ater heate	r (annual) ₁	12	1398.07	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m= 46.04	40.36	41.88	36.84	35.59	31.07	29.15	32.94	33.19	38.24	41.31	44.69		(65)
in <mark>clude</mark> (5	7)m in c <mark>al</mark>	culation of	of (65)m	only if c	ylinder i	s in th <mark>e</mark> (dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ins (Table	e 5), Wat	ts										
Jar	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08		(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 14.4	7 12.85	10.45	7.91	5.92	4.99	5.4	7.01	9.41	11.95	13.95	14.87		(67)
Appliances (gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5			_	
(68)m= 162.3	2 164.01	159.76	150.73	139.32	128.6	121.44	119.75	124	133.03	144.44	155.16		(68)
Cooking gain	ns (calcula	ated in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5				
(69)m= 32.3°	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31		(69)
Pumps and	fans gains	(Table 5	5a)										
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	on (nega	tive valu	es) (Tab	le 5)								
(71)m= -74.4	7 -74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47		(71)
Water heatir	ng gains (1	Γable 5)	-	-	-	-	-	_		-	-		
(72)m= 61.88	60.06	56.29	51.17	47.84	43.16	39.18	44.28	46.09	51.39	57.38	60.07		(72)
Total intern	al gains =	•	-	-	(66)	m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m= 292.5	9 290.84	280.43	263.73	247	230.67	219.93	224.97	233.43	250.3	269.7	284.03		(73)
6. Solar ga	ns:												
Solar gains ar	e calculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	nvert to th	e applicab	ole orientat	ion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	x ble 6a	Т	g_ able 6b	T	FF able 6c		Gains (W)	

Southeast _{0.9x}	0.77	x	3.8	x	36.79	x	0.3	X	0.7	=	20.35	(77)
Southeast 0.9x	0.77	x	3.8	x	62.67	x	0.3	X	0.7	=	34.66	(77)
Southeast 0.9x	0.77	x	3.8	х	85.75	x	0.3	x	0.7	=	47.42	(77)
Southeast 0.9x	0.77	x	3.8	x	106.25	x	0.3	X	0.7	=	58.76	(77)
Southeast 0.9x	0.77	x	3.8	х	119.01	х	0.3	X	0.7	=	65.81	(77)
Southeast _{0.9x}	0.77	x	3.8	x	118.15	x	0.3	X	0.7	=	65.34	(77)
Southeast 0.9x	0.77	x	3.8	х	113.91	x	0.3	X	0.7	=	62.99	(77)
Southeast 0.9x	0.77	x	3.8	x	104.39	x	0.3	x	0.7	=	57.73	(77)
Southeast _{0.9x}	0.77	x	3.8	x	92.85	x	0.3	X	0.7	=	51.35	(77)
Southeast 0.9x	0.77	x	3.8	x	69.27	x	0.3	X	0.7	=	38.31	(77)
Southeast 0.9x	0.77	x	3.8	х	44.07	х	0.3	X	0.7	=	24.37	(77)
Southeast _{0.9x}	0.77	x	3.8	x	31.49	x	0.3	X	0.7	=	17.41	(77)
Southwest _{0.9x}	0.77	x	2.21	x	36.79]	0.3	X	0.7	=	11.83	(79)
Southwest _{0.9x}	0.77	x	2.21	x	62.67]	0.3	X	0.7	=	20.16	(79)
Southwest _{0.9x}	0.77	x	2.21	x	85.75		0.3	X	0.7	=	27.58	(79)
Southwest _{0.9x}	0.77	x	2.21	x	106.25	ĺ	0.3	x	0.7	=	34.17	(79)
Southwest _{0.9x}	0.77	x	2.21	x	119.01	ĺ	0.3	x	0.7	=	38.28	(79)
Southwest _{0.9x}	0.77	x	2.21	X	118.15		0.3	Х	0.7		38	(79)
Southwest _{0.9x}	0.77	x	2.21	х	113.91	į .	0.3	х	0.7		36.64	(79)
Southwest _{0.9x}	0.77	x	2.21	х	104.39	j /	0.3	х	0.7	=	33.57	(79)
Southwest _{0.9x}	0.77	x	2.21	x	92.85	į/	0.3	х	0.7	=	29.86	(79)
Southwest _{0.9x}	0.77	x	2.21	x	69.27	ĺ	0.3	x	0.7	_	22.28	(79)
Southwest _{0.9x}	0.77	x	2.21	x	44.07		0.3	x	0.7	=	14.17	(79)
Southwest _{0.9x}	0.77	x	2.21	х	31.49	j	0.3	x	0.7		10.13	(79)
Northwest _{0.9x}	0.77	x	7.35	x	11.28	x	0.3	x	0.7	_ =	12.07	(81)
Northwest _{0.9x}	0.77	x	7.35	x	22.97	x	0.3	x	0.7	=	24.57	(81)
Northwest _{0.9x}	0.77	x	7.35	х	41.38	х	0.3	x	0.7	=	44.26	(81)
Northwest _{0.9x}	0.77	x	7.35	х	67.96	х	0.3	x	0.7	=	72.69	(81)
Northwest _{0.9x}	0.77	x	7.35	x	91.35	х	0.3	x	0.7	=	97.71	(81)
Northwest 0.9x	0.77	x	7.35	x	97.38	x	0.3	x	0.7	=	104.17	(81)
Northwest _{0.9x}	0.77	x	7.35	x	91.1	x	0.3	x	0.7	=	97.45	(81)
Northwest _{0.9x}	0.77	x	7.35	x	72.63	x	0.3	x	0.7	=	77.69	(81)
Northwest 0.9x	0.77	x	7.35	x	50.42	x	0.3	×	0.7		53.93	(81)
Northwest _{0.9x}	0.77	x	7.35	x	28.07	x	0.3	×	0.7	<u> </u>	30.02	(81)
Northwest _{0.9x}	0.77	x	7.35	x	14.2	x	0.3	x	0.7	= =	15.19	(81)
Northwest _{0.9x}	0.77	x	7.35	x	9.21	x	0.3	×	0.7	-	9.86	(81)
_				•			<u> </u>					_
Solar gains in w	vatts, calcula	ated	for each mon	th		(83)m	n = Sum(74)m .	(82)m				
(83)m= 44.25	79.38 119.	26	165.62 201.8	2	07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)
Total gains – in	ternal and s	olar	(84)m = (73) n	า + (83)m , watts							
(84)m= 336.84	370.23 399.	69	429.35 448.8	4	38.18 417.01	393	.96 368.57	340.91	323.43	321.42		(84)
7. Mean intern	al temperati	ure (heating seaso	n)								
Temperature of	during heatin	ng pe	eriods in the li	ving	area from Tab	ole 9	, Th1 (°C)				21	(85)
Utilisation fact	or for gains	for li	ving area, h1,	m (s	ee Table 9a)							_
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(86)m=	0.97	0.95	0.92	0.86	0.75	0.59	0.45	0.49	0.7	0.88	0.95	0.97		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)				•	
(87)m=	19.56	19.74	20.05	20.43	20.74	20.92	20.98	20.97	20.85	20.46	19.94	19.51		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	 h2 (°C)				•	
(88)m=	20.25	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25		(88)
Utilisa	tion fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)					!	
(89)m=	0.96	0.95	0.91	0.84	0.71	0.53	0.38	0.42	0.65	0.86	0.94	0.97		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to	7 in Tabl	e 9c)			ı	
(90)m=	18.29	18.57	19	19.55	19.96	20.19	20.25	20.25	20.11	19.59	18.86	18.24		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwe	llina) = fl	A × T1	+ (1 – fL	A) x T2					
(92)m=	19.06	19.28	19.63	20.08	20.43	20.63	20.69	20.68	20.55	20.11	19.52	19.01		(92)
Apply	adjustn	nent to tl	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	18.91	19.13	19.48	19.93	20.28	20.48	20.54	20.53	20.4	19.96	19.37	18.86		(93)
8. Spa	ace hea	ting requ	uirement											
						ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
tne ut			Ĭ	using Ta		lun	l. d	Aug	Con	Oct	Nov	Doo		
 Itilisa	Jan Ition fac	Feb tor for a	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.95	0.93	0.9	0.83	0.71	0.55	0.4	0.44	0.66	0.85	0.93	0.96		(94)
	l gains,	hmGm .	W = (94)	4)m x (84	4)m									
(95)m=	320.57	345.54	359.22	355.8	319.37	240.07	167.91	174.2	243.1	289.88	300.86	307.79		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]		Γ	ı	
(97)m=	656.63	638.17	581.1	488.29	379.13	257.01	172.13	180.14	276.64	413.66	544.25	653.22		(97)
· .	i	· · ·	i)m – (95 I	<u> </u>	ŕ	057	1	
(98)m=	250.03	196.65	165.08	95.4	44.47	0	0	0 	0	92.1	175.24	257	4075.05	(08)
_								lota	l per year	(kWh/yeai	r) = Sum(9	8) _{15,912} =	1275.95	(98)
Space	e heating	g require	ement in	kWh/m²	/year								22.85	(99)
9a. En	ergy req	uiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatin	_			ما مسمدار،									(204)
	•			econdar		mentary	-	(000) 4	(204)				0	(201)
	•			nain syst	• •			(202) = 1		(0.00)			1	(202)
			•	main sys				(204) = (2	02) x [1 –	(203)] =			1	(204)
	•	•		ing syste									90.5	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %	_	_		_	_	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
Space	i	· ·		alculate									Ī	
	250.03	196.65	165.08	95.4	44.47	0	0	0	0	92.1	175.24	257		
(211)m	i			00 ÷ (20		1		i					I	(211)
	276.28	217.29	182.41	105.41	49.13	0	0	0	0	101.76	193.63	283.97		 1.
								lota	ıl (kWh/yea	ar) =5um(2	۲۱) _{15,1012}	-	1409.89	(211)

Space heating fuel (secondary), kWh/month								
$= \{[(98)m \times (201)] \} \times 100 \div (208)$,					1	1	
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		_
		Total (kWh/yea	ar) =Sum(2	215) _{15,1012}	2=	0	(215)
Water heating Output from water heater (calculated above)								
141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53	103.15	118.46	127.62	137.89		
Efficiency of water heater		!					87.3	(216)
(217)m= 89.31 89.23 89.07 88.73 88.19	87.3 87.3	87.3	87.3	88.67	89.12	89.36		(217)
Fuel for water heating, kWh/month								
$(219)m = (64)m \times 100 \div (217)m$ (219)m = 158.92 139.55 145.31 128.65 125.29	110.87 104.36	117.44	118.16	133.6	143.19	154.32		
				19a) ₁₁₂ =			1579.65	(219)
Annual totals				k۱	Nh/year	•	kWh/yea	<u></u>
Space heating fuel used, main system 1							1409.89	
Water heating fuel used							1579.65	
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or po	sitive input fron	n outside				153.25		(230a)
central heating pump:						30		(230c)
boi <mark>ler with a fan-assisted flue</mark>						45		(230e)
Total electricity for the above, kWh/year		sum of	f (230a).	(230g) =			228.25	(231)
Electricity for lighting							255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) =					3473.35	(338)
12a. CO2 emissions – Individual heating system	ns including mid	cro-CHP						
	Energy			Emiss	ion fac	tor	Emission	S
	kWh/year			kg CO	2/kWh		kg CO2/ye	ar
Space heating (main system 1)	(211) x			0.2	16	=	304.54	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Motor booting	(219) x			0.2	16	=	341.2	(264)
Water heating								
Space and water heating	(261) + (262) -	+ (263) + (26	64) =				645.74	(265)
•	(261) + (262) - (231) x	+ (263) + (26	64) =	0.5	19	=	645.74 118.46	(265)
Space and water heating		+ (263) + (26	64) =	0.5		=		_
Space and water heating Electricity for pumps, fans and electric keep-hot	(231) x	+ (263) + (26			19		118.46	(267)

El rating (section 14)

(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Mid - GF, I		i i	Address	. i beu i	ivila - Gr				
1. Overall dwelling dime	nsions:									
			Are	a(m²)	Ī	Av. He	ight(m)	7	Volume(m ³	_
Ground floor			5	55.83	(1a) x	2	2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	1) 5	55.83	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	r
Number of chimneys	0 +	0] + [0	_ = [0	X	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns				Ī	0	×	10 =	0	(7a)
Number of passive vents					Ī	0	x	10 =	0	(7b)
Number of flueless gas fin	res				Ė	0	X ·	40 =	0	(7c)
								Air ch	nanges per ho	
Infiltration due to objects	to flyes and fans	(62) L(6b) L(7	7a) ı (7b) ı (70) -	_		_			_
Infiltration due to chimney If a pressurisation test has be					continue fr	0 rom (9) to		÷ (5) =	0	(8)
Number of storeys in th		, , , , , , , ,				(0) 10 (, ,		0	(9)
Additional infiltration	· ·						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.					•	ruction			0	(11)
if both types of wall are pr deducting areas of openin		rresponding to	the great	ter wall are	a (after					
If suspended wooden f	• / .	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter	0							0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2		_	. (45)		0	(15)
Infiltration rate	aEO overseed in	aubia matra	o por bo			12) + (13) ·		oroo	0	= (16)
Air permeability value, of the state of the			•	•	•	ietre or e	rivelope	alea	0.1	(17)
Air permeability value applies	•					is being u	sed		0.1	(10)
Number of sides sheltere	d								2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporati	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for		1	1. 1	۸	0	0.4	NI		1	
	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind specification (22)m= 5.1 5	eed from Table 7 4.9	3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)111- 3.1 3	7.0 4.7 4.0] 3.0] 3.0	J 3.7		4.3	I 4.3	I 4./	J	
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltra	tion rate (allowir	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.11	<u>`</u>	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1]	
Calculate effect		-	ate for t	he appli	cable ca	se						,	
If mechanical			" N (O	al.) (aa	\ - (15// (1	. (00)	\ (00 \			0.5	(23a
If exhaust air hea) = (23a)			0.5	(23b
If balanced with I		-	-	_								75.65	(230
a) If balanced						<u> </u>	- ^ ` `	í `	, 		1 ` '	÷ 100]	
(24a)m= 0.23	!	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(24a
b) If balanced			ntilation			overy (N	ЛV) (24b	``	r ´ `	- 		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole ho				•	•				5 (00)	,			
if (22b)m	<u>`</u>	 _		<u> </u>	ŕ	· · ·	ŕ	ŕ	· ` `	í –	Ι ,	1	(246
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(240
d) If natural v									0.5]			_	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air c	hange rat	te - en	ter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)				_	
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
3. Heat losses	and heat	loss n	aramete	or.					_				
ELEMENT	Gross	1000	Openin		Net Ar	ea	U-valı	16	AXU		k-value	9	ΑΧk
	area (m	1 ²)	m		A ,r		W/m2		(W/	K)	kJ/m²-		kJ/K
Doors					3.57	X	1	=	3.57				(26)
Windows Type	1				7.35	x .	1/[1/(1)+	0.04] =	7.07	П			(27)
Windows Type	2				3.8	x	1/[1/(1)+	0.04] =	3.65	П			(27)
Windows Type	3				2.21	x	1/[1/(1)+	0.04] =	2.13	5			(27)
Floor					55.83	x	0.13		7.2579		75	418	37.25 (28)
Walls	44.98	\neg	16.93	3	28.05	x	0.18	=	5.05	= ;	14		2.7 (29)
Total area of ele		 1 ²			100.8	=							(31)
Party wall	,				39.86	=	0		0		20	70	7.2 (32)
Party ceiling						=			0			= =	==
					55.83	=				Ĺ	30	= =	74.9 (32b
Internal wall **	f i l		ee - e:		63.71		. fa	/5/4/11			9		3.39 (320
* for windows and r ** include the areas						atea using	Tormula 1	/[(1/U-vail	ie)+0.04] a	as given in	paragrapr	1 3.2	
Fabric heat loss	s, W/K = S	S (A x !	U)				(26)(30)	+ (32) =				28.72	(33)
Heat capacity C	sm = S(A)	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	7625.44	
Thermal mass p	arameter	r (TMP	e Cm ÷	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			136.58	(35)
For design assessn	nents where	the det	ails of the	,			ecisely the	indicative	e values of	TMP in Ta	able 1f	135.50	(` ''
Thermal bridges				usina An	pendix k	<						11.28	(36)
if details of thermal	•	•			•							11.20	(00)
Total fabric hea			1/	. (-	,			(33) +	(36) =			40	(37)
Ventilation heat	loss calc	ulated	monthly	/				(38)m	= 0.33 × ((25)m x (5))		
											•		

(00)	I 40.5	T 40.4		0.00		0.00		0.50	2.22		1001		(20)
(38)m= 10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21		(38)
Heat transfer (1	40.00	40.00	40.22	40.22	40.00		= (37) + (E0 24		
(39)m= 50.6	50.51	50.41	49.92	49.82	49.33	49.33	49.23	49.53	49.82	50.02 Sum(39) ₁	50.21	49.89	(39)
Heat loss para	meter (I	HLP), W	m²K						= (39)m ÷		12 / 12-	49.09	(00)
(40)m= 0.91	0.9	0.9	0.89	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.9		_
Number of day	vs in mo	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	0.89	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occu	ınancv	N									00		(42)
if TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (T	ΓFA -13		.86		(42)
Annual averag	ge hot wa										3.41		(43)
Reduce the annua							to achieve	a water us	se target o	f			
	Feb					<u> </u>	Aug	Son	Oct	Nov	Doo		
Jan Hot water usage i		Mar r day for ea	Apr ach month	May $Vd, m = fa$	Jun ctor from 7	Jul Table 1c x	Aug (43)	Sep	Oct	INOV	Dec		
(44)m= 86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		
` ' -								-	Γotal = Su	m(44) ₁₁₂ :		940.97	(44)
Energy content of	f hot wa <mark>ter</mark>	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mon	th (see Ta	bles 1b, 1	c, 1d)		_
(45)m= 127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		-
If instantaneous v	vater heati	ing at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ :	=	1233.75	(45)
(46)m= 19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
Water storage	loss:						<u> </u>						
Storage volum	` '		•			•		ame ves	sel		0		(47)
If community hotherwise if no	_			_			. ,	ore) onto	or 'O' in <i>(</i>	(47)			
Water storage		noi wate	er (unis ii	iciuues i	HStaritar	ieous co	ווטט וטווונ	ers) erite	91 0 111 (41)			
a) If manufact	turer's d	eclared I	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro		-	-				(48) x (49)) =			0		(50)
b) If manufactHot water stor			•								0		(51)
If community h	_			C 2 (KW)	1711110700	· y /					U		(31)
Volume factor	from Ta	ble 2a									0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or	. , .	•	طممم سما				(/50) /	EE) (44)	_		0		(55)
Water storage		1		1		1		55) × (41)r					(50)
(56)m= 0 If cylinder contain	0 s dedicate	d solar sto	0 rage, (57)	0 m = (56)m	0 x [(50) – (0 H11)] ÷ (5)	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
	0	0			0	0		0		0		····	(57)
(57)m= 0			0	0			0	U	0	L "	0		(31)

Primary circuit loss (annual) from Table 3				0]	(58)
Primary circuit loss calculated for each month ((59) m = $(58) \div 36$	65 × (41)m			•	
(modified by factor from Table H5 if there is	solar water heati	ng and a cylinde	er thermostat)		_	
(59)m= 0 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)m =	(60) ÷ 365 × (41)m				
(61)m= 14.02 12.65 13.98 13.5 13.93	13.45 13.89	13.91 13.48	13.96 13.5	4 14.01	1	(61)
Total heat required for water heating calculated	d for each month	(62) m = $0.85 \times$	(45)m + (46)m	+ (57)m +	ı · (59)m + (61)m	
(62)m= 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53 103.15	 	- ` ´]	(62)
Solar DHW input calculated using Appendix G or Appendix					1	
(add additional lines if FGHRS and/or WWHRS				3,		
(63)m= 0 0 0 0 0	0 0	0 0	0 0	0	1	(63)
Output from water heater	l l	<u> </u>	! !	I	ı	
(64)m= 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53 103.15	118.46 127.6	137.89	1	
		L	vater heater (annu		1398.07	(64)
Heat gains from water heating, kWh/month 0.2	5 ′ [0 85 × (45)m	•	•	,	. 1	_ '
(65)m= 46.04 40.36 41.88 36.84 35.59	31.07 29.15	32.94 33.19	38.24 41.3	<u> </u>]	(65)
` '	<u> </u>		<u> </u>	ļ	l	(00)
include (57)m in calculation of (65)m only if o	cylinder is in the o	dwelling of not v	vater is from co	ommunity r	leating	
5. Internal gains (see Table 5 and 5a):			_			
Metabolic gains (Table 5), Watts					1	
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct No			(00)
(66)m= 93.08 93.08 93.08 93.08 93.08	93.08 93.08	93.08 93.08	93.08 93.0	8 93.08		(66)
Lighting gains (calculated in Appendix L, equat		lso see Table 5		_	1	
(67)m= 14.47 12.85 10.45 7.91 5.92	4.99 5.4	7.01 9.41	11.95 13.9	5 14.87		(67)
Appliances gains (calculated in Appendix L, eq	uation L13 or L1	3a), also see Ta	able 5			
(68)m= 162.32 164.01 159.76 150.73 139.32	128.6 121.44	119.75 124	133.03 144.4	155.16		(68)
Cooking gains (calculated in Appendix L, equa	tion L15 or L15a), also see Table	e 5		_	
(69)m= 32.31 32.31 32.31 32.31 32.31	32.31 32.31	32.31 32.31	32.31 32.3	1 32.31		(69)
Pumps and fans gains (Table 5a)						
(70)m= 3 3 3 3 3	3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (negative values) (Tab	ole 5)	•			•	
(71)m= -74.47 -74.47 -74.47 -74.47 -74.47	-74.47 -74.47	-74.47 -74.47	-74.47 -74.4	7 -74.47	1	(71)
Water heating gains (Table 5)	· · · · · ·	'	! !		1	
(72)m= 61.88 60.06 56.29 51.17 47.84	43.16 39.18	44.28 46.09	51.39 57.3	8 60.07]	(72)
Total internal gains =	(66)m + (67)n	n + (68)m + (69)m +	(70)m + (71)m + (72)m	1	
(73)m= 292.59 290.84 280.43 263.73 247	230.67 219.93	224.97 233.43	250.3 269.	7 284.03]	(73)
6. Solar gains:						
Solar gains are calculated using solar flux from Table 6a	and associated equa	ations to convert to t	he applicable orier	ntation.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m²	Table 6a	Table 6b	Table 6	C	(W)	
Southeast 0.9x 0.77 x 3.8	x 36.79	x 0.3	x 0.:	7 =	20.35	(77)
Southeast 0.9x 0.77 x 3.8	× 62.67	x 0.3	x 0.:		34.66	(77)
		J L 3.3				」 ` ′

					heating seas			Tal	.l. 0	Th4 (00)		•		21	(85)
	36.84	370.23	399.6	_	429.35 448	_	438.18	417.01	393	.96 368.57	340.9	323.43	321.42]	(84)
` ′	44.25 ns – in	79.38 ternal a	119.2 nd so		$\begin{array}{c c} 165.62 & 201 \\ \hline (84)m = (73) \end{array}$		207.51 (83)m	197.07 watts	168	.99 135.14	90.61	53.73	37.4	J	(83)
— —		i		\neg	for each mor	$\overline{}$	00= 7:			= Sum(74)m .			l :	1	(00)
	· · L	0.11		-	L	_ ^	<u> </u>	··]	0.5	^	5.1			(/
Northwest	<u> </u>	0.77	=	X	7.35	」 ^ 	_	9.21	^ x	0.3	┤	0.7	╡ -	9.86	(81)
Northwest	느	0.77		x x	7.35 7.35	」 × □ x		8.07	x x	0.3	X x	0.7	- -	30.02 15.19	(81)
Northwest Northwest	느	0.77	_	X	7.35	X		0.42	X	0.3	×	0.7	╡ =	53.93	(81)
Northwest	<u> </u>	0.77		X	7.35	×	—	2.63	X	0.3	×	0.7	=	77.69	(81)
Northwest	느	0.77		X	7.35	X	9	91.1	X	0.3	×	0.7	=	97.45	(81)
Northwest	<u>L</u>	0.77		X	7.35	×	9	7.38	x	0.3	×	0.7	=	104.17	(81)
Northwest	t _{0.9x}	0.77		X	7.35	×	9	1.35	x	0.3	×	0.7	=	97.71	(81)
Northwest	t _{0.9x}	0.77		X	7.35	×	6	7.96	x	0.3	×	0.7	=	72.69	(81)
Northwest	t _{0.9x}	0.77	$\overline{}$	X	7.35	×	4	1.38	x	0.3	×	0.7	=	44.26	(81)
Northwest		0.77		X	7.35	×		2.97	x	0.3	x	0.7	=	24.57	(81)
Northwest		0.77		X	7.35	×	_	1.28	X	0.3	x	0.7		12.07	(81)
Southwes		0.77		X	2.21	×		1.49		0.3	×	0.7		10.13	(79)
Southwes		0.77		X	2.21	4 ^ 7 x	 	4.07		0.3	×	0.7		14.17	(79)
Southwes		0.77		X	2.21	·	-	9.27		0.3	^	0.7	_ =	22.28	(79)
Southwes		0.77		X	2.21] ×	\	2.85		0.3	X	0.7	=]	29.86	(79)
Southwes	<u> </u>	0.77		x x	2.21	」× ▼		13.91		0.3	X	0.7		36.64	(79)
Southwes Southwes	<u> </u>	0.77		X	2.21	X		18.15] 1	0.3	X	0.7	=	38	(79)
Southwes	<u> </u>	0.77	_	X	2.21	X		19.01] 1	0.3	×	0.7	=	38.28	(79)
Southwes	<u> </u>	0.77	_	X	2.21	×		06.25		0.3	×	0.7	=	34.17	(79)
Southwes	느	0.77		X	2.21	×	8	5.75		0.3	x	0.7	=	27.58	(79)
Southwes	<u> </u>	0.77		X	2.21	X	6	2.67		0.3	x	0.7	=	20.16	(79)
Southwes	<u> </u>	0.77		X	2.21	x	3	6.79		0.3	x	0.7	=	11.83	(79)
Southeast	t 0.9x	0.77		x	3.8	x	3	1.49	x	0.3	x	0.7	=	17.41	(77)
Southeast	t _{0.9x}	0.77		X	3.8	×	4	4.07	x	0.3	x	0.7	=	24.37	(77)
Southeast	t _{0.9x}	0.77		X	3.8	x	6	9.27	x	0.3	x	0.7	=	38.31	(77)
Southeast	t 0.9x	0.77		x	3.8	x	9	2.85	x	0.3	x	0.7	=	51.35	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	10	04.39	x	0.3	x	0.7	=	57.73	(77)
Southeast	t _{0.9x}	0.77		x	3.8	T x	1	13.91	x	0.3	x	0.7	=	62.99	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	1	18.15	x	0.3	x	0.7	=	65.34	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	1	19.01	X	0.3	x	0.7	= =	65.81	(77)
Southeast	t _{0.9x}	0.77	\equiv	x	3.8	x		5.75 06.25	X	0.3	×	0.7	=	58.76	(77)

(86)m=	0.98	0.97	0.95	0.9	0.81	0.65	0.5	0.54	0.76	0.92	0.97	0.98		(86)
Mean i	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)				'	
(87)m=	19.55	19.72	20.01	20.39	20.71	20.91	20.98	20.97	20.83	20.42	19.92	19.51		(87)
Tempe	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	 h2 (°C)				1	
(88)m=	20.16	20.16	20.17	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.17	20.17		(88)
Utilisat	tion fact	or for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)			•		I	
(89)m=	0.98	0.97	0.94	0.88	0.77	0.59	0.41	0.46	0.71	0.9	0.96	0.98		(89)
Mean i	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to	7 in Tabl	e 9c)	!	!	I	
(90)m=	18.21	18.46	18.88	19.41	19.85	20.1	20.17	20.16	20.01	19.47	18.76	18.16		(90)
L									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean i	internal	temper	ature (fo	r the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) x T2					
_	19.02	19.22	19.56	20	20.37	20.59	20.65	20.65	20.5	20.05	19.46	18.97		(92)
Apply a	adjustm	ent to t	ne mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate	!		J	
(93)m=	18.87	19.07	19.41	19.85	20.22	20.44	20.5	20.5	20.35	19.9	19.31	18.82		(93)
8. Spa	ce heat	ing requ	uirement											
						ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the util	Jan	Feb	Mar	using Ta Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
L Utilisat			ains, hm		iviay	Juli	Jui	Aug	Seh	Oct	INOV	Dec		
(94)m=	0.97	0.96	0.93	0.88	0.77	0.61	0.45	0.49	0.72	0.89	0.96	0.98		(94)
L	gains,	hmGm	W = (94	4)m x (84	4)m								l	
(95)m=	327.22	354.94	372.95	376.29	345.82	265.66	187.23	193.99	265.33	304.94	309.38	313.53		(95)
Month	ly avera	ige 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)
Г							<u> </u>	x [(93)m	– (96)m				Ī	
` ′	737.21	715.71	650.82	546.72	424.54	288.13	192.6	201.66	309.74	463.09	610.68	734.3		(97)
· -		<u> </u>	ement fo 206.73			Wh/mont	th = 0.02	24 x [(97 ₎)m – (95 0)m] x (4 117.67		242.06	1	
(98)m=	305.03	242.44	206.73	122.71	58.57	U	U				216.93	313.06	4502.42	(98)
					.,			Tota	l per year	(Kvvn/yeai	i) = Sum(9	0)15,912 =	1583.13	
				kWh/m²									28.36	(99)
			nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	heatin	_	t from c	econdar	//cupple	montary	cyctom							(201)
						memary	-	(202) = 1 -	(201) -				0	
				nain syst	• •					(000)]			1	(202)
			_	main sys				(204) = (2	02) x [1 – ((203)] =			1	(204)
	•	•		ing syste									90.5	(206)
Efficier	ncy of s	econda	ry/suppl	ementar	y heating	g system	າ, %	-					0	(208)
L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	year
· -		•		alculate							1	1	I	
L	305.03	242.44	206.73	122.71	58.57	0	0	0	0	117.67	216.93	313.06		
` ′ ┌	111	· ·	·- ·	00 ÷ (20		_	_			15-			I	(211)
L	337.05	267.89	228.44	135.59	64.71	0	0	O Tota	0	130.02	239.71	345.92		
								rota	ıl (kWh/yea	u) =3um(2	۱۱) _{15,1012}	2==	1749.32	(211)

Space heating fuel (secondary), kWh/month							
$= \{[(98)m \times (201)] \} \times 100 \div (208)$ $(215)m = 0 $	0 0	0	0 0	0	0		
(2.5)	<u> </u>		/h/year) =Sum(_	0	(215)
Water heating							
Output from water heater (calculated above)	0.70	100.50 140	15 440 40	107.00	107.00	I	
141.94 124.52 129.42 114.15 110.5 9 Efficiency of water heater	91.11	102.53 103	3.15 118.46	127.62	137.89	87.3	(216)
· · · · · · · · · · · · · · · · · · ·	87.3 87.3	87.3 87	7.3 88.87	89.29	89.5	67.3	(217)
Fuel for water heating, kWh/month							, ,
(219) m = (64) m x $100 \div (217)$ m	40.07 404.00			1 40 00	154.07	I	
(219)m= 158.66 139.31 145.03 128.36 125.03 1	10.87 104.36		3.16 133.3 um(219a) ₁₁₂ =	142.93	154.07	4577.54	7(240)
Annual totals		rotal = 0		Wh/yea	r	1577.51 kWh/yea	(219)
Space heating fuel used, main system 1			,	Willy y Cal		1749.32	<u>"</u>
Water heating fuel used						1577.51	=
Electricity for pumps, fans and electric keep-hot							
mechanical ventilation - balanced, extract or pos	itive input fror	n outside			153.25		(230a)
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) =			2 <mark>28.25</mark>	(231)
Electricity for lighting						255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) =				3810.65	(338)
12a. CO2 emissions – Individual heating systems							
	Energy kWh/year			sion fac 2/kWh	tor	Emission	
Space heating (main system 1)	(211) x		0.2	16	=	377.85	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2	16	=	340.74	(264)
Space and water heating	(261) + (262)	+ (263) + (264)	=			718.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	118.46	(267)
Electricity for lighting	(232) x		0.5	19	=	132.64	(268)
Total CO2, kg/year		\$	sum of (265)(271) =		969.7	
						300.7	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			17.37	(272)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2		Strom Softwa				Versio	on: 1.0.5.41	
				Address	: 1 Bed I	Mid - MF				
Address :	1 Bed Mid - MF, Lor	ndon, TE	BC .							
1. Overall dwelling dime	nsions:		A ***	n/m 2\		Av. Ua	iaht/m\		Volume(m³)	
Ground floor				a(m²) 55.83	(1a) x		ight(m) 2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	2)+(1b)+(1c)+(1d)+(1c	\⊥ (1r							133.30	
	a)+(1b)+(1c)+(1u)+(1e	:)+(11	'/5	55.83	(4)) . (3c) . (3c	1) . (30) .	(2n) -		٦
Dwelling volume					(3a)+(3b))+(30)+(30	d)+(3e)+	.(311) =	139.58	(5)
2. Ventilation rate:	main s	econdar	37	other		total			m³ per houi	
	heating h	eating	у —	Other		lotai			, per nour	_
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	ns					0	X '	10 =	0	(7a)
Number of passive vents					Ī	0	x '	10 =	0	(7b)
Number of flueless gas fin	res				Ī	0	X 4	40 =	0	(7c)
		(01) (7							nanges per ho	_
Infiltration due to chimney If a pressurisation test has be					continuo fr	0 (0) to		÷ (5) =	0	(8)
Number of storeys in the		σα, ρισσσσ	u 10 (17), (Juliel Wise (continue ii	om (a) to ((10)		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or	0.35 for	r masoni	y constr	ruction			0	(11)
	resent, use the value corres	ponding to	the great	er wall are	a (after					
deducting areas of opening If suspended wooden f		ed) or 0.	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	,	,	(,,					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,	•		•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili	-								0.1	(18)
Air permeability value applie. Number of sides sheltere		s been don	e or a deg	gree air pe	rmeability	is being u	sed			(19)
Shelter factor	u			(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporat	ing shelter factor			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for	-	ł								┛`′
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp	eed from Table 7	•		-	•	•	•	•	•	
 	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
W. J. F. (00.)		-		•	-	•	•	•	•	
Wind Factor (22a)m = $(22a)$ m =	'	0.05	0.05	T 0.00	4	1.00	1 4 4 0	1 40	1	
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	J	

djusted infiltra	ation rat	e (allowi	ing for sl	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1]	
Calculate effect If mechanica		_	rate for t	he appli	icable ca	se						0.5	(2
If exhaust air he			endix N. (2	(23a) = (23a	a) × Fmv (e	eguation (N5)) . othe	rwise (23b	o) = (23a)			0.5	(2
If balanced with									, (,			75.65	(2
a) If balance		-	-	_					2h)m + (23b) × [1 – (23c)		(2
24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22]	(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (I	л МV) (24k	p)m = (22)	2b)m + (23b)	<u> </u>	ı	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
c) If whole h				•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
d) If natural if (22b)n				•	•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change	rate - er	nter (24a	or (24l	b) or (24	c) or (24	ld) in bo	x (25)	•		•	•	
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losse	s and he	eat loss i	naramet	er.									
LEMENT	Gros		Openin		Net Ar	rea	U-val	ue	AXU		k-value	e /	ΑΧk
	area		n		Α,		W/m2		(W/	K)	kJ/m²-		kJ/K
oors					3.57	х	1	=	3.57				(2
/in <mark>dows</mark> Type	1				7.35	x	1/[1/(1)+	0.04] =	7.07				(2
/indows Type	2				3.8	X	1/[1/(1)+	0.04] =	3.65				(2
indows Type	3	'			2.21	x	1/[1/(1)+	0.04] =	2.13				(2
/alls	44.9	98	16.9	3	28.0	5 X	0.18	=	5.05		14	392	2.7
otal area of e	lements	s, m²			44.98	3						_	(;
arty wall					39.86	5 x	0	=	0		20	797	7.2
arty floor					55.83	3					40	223	3.2
arty ceiling					55.83	3				Ī	30	167	4.9 (
ternal wall **					63.7					Ī	9	573	.39 (
for windows and include the area					alue calcu		g formula 1	I/[(1/U-valu	ue)+0.04] á	as given in	paragraph		,
abric heat los	s, W/K	= S (A x	U)				(26)(30) + (32) =				21.47	(:
eat capacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	5671.39	(
nermal mass	parame	eter (TMF	= Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			101.58	(
or design assess on be used instea	ad of a de	tailed calc	ulation.			•	recisely the	e indicative	e values of	TMP in Ta	able 1f		
nermal bridge	,	,			•	K						7.11	(:
details of therma		are not kn	nown (36) =	= 0.05 x (3	31)			(22) -	(26) -				<u> </u>
otal fabric he		ala lata							$-(36) = 0.33 \times ($,		28.58	(;
entilation hea													

								ı				1	I	
(38)m=	10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21		(38)
Heat t	ransfer o	coefficie	nt, W/K		•		•		(39)m	= (37) + (38)m		•	
(39)m=	39.18	39.08	38.98	38.49	38.39	37.9	37.9	37.81	38.1	38.39	38.59	38.78		¬
Heat le	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) _{1.} · (4)	12 /12=	38.47	(39)
(40)m=	0.7	0.7	0.7	0.69	0.69	0.68	0.68	0.68	0.68	0.69	0.69	0.69		_
Numb	or of do	o in ma	nth (Tab	lo 10\					,	Average =	Sum(40) ₁ .	12 /12=	0.69	(40)
Nullib	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	
4 \\\/	ater heat	ing ene	rgy requi	irement:								kWh/ye	ar.	
4. VVC	ater rieat	ing ene	igy requi	nement.								KVVII/ y	rai.	
	ned occu			· [4 _ avm	(0 0000	140 v /TF	-A 42.0°	\0\1 · 0 (0040 v /	FFA 40		86		(42)
	A > 13.9		+ 1.76 x	[1 - ехр	(-0.0003	649 X (11	-A -13.9)2)] + 0.() X C10C	IFA -13.	.9)			
			ater usaç									3.41		(43)
		-	hot water person per	• •		-	-	to achieve	a water us	se target o	f			
710171101			,	· ·			<u> </u>	Aug	Con	Oct	Nov	Doo		
Hot wat	Jan er usage ii	Feb	Mar r day for ea	Apr ach month	May $Vd,m = fa$	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		
(44)111=	80.20	03.12	79.90	70.05	73.71	10.51	70.37	73.7			m(44) ₁₁₂ =		940.97	(44)
Energy	content of	hot wa <mark>ter</mark>	used - cal	culated me	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600			1 7		340.37	(\.,'
(45)m=	127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
										Γotal = Su	m(45) ₁₁₂ =	=	1233.75	(45)
If instan	taneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,) to (61)				ĺ	
(46)m= Water	19.19 storage	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
	•) includir	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
		, ,	and no ta	•			•					0	I	()
	•	•	hot wate		•			` '	ers) ente	er '0' in (47)			
Water	storage	loss:												
,			eclared I		or is kno	wn (kWł	n/day):					0		(48)
•			m Table									0		(49)
			r storage	-				(48) x (49)) =			0		(50)
•			eclared of factor fr	-								0		(51)
		•	see secti		_ (.,	-77						I	()
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
_			r storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
	(50) or (. , .	•									0		(55)
	storage	loss cal	culated t	for each	month	-	r	((56)m = (55) × (41)ı	n	1	i .	•	
(56)m=	0	0	0	0 (53)	0 (50)	0	0	0	0 (50)	0	0	0	 	(56)
it cylind	er contains	s dedicate	a solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	u), else (5	/)m = (56)	m where (H11) IS fro	m Append	ıx H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3				0]	(58)
Primary circuit loss calculated for each month ((59) m = $(58) \div 36$	65 × (41)m			•	
(modified by factor from Table H5 if there is	solar water heati	ng and a cylinde	er thermostat)		_	
(59)m= 0 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)m =	(60) ÷ 365 × (41)m				
(61)m= 14.02 12.65 13.98 13.5 13.93	13.45 13.89	13.91 13.48	13.96 13.5	4 14.01	1	(61)
Total heat required for water heating calculated	d for each month	(62) m = $0.85 \times$	(45)m + (46)m	+ (57)m +	ı · (59)m + (61)m	
(62)m= 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53 103.15	 	- ` ´]	(62)
Solar DHW input calculated using Appendix G or Appendix					1	
(add additional lines if FGHRS and/or WWHRS				3,		
(63)m= 0 0 0 0 0	0 0	0 0	0 0	0	1	(63)
Output from water heater	l l	<u> </u>	! !	I	ı	
(64)m= 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53 103.15	118.46 127.6	137.89	1	
		L	vater heater (annu		1398.07	(64)
Heat gains from water heating, kWh/month 0.2	5 ′ [0 85 × (45)m	•	•	,	. 1	_ '
(65)m= 46.04 40.36 41.88 36.84 35.59	31.07 29.15	32.94 33.19	38.24 41.3	<u> </u>]	(65)
` '	<u> </u>		<u> </u>	ļ	l	(00)
include (57)m in calculation of (65)m only if o	cylinder is in the o	dwelling of not v	vater is from co	ommunity r	leating	
5. Internal gains (see Table 5 and 5a):			_			
Metabolic gains (Table 5), Watts					1	
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct No			(00)
(66)m= 93.08 93.08 93.08 93.08 93.08	93.08 93.08	93.08 93.08	93.08 93.0	8 93.08		(66)
Lighting gains (calculated in Appendix L, equat		lso see Table 5		_	1	
(67)m= 14.47 12.85 10.45 7.91 5.92	4.99 5.4	7.01 9.41	11.95 13.9	5 14.87		(67)
Appliances gains (calculated in Appendix L, eq	uation L13 or L1	3a), also see Ta	able 5			
(68)m= 162.32 164.01 159.76 150.73 139.32	128.6 121.44	119.75 124	133.03 144.4	155.16		(68)
Cooking gains (calculated in Appendix L, equa	tion L15 or L15a), also see Table	e 5		_	
(69)m= 32.31 32.31 32.31 32.31 32.31	32.31 32.31	32.31 32.31	32.31 32.3	1 32.31		(69)
Pumps and fans gains (Table 5a)						
(70)m= 3 3 3 3 3	3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (negative values) (Tab	ole 5)	•			•	
(71)m= -74.47 -74.47 -74.47 -74.47 -74.47	-74.47 -74.47	-74.47 -74.47	-74.47 -74.4	7 -74.47	1	(71)
Water heating gains (Table 5)	· · · · · ·	'	! !		1	
(72)m= 61.88 60.06 56.29 51.17 47.84	43.16 39.18	44.28 46.09	51.39 57.3	8 60.07]	(72)
Total internal gains =	(66)m + (67)n	n + (68)m + (69)m +	(70)m + (71)m + (72)m	1	
(73)m= 292.59 290.84 280.43 263.73 247	230.67 219.93	224.97 233.43	250.3 269.	7 284.03]	(73)
6. Solar gains:						
Solar gains are calculated using solar flux from Table 6a	and associated equa	ations to convert to t	he applicable orier	ntation.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m²	Table 6a	Table 6b	Table 6	C	(W)	
Southeast 0.9x 0.77 x 3.8	x 36.79	x 0.3	x 0.:	7 =	20.35	(77)
Southeast 0.9x 0.77 x 3.8	× 62.67	x 0.3	x 0.:		34.66	(77)
		J L 3.3				」 ` ′

					heating seas			Tal	.l. 0	Th4 (00)		•		21	(85)
	36.84	370.23	399.6	_	429.35 448	_	438.18	417.01	393	.96 368.57	340.9	323.43	321.42]	(84)
` ′	44.25 ns – in	79.38 ternal a	119.2 nd so		$\begin{array}{c c} 165.62 & 201 \\ \hline (84)m = (73) \end{array}$		207.51 (83)m	197.07 watts	168	.99 135.14	90.61	53.73	37.4	J	(83)
— —		i		\neg	for each mor	$\overline{}$	00= 7:			= Sum(74)m .			l :	1	(00)
	···	0.11		-	L	_ ^	<u> </u>	··]	0.5	^	5.1			(/
Northwest	<u> </u>	0.77	=	X	7.35	」 ^ 	_	9.21	^ x	0.3	┤	0.7	╡ -	9.86	(81)
Northwest	느	0.77		x x	7.35 7.35	」 × □ x		8.07	x x	0.3	X x	0.7	- -	30.02 15.19	(81)
Northwest Northwest	느	0.77	_	X	7.35	X		0.42	X	0.3	×	0.7	╡ =	53.93	(81)
Northwest	<u> </u>	0.77		X	7.35	×	—	2.63	X	0.3	×	0.7	=	77.69	(81)
Northwest	느	0.77		X	7.35	X	9	91.1	X	0.3	×	0.7	=	97.45	(81)
Northwest	<u>L</u>	0.77		X	7.35	×	9	7.38	x	0.3	×	0.7	=	104.17	(81)
Northwest	t _{0.9x}	0.77		X	7.35	×	9	1.35	x	0.3	×	0.7	=	97.71	(81)
Northwest	t _{0.9x}	0.77		X	7.35	×	6	7.96	x	0.3	×	0.7	=	72.69	(81)
Northwest	t _{0.9x}	0.77	$\overline{}$	X	7.35	×	4	1.38	x	0.3	×	0.7	=	44.26	(81)
Northwest		0.77		X	7.35	×		2.97	x	0.3	x	0.7	=	24.57	(81)
Northwest		0.77		X	7.35	×	_	1.28	X	0.3	x	0.7		12.07	(81)
Southwes		0.77		X	2.21	×		1.49		0.3	×	0.7		10.13	(79)
Southwes		0.77		X	2.21	4 ^ 7 x	_	4.07		0.3	×	0.7		14.17	(79)
Southwes		0.77		X	2.21	·	-	9.27		0.3	^	0.7	_ =	22.28	(79)
Southwes		0.77		X	2.21] ×	\ 	2.85		0.3	X	0.7	=]	29.86	(79)
Southwes	<u> </u>	0.77		x x	2.21	」× ▼		13.91		0.3	X	0.7		36.64	(79)
Southwes Southwes	<u> </u>	0.77		X	2.21	X		18.15] 1	0.3	X	0.7	=	38	(79)
Southwes	<u> </u>	0.77	_	X	2.21	X		19.01] 1	0.3	×	0.7	=	38.28	(79)
Southwes	<u> </u>	0.77	_	X	2.21	×		06.25		0.3	×	0.7	=	34.17	(79)
Southwes	느	0.77		X	2.21	×	8	5.75		0.3	x	0.7	=	27.58	(79)
Southwes	<u> </u>	0.77		X	2.21	X	6	2.67		0.3	x	0.7	=	20.16	(79)
Southwes	<u> </u>	0.77		X	2.21	x	3	6.79		0.3	x	0.7	=	11.83	(79)
Southeast	t 0.9x	0.77		x	3.8	x	3	1.49	x	0.3	x	0.7	=	17.41	(77)
Southeast	t _{0.9x}	0.77		X	3.8	×	4	4.07	x	0.3	x	0.7	=	24.37	(77)
Southeast	t _{0.9x}	0.77		X	3.8	x	6	9.27	x	0.3	x	0.7	=	38.31	(77)
Southeast	t 0.9x	0.77		x	3.8	x	9	2.85	x	0.3	x	0.7	=	51.35	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	10	04.39	x	0.3	x	0.7	=	57.73	(77)
Southeast	t _{0.9x}	0.77		x	3.8	T x	1	13.91	x	0.3	x	0.7	=	62.99	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	1	18.15	x	0.3	x	0.7	=	65.34	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	1	19.01	X	0.3	x	0.7	= =	65.81	(77)
Southeast	t _{0.9x}	0.77	\equiv	x	3.8	x		5.75 06.25	X	0.3	×	0.7	=	58.76	(77)

(86)m=	0.96	0.94	0.9	0.82	0.69	0.53	0.39	0.43	0.64	0.85	0.93	0.96		(86)
Mean i	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.76	19.94	20.23	20.57	20.82	20.95	20.99	20.98	20.9	20.58	20.12	19.71		(87)
Tempe	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	 h2 (°C)				•	
(88)m=	20.34	20.34	20.34	20.35	20.35	20.36	20.36	20.36	20.36	20.35	20.35	20.35		(88)
Utilisat	tion fact	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)					•	
(89)m=	0.95	0.93	0.89	0.8	0.66	0.48	0.34	0.37	0.6	0.82	0.92	0.96		(89)
Mean i	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to	7 in Tabl	e 9c)			ı	
(90)m=	18.65	18.92	19.33	19.81	20.15	20.31	20.35	20.35	20.25	19.84	19.18	18.59		(90)
L									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean i	internal	temper	ature (fo	r the wh	ole dwe	lling) = fl	A × T1	+ (1 – fl	A) x T2					
	19.32	19.53	19.87	20.27	20.56	20.7	20.74	20.73	20.64	20.29	19.75	19.27		(92)
Apply a	adjustm	ent to the	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	priate	Į.			
(93)m=	19.17	19.38	19.72	20.12	20.41	20.55	20.59	20.58	20.49	20.14	19.6	19.12		(93)
8. Spa	ce heat	ting requ	uirement											
						ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
tne util		Feb	Ť	using Ta		lup	lul	Aug	Son	Oot	Nov	Doo		
_ L Itilisat	Jan tion fact		Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	NOV	Dec		
(94)m=	0.94	0.92	0.87	0.79	0.66	0.49	0.36	0.39	0.61	0.82	0.91	0.95		(94)
L	gains,	hmGm .	W = (9	4)m x (84	4)m									
	316.34	339.23	349.33	339.53	296.52	216.18	148.94	155.02	223.33	278.19	295.03	304.19		(95)
Mo <mark>nth</mark> l	ly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat Id	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	Г	ī	ı	
` ′	582.41	566.04	515.3	431.85	334.23	225.52	151.05	158.07	243.58	366.14	482.19	578.63		(97)
· -)m – (95			004.40	I	
(98)m=	197.96	152.42	123.48	66.47	28.06	0	0	0	0	65.43	134.76	204.18	070.75	(00)
_								lota	l per year	(kwh/yeai	') = Sum(9	8)15,912 =	972.75	(98)
Space	heating	g require	ement in	kWh/m²	/year								17.42	(99)
9a. Ene	ergy req	uiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	heatin	_			ما مسمار									(204)
	-					mentary	•	(000) 4	(004)				0	(201)
	-			nain syst	• •			(202) = 1		(200)			1	(202)
			_	main sys				(204) = (2	02) x [1 – ([203)] =			1	(204)
	•	•		ing syste									90.5	(206)
Efficier	ncy of s	econda	ry/suppl	ementar	y heating	g system	າ, %	_	-		_	_	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
· -				alculate									Ī	
	197.96	152.42	123.48	66.47	28.06	0	0	0	0	65.43	134.76	204.18		
· · · -				00 ÷ (20		1		i	· ·		i	ı	I	(211)
L	218.74	168.42	136.44	73.45	31	0	0	0	0	72.3	148.9	225.62		
								lota	l (kWh/yea	ıı) =5um(2	(11) _{15,1012}	=	1074.86	(211)

Space heating fuel (secondary), kWh/month								
= {[(98)m x (201)] } x 100 ÷ (208)							•	
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		_
		Total	(kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating								
Output from water heater (calculated above) 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53	103.15	118.46	127.62	137.89		
Efficiency of water heater		<u> </u>					87.3	(216)
(217)m= 89.14 89.03 88.83 88.45 87.93	87.3 87.3	87.3	87.3	88.41	88.91	89.18		(217)
Fuel for water heating, kWh/month	•						•	
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 159.24 139.86 145.69 129.05 125.67 $	110.87 104.36	117.44	118.16	133.99	143.53	154.62		
(2.0)	10.07			19a) ₁₁₂ =	1 10.00	101.02	1582.47	(219)
Annual totals					Wh/year	•	kWh/yea	— '
Space heating fuel used, main system 1					·		1074.86	
Water heating fuel used							1582.47	
Electricity for pumps, fans and electric keep-hot								_
mechanical ventilation - balanced, extract or po-	sitive input fron	n outside				153.25		(230a)
central heating pump:						30		(230c)
boiler with a fan-assisted flue						45		(230e)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			228.25	(231)
Electricity for lighting							255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) :					3141.15	(338)
12a. CO2 emissions – Individual heating system								
	Energy			Emiss	ion fac	tor	Emissions	•
	kWh/year			kg CO		101	kg CO2/ye	
Space heating (main system 1)	(211) x			0.2	16	=	232.17	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Space healing (secondary)								(200)
Water heating	(219) x			0.2	16	=	341.81	(264)
•	(219) x (261) + (262) -	+ (263) + (2	264) =	0.2	16	=	341.81 573.98	=
Water heating		+ (263) + (2	264) =	0.2		=		(264)
Water heating Space and water heating	(261) + (262) -	+ (263) + (2	264) =		19		573.98	(264)
Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	(261) + (262) - (231) x	+ (263) + (2		0.5	19	=	573.98 118.46	(264) (265) (267)

El rating (section 14)

(274)

			User D	etai <u>ls:</u>						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Mid - TF, L		i i	Address	i beu i	viia - TF				
1. Overall dwelling dime	nsions:									
			Are	a(m²)		Av. He	ight(m)	7	Volume(m ³	_
Ground floor			5	55.83	(1a) x	2	2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	1) 5	55.83	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns					0	x	10 =	0	(7a)
Number of passive vents					Ē	0	x '	10 =	0	(7b)
Number of flueless gas fir	res				F	0	X e	40 =	0	(7c)
					L					
								Air ch	nanges <mark>per</mark> ho	ur
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in th		ended, procee	d to (17),	otherwise (continue fr	om (9) to ((16)		0	(9)
Additional infiltration	ie aweiling (115)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pr		rresponding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden fl	• / .	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	•	•	`	,,					0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	_			0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value, of the state of the			•	•	•	etre of e	nvelope	area	2	(17)
Air permeability value applies	•					is being u	sed		0.1	(18)
Number of sides sheltere			·	,	·	ŭ			2	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for		i							1	
L	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe		20	3.8	27	<i>A</i>	4.3	1 F	4.7	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	ა.ఠ	3.7	4	4.3	4.5	4./	I	
Wind Factor (22a)m = $(22a)$ m =	2)m ÷ 4								_	
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

djusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
<i>Calculate effec</i> If mechanica		-	rate for t	ne appıı	cable ca	se						0.5	(23
If exhaust air he			endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with		•		, ,	,	. ,	,,	,	, , ,			75.65	
a) If balance		-	-	_					2b)m + (23b) x [1	ا (23c) – 1		(20
24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22	00]	(24
b) If balance	d mech	anical ve	ntilation	without	heat red	overv (N	ı ЛV) (24b)m = (22	2b)m + (23b)			
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole he				•	•				5 x (23h) '		l	
$\frac{1}{24c} = 0$	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	/entilatio	n or wh	ole hous	e nositiv		ventilatio	n from l	l					`
if (22b)m				•					0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)		-	-		
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losses	and he	eat loss r	paramete	ir.							_	_	
LEMENT	Gros area	ss	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-value kJ/m²-ł		A X k kJ/K
oo <mark>rs</mark>					3.57	x	1	= [3.57	Ď.			(20
/indows Type	1				7.35	X	1/[1/(1)+	0.04] =	7.07	Ħ			(27
/indows Type	2				3.8	X	1/[1/(1)+	0.04] =	3.65	Ħ			(27
Vindows Type	3				2.21	×	1/[1/(1)+	0.04] =	2.13	5			(27
Valls	44.9	98	16.93	3	28.05	x	0.18	 	5.05	=	14		92.7 (29
loof	55.8		0		55.83	=	0.11	<u>-</u>	6.14	=	9	국 누	02.47 (30
otal area of el					100.8	=	<u> </u>						(3′
arty wall		,			39.86	=	0		0	— г	20		97.2 (3
arty floor					55.83	=					40	= =	233.2 (32
nternal wall **					63.71	=				L T	9	= =	73.39 (32
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	re)+0.04] a	L as given in			(02
abric heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				27.61	(33
leat capacity (Cm = S((Axk)						((28)	.(30) + (32)	2) + (32a).	(32e) =	4498.9	96 (34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			80.58	3 (3
or design assess an be used instea				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge	s : S (L	x Y) cal	culated (using Ap	pendix l	<						14.72	2 (30
details of therma otal fabric hea		are not kn	own (36) =	= 0.05 x (3	11)			(33) +	(36) =			42.32	2 (3
entilation hea	t loss ca	alculated	l monthly	/				(38)m	= 0.33 × ((25)m x (5)))		
		Mar	Apr	May	Jun	Jul	Aug	Sep		i .	Dec	l	

(38)m= 10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21		(38)
Heat transfer of			0.01	0.02	0.00	0.00	0.20		= (37) + (10.21		()
(39)m= 52.92	52.82	52.73	52.24	52.14	51.65	51.65	51.55	51.84	52.14	52.33	52.53		
Heat loss para		JI D) \\\/	/m²k′				<u> </u>		Average = = (39)m ÷	Sum(39) ₁	12 /12=	52.21	(39)
(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		
(10)										Sum(40) ₁	<u> </u>	0.94	(40)
Number of day	/s in moi	nth (Tab	le 1a)										_
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occu	ıpancy, l	N								1.	86		(42)
if TFA > 13.5		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.				, ,
if TFA £ 13.9 Annual average	•	ater usad	ne in litre	s ner da	av Vd av	erage =	(25 x N)	+ 36		70	3.41		(43)
Reduce the annua	al average	hot water	usage by	5% if the a	lwelling is	designed			se target o		0.41		(40)
not more that 125	litres per _l	person per	day (all w	ater use, l	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i		day for ea				able 1c x							
(44)m= 86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		7
Energy content of	hot wa <mark>ter</mark>	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x E))Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		940.97	(44)
(45)m= 127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
									Total = Su	m(45) ₁₁₂ =	=	1233.75	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)		,		ı	
(46)m= 19.19 Water storage	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
Storage volum		includin	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	, ,		•			•					0		(11)
Otherwise if no	_			_			. ,	ers) ente	er '0' in (47)			
Water storage												ı	
a) If manufact				or is kno	wn (kWr	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from b) If manufact		•			or is not		(48) x (49)) =			0		(50)
Hot water stor			-								0		(51)
If community h	eating s	ee secti	on 4.3										
Volume factor											0		(52)
Temperature f											0		(53)
Energy lost fro		-	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	. , .	•	for each	month			((56)m = (55) ~ (41).	m		0		(55)
Water storage										I ^			(EC)
(56)m= 0 If cylinder contains	0 s dedicate	d solar sto	0 rage. (57)	0 = (56)m	0 x [(50) – (0 H11)1 <i>→ (</i> 5	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
	1												(E7)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3				0	1	(58)
Primary circuit loss calculated for each month ((59) m = $(58) \div 36$	65 × (41)m			•	
(modified by factor from Table H5 if there is	solar water heati	ng and a cylinde	er thermostat)		_	
(59)m= 0 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)m =	(60) ÷ 365 × (41)m				
(61)m= 14.02 12.65 13.98 13.5 13.93	13.45 13.89	13.91 13.48	13.96 13.5	4 14.01	1	(61)
Total heat required for water heating calculated	d for each month	(62) m = $0.85 \times$	(45)m + (46)m	+ (57)m +	ı · (59)m + (61)m	
(62)m= 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53 103.15	 	- ` ´]	(62)
Solar DHW input calculated using Appendix G or Appendix					1	
(add additional lines if FGHRS and/or WWHRS				3,		
(63)m= 0 0 0 0 0	0 0	0 0	0 0	0	1	(63)
Output from water heater	l l	<u> </u>	! !	I	ı	
(64)m= 141.94 124.52 129.42 114.15 110.5	96.79 91.11	102.53 103.15	118.46 127.6	137.89	1	
		L	vater heater (annu		1398.07	(64)
Heat gains from water heating, kWh/month 0.2	5 ′ [0 85 x (45)m	•	•	,	. 1	_ '
(65)m= 46.04 40.36 41.88 36.84 35.59	31.07 29.15	32.94 33.19	38.24 41.3	<u> </u>]	(65)
` '	<u> </u>		<u> </u>	ļ	l	(00)
include (57)m in calculation of (65)m only if o	cylinder is in the o	dwelling of not v	vater is from co	ommunity r	leating	
5. Internal gains (see Table 5 and 5a):			_			
Metabolic gains (Table 5), Watts					1	
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct No			(00)
(66)m= 93.08 93.08 93.08 93.08 93.08	93.08 93.08	93.08 93.08	93.08 93.0	8 93.08		(66)
Lighting gains (calculated in Appendix L, equat		lso see Table 5		_	1	
(67)m= 14.47 12.85 10.45 7.91 5.92	4.99 5.4	7.01 9.41	11.95 13.9	5 14.87		(67)
Appliances gains (calculated in Appendix L, eq	uation L13 or L1	3a), also see Ta	able 5		-	
(68)m= 162.32 164.01 159.76 150.73 139.32	128.6 121.44	119.75 124	133.03 144.4	155.16		(68)
Cooking gains (calculated in Appendix L, equa	tion L15 or L15a), also see Table	e 5		_	
(69)m= 32.31 32.31 32.31 32.31 32.31	32.31 32.31	32.31 32.31	32.31 32.3	1 32.31		(69)
Pumps and fans gains (Table 5a)						
(70)m= 3 3 3 3 3	3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (negative values) (Tab	ole 5)	•			•	
(71)m= -74.47 -74.47 -74.47 -74.47 -74.47	-74.47 -74.47	-74.47 -74.47	-74.47 -74.4	7 -74.47	1	(71)
Water heating gains (Table 5)	· · · · · ·	'	! !		1	
(72)m= 61.88 60.06 56.29 51.17 47.84	43.16 39.18	44.28 46.09	51.39 57.3	8 60.07]	(72)
Total internal gains =	(66)m + (67)n	n + (68)m + (69)m +	(70)m + (71)m + (72)m	1	
(73)m= 292.59 290.84 280.43 263.73 247	230.67 219.93	224.97 233.43	250.3 269.	7 284.03]	(73)
6. Solar gains:						
Solar gains are calculated using solar flux from Table 6a	and associated equa	ations to convert to t	he applicable orier	ntation.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	Table 6b	Table 6	C	(W)	
Southeast 0.9x 0.77 x 3.8	x 36.79	x 0.3	x 0.:	7 =	20.35	(77)
Southeast 0.9x 0.77 x 3.8	× 62.67	x 0.3	x 0.:		34.66	(77)
		J L 3.3				」 ` ′

					heating seas			Tal	.l. 0	Th4 (00)		•		21	(85)
	36.84	370.23	399.6	_	429.35 448	_	438.18	417.01	393	.96 368.57	340.9	323.43	321.42]	(84)
` ′	44.25 ns – in	79.38 ternal a	119.2 nd so		$\begin{array}{c c} 165.62 & 201 \\ \hline (84)m = (73) \end{array}$		207.51 (83)m	197.07 watts	168	.99 135.14	90.61	53.73	37.4	J	(83)
— —		i		\neg	for each mor	$\overline{}$	00= 7:			= Sum(74)m .			l :	1	(00)
	···	0.11		-	L	_ ^	<u> </u>	··]	0.5	^	5.1			(/
Northwest	<u> </u>	0.77	=	X	7.35	」 ^ 	_	9.21	^ x	0.3	┤	0.7	╡ -	9.86	(81)
Northwest	느	0.77		x x	7.35 7.35	」 × □ x		8.07	x x	0.3	X x	0.7	- -	30.02 15.19	(81)
Northwest Northwest	느	0.77	_	X	7.35	X		0.42	X	0.3	×	0.7	╡ =	53.93	(81)
Northwest	<u> </u>	0.77		X	7.35	×	—	2.63	X	0.3	×	0.7	=	77.69	(81)
Northwest	느	0.77		X	7.35	X	9	91.1	X	0.3	×	0.7	=	97.45	(81)
Northwest	<u>L</u>	0.77		X	7.35	×	9	7.38	x	0.3	×	0.7	=	104.17	(81)
Northwest	t _{0.9x}	0.77		X	7.35	×	9	1.35	x	0.3	×	0.7	=	97.71	(81)
Northwest	t _{0.9x}	0.77		X	7.35	×	6	7.96	x	0.3	×	0.7	=	72.69	(81)
Northwest	t _{0.9x}	0.77	$\overline{}$	X	7.35	×	4	1.38	x	0.3	×	0.7	=	44.26	(81)
Northwest		0.77		X	7.35	×		2.97	x	0.3	x	0.7	=	24.57	(81)
Northwest		0.77		X	7.35	×	_	1.28	X	0.3	x	0.7		12.07	(81)
Southwes		0.77		X	2.21	×		1.49		0.3	×	0.7		10.13	(79)
Southwes		0.77		X	2.21	4 ^ 7 x	/	4.07		0.3	×	0.7		14.17	(79)
Southwes		0.77		X	2.21	·	-	9.27		0.3	^	0.7	_ =	22.28	(79)
Southwes		0.77		X	2.21] ×	\	2.85		0.3	X	0.7	=]	29.86	(79)
Southwes	<u> </u>	0.77		x x	2.21	」× ▼		13.91		0.3	X	0.7		36.64	(79)
Southwes Southwes	<u> </u>	0.77		X	2.21	X		18.15] 1	0.3	X	0.7	=	38	(79)
Southwes	<u> </u>	0.77	_	X	2.21	X		19.01] 1	0.3	×	0.7	=	38.28	(79)
Southwes	<u> </u>	0.77	_	X	2.21	X		06.25		0.3	×	0.7	=	34.17	(79)
Southwes	느	0.77		X	2.21	×	8	5.75		0.3	x	0.7	=	27.58	(79)
Southwes	<u> </u>	0.77		X	2.21	X	6	2.67		0.3	x	0.7	=	20.16	(79)
Southwes	<u> </u>	0.77		X	2.21	x	3	6.79		0.3	x	0.7	=	11.83	(79)
Southeast	t 0.9x	0.77		x	3.8	x	3	1.49	x	0.3	x	0.7	=	17.41	(77)
Southeast	t _{0.9x}	0.77		X	3.8	×	4	4.07	x	0.3	x	0.7	=	24.37	(77)
Southeast	t _{0.9x}	0.77		X	3.8	x	6	9.27	x	0.3	x	0.7	=	38.31	(77)
Southeast	t 0.9x	0.77		x	3.8	x	9	2.85	x	0.3	x	0.7	=	51.35	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	10	04.39	x	0.3	x	0.7	=	57.73	(77)
Southeast	t _{0.9x}	0.77		x	3.8	T x	1	13.91	x	0.3	x	0.7	=	62.99	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	1	18.15	x	0.3	x	0.7	=	65.34	(77)
Southeast	t _{0.9x}	0.77		x	3.8	X	1	19.01	X	0.3	x	0.7	= =	65.81	(77)
Southeast	t _{0.9x}	0.77	\equiv	x	3.8	x		5.75 06.25	X	0.3	×	0.7	=	58.76	(77)

						•						•	ı	
(86)m=	0.95	0.93	0.9	0.84	0.75	0.62	0.49	0.53	0.71	0.86	0.93	0.95		(86)
Mean	interna	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	18.78	19.01	19.41	19.93	20.41	20.76	20.91	20.88	20.62	20.02	19.31	18.72		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°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	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.94	0.92	0.89	0.82	0.71	0.56	0.41	0.45	0.66	0.84	0.92	0.95		(89)
Mean	internal	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to	7 in Tabl	e 9c)			•	
(90)m=	17.13	17.46	18.03	18.78	19.45	19.9	20.07	20.05	19.74	18.92	17.91	17.05		(90)
•									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean	internal	l temper	ature (fo	r the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	.A) × T2			,		
(92)m=	18.12	18.39	18.86	19.48	20.03	20.42	20.58	20.55	20.27	19.58	18.75	18.06		(92)
Apply	adjustn	nent to t	he mean	interna	temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	17.97	18.24	18.71	19.33	19.88	20.27	20.43	20.4	20.12	19.43	18.6	17.91		(93)
			uirement											
			ernal ter or gains			ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
lile ul	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l Utilisa			ains, hm	_	iviay	Juli	Jui	Aug	ОСР	Oct	1404	DCC		
(94)m=	0.92	0.9	0.86	0.8	0.7	0.57	0.44	0.47	0.66	0.82	0.9	0.93		(94)
Usefu	<mark>l g</mark> ains,	hmGm	, W = (94	4)m x (8	4)m									
(95)m=	309.94	333.07	345.58	344.05	315.68	248.64	181.74	186.3	243.44	279.58	289.93	298.04		(95)
			rnal tem		from Ta									
(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)
			r			1			- (96)m	460.48	C00.04	700.07	1	(97)
(97)m=	723.53	704.8	643.83	544.67	426.47	292.82	197.57	206.33			602.04	720.27		(97)
(98)m=	307.71	249.8	221.9	144.44	82.42	0	0.02	0)m – (95 0	134.58	224.72	314.14		
()									l per year				1679.72	(98)
Snace	haatin	a requir	ement in	k\/\/h/m2	!/vear				, , , , , , ,	()	, (-	- /	30.09	(99)
•	·	•				-1	1 12		NID)				30.09	(00)
	ergy rec e heatir		nts — Indi	ividuai n	eating s	ystems ii	nciuaing	micro-C	JHP)					
•		•	at from s	econdar	y/supple	mentary	system						0	(201)
			at from m			,	•	(202) = 1	- (201) =				1	(202)
			ng from	-	• •			(204) = (2	02) × [1 –	(203)] =			1	(204)
			ace heat	-									90.5	(206)
	•	-		• .		g system	ո. %						0	(208)
	Jan	Feb	Mar		May	Jun	Jul	Λιια	Son	Oct	Nov	Doc	kWh/	`
Space			ement (c	Apr alculate			Jui	Aug	Sep	<u> </u>	INOV	Dec	[KVVII/]	y c ai
27400	307.71	249.8	221.9	144.44	82.42	0	0	0	0	134.58	224.72	314.14		
ا (211)m	= {[(98])m x (20	 (4)] } x 1	00 ÷ (20)6)	<u> </u>		!			I	Į	I	(211)
(=),,,	340.01	276.03	245.2	159.6	91.08	0	0	0	0	148.71	248.31	347.12		` ,
l		1				1		Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1856.05	(211)

$= \{ [(98)m \times (201)] \} \times 100 \div (208) $ $(215)m = $	0 0	0 0	0	0	0		
	ļ.	Total (kWh/y	ear) =Sum(2	215) _{15,1012}	<u> </u>	0	(215)
Water heating					!		
Output from water heater (calculated above) 141.94 124.52 129.42 114.15 110.5 9	96.79 91.11	102.53 103.15	118.46	127.62	137.89	1	
Efficiency of water heater	90.79 91.11	102.55	110.40	127.02	137.09	87.3	(216)
·	87.3 87.3	87.3 87.3	88.97	89.31	89.5	07.0	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m							
	10.87 104.36	117.44 118.16	133.14	142.88	154.07		
	-	Total = Sum(219a) ₁₁₂ =			1576.62	(219)
Annual totals			k۱	Wh/year	•	kWh/yea	<u>r</u>
Space heating fuel used, main system 1						1856.05	╡
Water heating fuel used						1576.62	
Electricity for pumps, fans and electric keep-hot						•	
mechanical ventilation - balanced, extract or pos	itive input fror	n outside			153.25		(230:
central heating pump:					30		(230
boiler with a fan-assisted flue					45		(230
Total electricity for the above, kWh/year		sum of (230a)(230g) =			228.25	(231)
Electricity for lighting						2 <mark>55.56</mark>	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) =				3916.49	(338)
						_	
12a. CO2 emissions – Individual heating system	s including mi	cro-CHP					
12a. CO2 emissions – Individual heating systeme	Energy	cro-CHP		ion fac	tor	Emissions	
12a. CO2 emissions – Individual heating systeme		cro-CHP	Emiss kg CO2		tor	Emissions kg CO2/ye	
12a. CO2 emissions – Individual heating systems Space heating (main system 1)	Energy	cro-CHP		2/kWh	tor =		
Space heating (main system 1)	Energy kWh/year	cro-CHP	kg CO	2/kWh	,	kg CO2/ye	ar (261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year	cro-CHP	kg CO2	2/kWh	=	kg CO2/ye	ar (261) (263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	cro-CHP + (263) + (264) =	0.2°	2/kWh	= =	kg CO2/ye	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		0.2°	2/kWh	= =	kg CO2/ye 400.91 0 340.55	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)		0.2°	2/kWh 16 19 16	= =	kg CO2/ye 400.91 0 340.55 741.46	ar —
	Energy kWh/year (211) x (215) x (219) x (261) + (262) (231) x	+ (263) + (264) =	0.2° 0.5° 0.5°	2/kWh 16 19 16 19	= = =	kg CO2/ye 400.91 0 340.55 741.46 118.46 132.64	ar (26) (26) (26) (26) (26)
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) (231) x	+ (263) + (264) = sum	0.2° 0.5° 0.5° 0.5°	2/kWh 16 19 16 19	= = =	kg CO2/ye 400.91 0 340.55 741.46 118.46	ar (26) (26) (26) (26) (26)

El rating (section 14)

(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	n: 1.0.5.41	
Address :	1 Bed Var - EF, L		i i	Address	. i beu	vai - Er				
1. Overall dwelling dime	nsions:									
			Are	a(m²)	•	Av. He	ight(m)	_	Volume(m ³	_
Ground floor			5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	n)	54.08	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	135.2	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0] + [0	= [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	T + [0	= [0	x 2	20 =	0	(6b)
Number of intermittent far	ns					0	x -	10 =	0	(7a)
Number of passive vents					F	0	x -	10 =	0	(7b)
Number of flueless gas fir	res				ř	0	X 4	40 =	0	(7c)
					L					` '
								Air ch	nanges per ho	our
Infiltration due to chimne						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in the		ended, procee	d to (17),	otherwise (continue fr	rom (9) to ((16)		0	(9)
Additional infiltration	ie dweiling (113)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masonı	ry consti	ruction	,	•	0	(11)
if both types of wall are pr		rresponding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden f	• / .	ealed) or 0.	.1 (seale	ed). else	enter 0				0	(12)
If no draught lobby, ent	•	•	(,,					0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate						12) + (13) -			0	(16)
Air permeability value,	•		•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili Air permeability value applies	•					is beina u	sed		0.1	(18)
Number of sides sheltere				g <i> </i>					2	(19)
Shelter factor				(20) = 1 -	[0.075 x ([*]	19)] =			0.85	(20)
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for		i		<u> </u>			·		1	
L 1	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp			2.0	1 2 7	1 4	1 40	1 45	4.7	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

O.11 Calculate effec If mechanica If exhaust air he If balanced with a) If balanced 24a)m= 0.23 b) If balanced	I ventilat at pump u	ion:	0.09 rate for t	0.09 he appli	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
If exhaust air he If balanced with a) If balanced 24a)m= 0.23 b) If balanced	at pump u				cabie ca	se			!	!		•	
If balanced with a) If balanced 24a)m= 0.23 b) If balanced		-: A										0.5	(2:
a) If balanced 24a)m= 0.23 b) If balanced	heat recov	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(2
0.23 b) If balanced		very: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				75.65	(2
b) If balance	d mecha	nical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
· — —	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
?4b)m= 0	d mecha	nical ve	entilation	without	heat red	covery (N	ЛV) (24b	m = (22)	2b)m + (23b)	_	•	
	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole ho				•	•				.5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural v if (22b)m				•	•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change r	ate - er	nter (24a) or (24h	o) or (24	c) or (24	d) in box	x (25)				_	
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losses	and he	at loss i	paramet	er:							_	_	
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-l		A X k kJ/K
)oo <mark>rs</mark>					3.57	X	1	= [3.57				(2
Vin <mark>dows</mark> Type	1				1.81	X	1/[1/(1)+	0.04] =	1.74				(2
Vindows Type	2				6.09	x	1/[1/(1)+	0.04] =	5.86				(2
Vindows Type	3	'			1.05	X	1/[1/(1)+	0.04] =	1.01				(2
Vindows Type	4				5.57	X	1/[1/(1)+	0.04] =	5.36				(2
loor					13.85	5 X	0.13		1.8005	<u> </u>	75	10	38.75 (2
Valls	62.5		18.0	9	44.4	1 X	0.18	=	7.99		14	62	21.74 (2
otal area of el	ements,	m²			76.35	5							(3
arty wall					19.77	7 X	0		0		20] [3	95.4 (3
arty floor					40.23	3					40	<u> </u>	609.2 (3
arty ceiling					54.08	<u></u>				[30		622.4 (3
nternal wall **					63.3	=				[9		69.7
for windows and i					alue calcui		ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	n paragraph		,
abric heat los	s, W/K =	S (A x	U)				(26)(30)) + (32) =				27.33	(3
leat capacity (Cm = S(A)	Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	5857.1	9 (3
hermal mass	paramet	er (TMF	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			108.3	1 (3
or design assessi an be used instea				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
	s : S (L :	x Y) cal	culated i	using Ap	pendix l	K						13	(3

Total fabria boot loss	(07)
Total fabric heat loss $(33) + (36) = 40.33$ Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$	(37)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m= 10.27 10.17 10.08 9.6 9.51 9.03 9.03 8.94 9.22 9.51 9.7 9.89	(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m	()
(39)m= 50.59 50.5 50.41 49.93 49.84 49.36 49.36 49.27 49.55 49.84 50.03 50.22	
Average = Sum(39) ₁₁₂ /12= 49.91	(39)
Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)	
(40)m= 0.94 0.93 0.93 0.92 0.92 0.91 0.91 0.91 0.92 0.92 0.93 0.93	
Average = $Sum(40)_{112}/12=$ 0.92 Number of days in month (Table 1a)	(40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(41)m= 31 28 31 30 31 30 31 30 31 30 31	(41)
4. Water heating energy requirement: kWh/year:	
Assumed assuments N	(40)
Assumed occupancy, N	(42)
if TFA £ 13.9, N = 1	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of	(43)
not more that 125 litres per person per day (all water use, hot and cold)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Hot water usage in litres per day for each month $Vd,m = factor from Table 1c \times (43)$	
(44)m= 84.92 81.83 78.74 75.65 72.56 69.48 69.48 72.56 75.65 78.74 81.83 84.92	
Total = Sum(44) ₁₁₂ = 926.35	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)	
(45)m= 125.93 110.14 113.65 99.08 95.07 82.04 76.02 87.24 88.28 102.88 112.3 121.95	
Total = Sum(45) ₁₁₂ = 1214.59 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	(45)
(46)m= 18.89 16.52 17.05 14.86 14.26 12.31 11.4 13.09 13.24 15.43 16.85 18.29	(46)
Water storage loss:	(10)
Storage volume (litres) including any solar or WWHRS storage within same vessel 0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)	
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)	
Water storage loss:	(40)
a) If manufacturer's declared loss factor is known (kWh/day): 0	(48)
Temperature factor from Table 2b 6 Energy lost from water sterage, kWh/year (48) x (40) =	(49)
Energy lost from water storage, kWh/year (48) x (49) = 0 b) If manufacturer's declared cylinder loss factor is not known:	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	(51)
If community heating see section 4.3	
Volume factor from Table 2a 0	(52)
Temperature factor from Table 2b	(53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ Enter (50) or (54) in (55)	(54)
Enter (50) or (54) in (55)	(55)

Water storage los	ss calc	ulated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains de	dicated	solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit los	ss (anr	nual) fro	m Table	3							0		(58)
Primary circuit los	ss calc	ulated f	or each	month (59)m = ((58) ÷ 36	55 × (41)	m				•	
(modified by fac	ctor fro	om Tabl	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calcul	lated f	or each	month ((61)m =	(60) ÷ 36	65 × (41))m					_	
(61)m= 14.01 1	2.64	13.97	13.49	13.92	13.45	13.88	13.91	13.47	13.95	13.53	14.01		(61)
Total heat require	ed for v	water he	eating ca	alculated	I for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 139.94 12	22.78	127.62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		(62)
Solar DHW input calc	ulated u	sing App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	on to wate	er heating)		
(add additional lin	nes if F	GHRS	and/or \	VWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from wate	r heate	er											
(64)m= 139.94 12	22.78	127.62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		_
							Outp	out from wa	ater heate	r (annual)₁	12	1378.84	(64)
Heat gains from v	water h	eating,	kWh/mo	onth 0.2	5 [0.85	× (45)m	+ (61)n	1] + 0.8 >	((46)m	+ (57)m	+ (59)m	1	
(65)m= 45.37 3	9.78	41.28	36.32	35.09	3 0.64	20.75	22 40	00.70	07.7	40.00			(65)
			30.32	33.09	30.04	28.7 <mark>5</mark>	32.48	32.72	37.7	40.72	44.05		(00)
in <mark>clude</mark> (57)m ii		_			_							eating	(00)
include (57)m in	n calcu	ulation o	of (65)m	only if c	_							eating	(00)
1 1	n calcu	ulation o	of (65)m and 5a	only if c	_							neating	(00)
5. Internal gains Metabolic gains (n calcu	ulation o	of (65)m and 5a	only if c	_							neating	(00)
5. Internal gains Metabolic gains (n calcus (see	ulation of Table 5 5), Wat	of (65)m and 5a	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	(66)
5. Internal gains Metabolic gains (n calcus (see Table Feb 0.52	Table 5 5), Wat Mar 90.52	of (65)m and 5a ts Apr 90.52	only if constant of the consta	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	ater is fr	om com	munity h	neating	
5. Internal gains Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca	n calcus (see Table Feb 0.52	Table 5 5), Wat Mar 90.52	of (65)m and 5a ts Apr 90.52	only if constant of the consta	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	ater is fr	om com	munity h	neating	
5. Internal gains Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca	r calculate	Table 5 5), Wat Mar 90.52 ed in Ap	of (65)m and 5a ts Apr 90.52 ppendix 7.69	May 90.52 L, equati	Jun 90.52 ion L9 o	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	Sep 90.52 Table 5 9.15	Oct 90.52	Nov 90.52	Dec 90.52	neating	(66)
5. Internal gains Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains	r calculate	Table 5 5), Wat Mar 90.52 ed in Ap	of (65)m and 5a ts Apr 90.52 ppendix 7.69	May 90.52 L, equati	Jun 90.52 ion L9 o	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	Sep 90.52 Table 5 9.15	Oct 90.52	Nov 90.52	Dec 90.52	neating	(66)
5. Internal gains Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains	r calculate (calculate 59.45	Table 5 5), Wat Mar 90.52 ed in Ap 10.16 ulated in	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54	only if construction in the construction in th	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1 118.06	Aug 90.52 Iso see 6.82 3a), also	Sep 90.52 Table 5 9.15 see Ta	Oct 90.52 11.62 ble 5 129.34	Nov 90.52	Dec 90.52	neating	(66) (67)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca	r calculate (calculate 59.45	Table 5 5), Wat Mar 90.52 ed in Ap 10.16 ulated in	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54	only if construction in the construction in th	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1 118.06	Aug 90.52 Iso see 6.82 3a), also	Sep 90.52 Table 5 9.15 see Ta	Oct 90.52 11.62 ble 5 129.34	Nov 90.52	Dec 90.52	neating	(66) (67)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca	Table Table Table Table Table (c.52 Calculate (calculate (calculate (calculate (calculate (calculate (calculate) (calculate (calculate)	Table 5 5), Wat Mar 90.52 ed in Ap 10.16 ulated in 155.32 ed in Ap 32.05	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05	May 90.52 L, equati 5.75 dix L, eq 135.45 L, equat	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Ta 120.55	Oct 90.52 11.62 ble 5 129.34 5	Nov 90.52 13.56	Dec 90.52	neating	(66) (67) (68)
5. Internal gains Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca (69)m= 32.05 3	Table Table Table Table Table (c.52 Calculate (calculate (calculate (calculate (calculate (calculate (calculate) (calculate (calculate)	Table 5 5), Wat Mar 90.52 ed in Ap 10.16 ulated in 155.32 ed in Ap 32.05	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05	May 90.52 L, equati 5.75 dix L, eq 135.45 L, equat	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Ta 120.55	Oct 90.52 11.62 ble 5 129.34 5	Nov 90.52 13.56	Dec 90.52	neating	(66) (67) (68)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca (69)m= 32.05 3 Pumps and fans g	Table Table Table Table 0.52 0.52 0.52 0.52 0.59.45 0.69.45 0.	mulation of the state of the st	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05 5a)	only if construction only if c	Jun 90.52 ion L9 of 4.86 uation L 125.02 iion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	neating	(66) (67) (68) (69)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca (69)m= 32.05 3 Pumps and fans ((70)m= 3 Losses e.g. evapor	Table Table Table Table 0.52 0.52 0.52 0.52 0.59.45 0.69.45 0.	mulation of the state of the st	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05 5a)	only if construction only if c	Jun 90.52 ion L9 of 4.86 uation L 125.02 iion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	neating	(66) (67) (68) (69)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca (69)m= 32.05 3 Pumps and fans ((70)m= 3 Losses e.g. evapor	r calculate 12.5 (calculate 2.05 gains (Jable 5 5), Wat Mar 90.52 ed in Ap 10.16 Jated in 155.32 ed in Ap 32.05 (Table 5 3 n (negat	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05 5a) 3 tive valu	only if construction only if c	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85 32.05	neating	(66) (67) (68) (69) (70)
Metabolic gains (Carlotte Jan 14.07 14.07 15.00 14.07 15.00	r calculate 12.5 (calculate 2.05 gains (Jable 5 5), Wat Mar 90.52 ed in Ap 10.16 Jated in 155.32 ed in Ap 32.05 (Table 5 3 n (negat	of (65)m and 5a ts Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05 5a) 3 tive valu	only if construction only if c	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85 32.05	neating	(66) (67) (68) (69) (70)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca (69)m= 32.05 3 Pumps and fans ((70)m= 3 Losses e.g. evape (71)m= -72.41 -7 Water heating gains	Table Feb 0.52 alculate 12.5 (calculate 2.05 gains (3 oration 72.41 ins (Ta 59.2	ulation of Table 5 5), Wat Mar 90.52 ed in Apr 10.16 ulated in 155.32 ed in Apr 32.05 (Table 5 3 n (negat 7-72.41 able 5)	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41	only if construction only if construction only if construction on the construction of the construction on the construction on the construction of the construction on the construction of the construction on the construction of	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	Nov 90.52 13.56 140.43 32.05 3	Dec 90.52 14.46 150.85 32.05 3	neating	(66) (67) (68) (69) (70)
Metabolic gains (Jan (66)m= 90.52 9 Lighting gains (ca (67)m= 14.07 1 Appliances gains (68)m= 157.81 15 Cooking gains (ca (69)m= 32.05 3 Pumps and fans ((70)m= 3 Losses e.g. evapor (71)m= -72.41 -7 Water heating gain (72)m= 60.99 5	Table Feb 0.52 alculate 12.5 (calculate 2.05 gains (3 oration 72.41 ins (Ta 59.2	ulation of Table 5 5), Wat Mar 90.52 ed in Apr 10.16 ulated in 155.32 ed in Apr 32.05 (Table 5 3 n (negat 7-72.41 able 5)	of (65)m and 5a ts Apr 90.52 ppendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41	only if construction only if construction only if construction on the construction of the construction on the construction on the construction of the construction on the construction of the construction on the construction of	Jun 90.52 ion L9 of 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	Nov 90.52 13.56 140.43 32.05 3	Dec 90.52 14.46 150.85 32.05 3	neating	(66) (67) (68) (69) (70)

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

Orientation: Access Factor Table 6d	or	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast _{0.9x} 0.77	x	1.81	х	22.97	x	0.3	x	0.7	=	6.05	(75)
Northeast 0.9x 0.77	X	1.81	х	41.38	x	0.3	x	0.7	=	10.9	(75)
Northeast 0.9x 0.77	x	1.81	x	67.96	x	0.3	x	0.7] =	17.9	(75)
Northeast 0.9x 0.77	x	1.81	x	91.35	x	0.3	x	0.7	=	24.06	(75)
Northeast 0.9x 0.77	X	1.81	x	97.38	x	0.3	x	0.7] =	25.65	(75)
Northeast 0.9x 0.77	x	1.81	х	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x} 0.77	X	1.81	x	72.63	x	0.3	x	0.7	=	19.13	(75)
Northeast _{0.9x} 0.77	x	1.81	x	50.42	x	0.3	x	0.7	=	13.28	(75)
Northeast _{0.9x} 0.77	x	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast _{0.9x} 0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast 0.9x 0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x 0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x 0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x 0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x 0.77	X	1.05	X	106.25	X	0.3	X	0.7] =	16.24	(77)
Southeast 0.9x 0.77	X	1.05	x	119.01	x	0.3	x	0.7		18.19	(77)
Southeast 0.9x 0.77	X	1.05	х	118.15] x	0.3	x	0.7	=	18.05	(77)
Southeast 0.9x 0.77	X	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast 0.9x 0.77	X	1.05	x	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast 0.9x 0.77	X	1.05	x	92.85	×	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x 0.77	X	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x 0.77	X	1.05	X	44.07	X	0.3	X	0.7	=	6.73	(77)
Southeast 0.9x 0.77	X	1.05	X	31.49	X	0.3	X	0.7	=	4.81	(77)
Southwest _{0.9x} 0.77	X	5.57	x	36.79]	0.3	X	0.7	=	29.83	(79)
Southwest _{0.9x} 0.77	X	5.57	x	62.67]	0.3	x	0.7	=	50.8	(79)
Southwest _{0.9x} 0.77	X	5.57	x	85.75]	0.3	X	0.7	=	69.51	(79)
Southwest _{0.9x} 0.77	X	5.57	x	106.25]	0.3	X	0.7	=	86.13	(79)
Southwest _{0.9x} 0.77	X	5.57	x	119.01]	0.3	x	0.7	=	96.47	(79)
Southwest _{0.9x} 0.77	X	5.57	x	118.15]	0.3	X	0.7	=	95.77	(79)
Southwest _{0.9x} 0.77	X	5.57	x	113.91]	0.3	x	0.7	=	92.34	(79)
Southwest _{0.9x} 0.77	X	5.57	x	104.39]	0.3	X	0.7	=	84.62	(79)
Southwest _{0.9x} 0.77	X	5.57	x	92.85]	0.3	X	0.7	=	75.27	(79)
Southwest _{0.9x} 0.77	X	5.57	x	69.27]	0.3	X	0.7	=	56.15	(79)
Southwest _{0.9x} 0.77	X	5.57	x	44.07]	0.3	X	0.7	=	35.72	(79)
Southwest _{0.9x} 0.77	X	5.57	x	31.49]	0.3	x	0.7	=	25.52	(79)
Northwest 0.9x 0.77	X	6.09	x	11.28	x	0.3	x	0.7	=	10	(81)
Northwest 0.9x 0.77	X	6.09	x	22.97	x	0.3	x	0.7] =	20.35	(81)
Northwest _{0.9x} 0.77	x	6.09	X	41.38	×	0.3	x	0.7	=	36.67	(81)

Northwest 0.9x 0.77	X	6.0	9	x [6	7.96	x		0.3	x	0.7	=	60.23	(81)
Northwest 0.9x 0.77	X	6.0	9	x [9	1.35	x		0.3	x	0.7	=	80.96	(81)
Northwest 0.9x 0.77	X	6.0	9	x	9	7.38	x		0.3	x	0.7	=	86.31	(81)
Northwest _{0.9x} 0.77	x	6.0	9	x	ç	91.1	x		0.3	x	0.7	=	80.74	(81)
Northwest 0.9x 0.77	X	6.0	9	x [7	2.63	x		0.3	x [0.7	=	64.37	(81)
Northwest 0.9x 0.77	X	6.0	9	x	5	0.42	x		0.3	x	0.7	=	44.69	(81)
Northwest 0.9x 0.77	X	6.0	9	x	2	8.07	x		0.3	x	0.7	=	24.88	(81)
Northwest 0.9x 0.77	x	6.0	9	x	1	14.2	x		0.3	x	0.7	=	12.58	(81)
Northwest 0.9x 0.77	x	6.0	9	x	9	9.21	x		0.3	x	0.7	=	8.17	(81)
							_							_
Solar gains in watts, calcula	ated	for eacl	h month				(83)m	ı = Sı	ım(74)m .	(82)m				
(83)m= 48.42 86.78 130	.19	180.49	219.68	22	25.79	214.48	184	.07	147.42	99	58.78	40.93		(83)
Total gains – internal and s	olar	(84)m =	= (73)m ·	+ (8	33)m ,	, watts	•						ı	
(84)m= 334.44 371.08 404	.31	438.32	461.2	45	51.38	429.58	404	.13	375.73	343.78	322.49	318.6		(84)
7. Mean internal temperat	ure ((heating	season)							•			
Temperature during heating		`		<i></i>	area f	rom Tal	ole 9	Th1	1 (°C)				21	(85)
Utilisation factor for gains	٠.			•			010 0	,	. (0)				21	
	lar		May	È	Jun	Jul			Sep	Oct	Nov	Dec		
(86)m= 0.97 0.95 0.9	_	Apr 0.87	0.76).61	0.48	0.5	ug	0.72	0.89	0.95	0.97		(86)
										0.00	0.55	0.07		(00)
Mean internal temperature	-	_	•		i								1	(07)
(87)m= 19.23 19.44 19.	79	20.24	20.62	20	0.87	20.96	20.	94	20.76	20.28	19.68	19.19		(87)
Temperature during heating	ng p	eriods ir	rest of	dw	elling	from Ta	able 9	9, Th	12 (°C)					
(88)m= 20.14 20.14 20.	14	20.15	20.15	20	0.16	20.16	20.	16	20.15	20.15	20.15	20.14		(88)
Utilisation factor for gains	for r	est of d	welling,	h2,i	m (se	e Table	9a)							
(89)m= 0.96 0.95 0.9	\neg	0.84	0.72).55	0.39	0.4	14	0.67	0.87	0.94	0.97]	(89)
Mean internal temperature	in t	he rest	of dwelli	na	T2 (fc	allow etc	ne 3	to 7	in Tahl	a 9c)			ı	
(90)m= 17.76 18.06 18.	$\overline{}$	19.19	19.72	<u> </u>	0.03	20.13	20.	$\overline{}$	19.91	19.26	18.41	17.69]	(90)
(66)					0.00						ng area ÷ (4		0.6	(91)
											•	,	0.0	(0.7
Mean internal temperature	`			_			T					ı	1	4
(92)m= 18.64 18.88 19.		19.82	20.25		0.53	20.62	20.		20.42	19.87	19.17	18.58		(92)
Apply adjustment to the m				_				_		•	1		1	(00)
(93)m= 18.49 18.73 19.		19.67	20.1	20	0.38	20.47	20.	46	20.27	19.72	19.02	18.43		(93)
8. Space heating requiren														
Set Ti to the mean internate the utilisation factor for ga		•		ed	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=((76)m an	d re-cald	culate	
	lar			Γ	Jun	Jul	Ι	ug	Sep	Oct	Nov	Dec	1	
Utilisation factor for gains,		Apr	May	L_`	Juli	Jui		ug	Sep	OCI	INOV	Dec		
(94)m= 0.95 0.93 0.	-	0.83	0.72).57	0.43	0.4	17	0.68	0.85	0.93	0.96]	(94)
Useful gains, hmGm , W =					,,	0.40	0	''	0.00	0.00	0.55	0.50		(0.)
(95)m= 317.54 345.48 362	$\overline{}$	364.43	333.34	25	6.95	182.85	188	.73	254.68	293.63	299.59	304.36]	(95)
Monthly average external						. 52.00	L				1	1	J	χ= = /
(96)m= 4.3 4.9 6.		8.9	11.7		4.6	16.6	16	.4	14.1	10.6	7.1	4.2]	(96)
Heat loss rate for mean in											1	L	J	` '
(97)m= 717.83 698.64 637		537.53	418.87		35.29	191.08	199	- -	305.68	454.34	596.15	714.75]	(97)
, ,	I										!		I	

Space heating req	uiremen	ıt foı	r each m	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m= 297.82 237.			124.63	63.63	0	0	0	0	119.57	213.53	305.33		
	•	•				•	Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1566.01	(98)
Space heating req	uiremen	ıt in	kWh/m²	/year]	28.96	(99)
9a. Energy requirer	nents –	Indi	vidual h	eating s	ystems i	ncluding	micro-C	CHP)			-		
Space heating:											r		_
Fraction of space			-		mentary	•					ļ	0	(201)
Fraction of space			•	• •			(202) = 1	, ,	(000)1			1	(202)
Fraction of total he	•		•				(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency of main	•		•			0.4						90.5	(206)
Efficiency of secor	-				g systen	า, % เ		i	·	ı		0	(208)
Jan Fe		ar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating req		Ť	124.63	63.63	0	0	0	0	119.57	213.53	305.33		
(211) m = {[(98)m x									1.0.0.		000.00		(211)
329.08 262.	<u> </u>		137.71	70.31	0	0	0	0	132.12	235.94	337.38		(211)
							Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1730.4	(211)
Space heating fue	(secon	dary	y), kWh/	month									
= {[(98)m x (201)] }		T											
(215)m= 0 0	0	_	0	0	0	0	0 Tota	0 (k\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	0 er) =Sum('	0 215) _{15,1012}	0	0	(215)
Water heating							Tota	ii (KVVII) yee	ai) =0uiii(2	213) _{15,1012}		0	(215)
Output from water h	eater (c	alcu	ulated al	oove)									
139.94 122.	78 127.	62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		
Efficiency of water I	eater											87.3	(216)
(217)m= 89.45 89.3			88.95	88.45	87.3	87.3	87.3	87.3	88.89	89.29	89.49		(217)
Fuel for water heati (219)m = (64) m x													
(219)m= 156.44 $137.$		$\overline{}$	126.56	123.22	109.38	102.99	115.86	116.56	131.44	140.94	151.93		
	•	•				•	Tota	I = Sum(2	19a) ₁₁₂ =	•		1555.68	(219)
Annual totals									k'	Wh/year		kWh/yea	- -
Space heating fuel		ain	system	1							ļ	1730.4	╛
Water heating fuel	ised											1555.68	
Electricity for pump	s, fans a	and	electric l	keep-ho	t								
mechanical ventila	tion - ba	alan	ced, ext	ract or p	ositive i	nput fron	n outside	Э			148.45		(230a)
central heating pu	np:										30		(230c)
boiler with a fan-as	sisted f	lue									45		(230e)
Total electricity for t	ne abov	e, k	:Wh/yea	r			sum	of (230a).	(230g) =		 	223.45	(231)
Electricity for lightin	9										[248.46	(232)
Total delivered ene	-	ll us	ses (211)(221)	+ (231)	+ (232).	(237b)	=			[3757.99	(338)
	J, s		, •	, ()	()	, , , –).	, 7				L		」 ` ′

12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	373.77 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	336.03 (264)
Space and water heating	(261) + (262) + (263) + (264) =		709.79 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	115.97 (267)
Electricity for lighting	(232) x	0.519 =	128.95 (268)
Total CO2, kg/year	sum	of (265)(271) =	954.71 (272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	17.65 (273)
El rating (section 14)			87 (274)



			User D	Details: _						
Assessor Name: Software Name:	Stroma FSAP			Strom Softwa Address	are Ve	rsion:		Versic	on: 1.0.5.41	
Address :	1 Bed Var - MF,		i i	Address	i Bea	var - MF				
1. Overall dwelling dime	nsions:									
			Are	a(m²)		Av. He	ight(m)	-	Volume(m ³	_
Ground floor			5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)-	+(1e)+(1r	n) <u></u>	54.08	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	135.2	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0	0] + [0] = [0	X ·	40 =	0	(6a)
Number of open flues	0	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns					0	x	10 =	0	(7a)
Number of passive vents					Ē	0	x '	10 =	0	(7b)
Number of flueless gas fir	res				F	0	X e	40 =	0	(7c)
					L					
								Air ch	nanges per ho	our
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in the		tended, procee	d to (17),	otherwise (continue tr	rom (9) to ((16)		0	(9)
Additional infiltration	.e d						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or tim	ber frame or	0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openin		orresponding to	the great	ter wall are	a (after					
If suspended wooden f	• / .	sealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else ente	r 0		,					0	(13)
Percentage of windows	and doors draug	ht stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	_			0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value, If based on air permeabili	•		•	•	•	etre of e	envelope	area	2	(17)
Air permeability value applies	,					is being us	sed		0.1	(18)
Number of sides sheltere	d				-				2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for	- 1 	1		Ι	0				1	
L 1		lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind specification (22)m= 5.1 5	eed from Table 7 4.9 4.4 4.	3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	4.4 4.	3 3.8	ა.ఠ	3./	4	4.3	4.5	4.7	I	
Wind Factor (22a)m = $(22a)$ m =	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		

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effect		_	rate for t	he appli	cable ca	ise	-	-	-	-	-		7(220)
If exhaust air h			endix N (2	3h) = (23a	a) x Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0.5	(23a)
If balanced with) - (20 0)			0.5	(23b) (23c)
a) If balance		•	-	_					2h\m + (23h) v [1 – (23c)	75.65 ± 1001	(230)
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22]	(24a)
b) If balance	<u> </u>	ļ			heat red	coverv (N	и ЛV) (24b	<u> </u>	2b)m + (1 23b)		I	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole h if (22b)n				•	•				5 x (23h))	l	1	
(24c)m = 0	0.07	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural	ventilatio	n or wh	ole hous	e nositiv	ve input	ventilatio						J	, ,
if (22b)n									0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				_	
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
3. Heat losse	s and he	eat loss	paramete	er:									_
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²·l		X k /K
Doo <mark>rs</mark>					3.57	X	1	=	3.57				(26)
Windows Type	1				1.81	X	1/[1/(1)+	0.04] =	1.74				(27)
Windows Type	2				6.09	x	1/[1/(1)+	0.04] =	5.86				(27)
Windows Type	3				1.05	X	1/[1/(1)+	0.04] =	1.01				(27)
Windows Type	e 4				5.57	X	1/[1/(1)+	0.04] =	5.36				(27)
Walls	62.	5	18.09	9	44.41	1 X	0.18	=	7.99		14	621.7	(29)
Total area of e	lements	, m²			62.5								(31)
Party wall					19.77	7 X	0	=	0		20	395.4	(32)
Party floor					54.08	3					40	2163.	(32a)
Party ceiling					54.08	3				Ī	30	1622.	(32b)
Internal wall **					63.3						9	569.7	(32c)
* for windows and ** include the area						lated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				25.53	(33)
Heat capacity	Cm = S((Axk)						((28).	.(30) + (32	2) + (32a)	(32e) =	5372.44	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			99.34	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	K						9.02	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	31)			(00)	(00)				 .
Total fabric he	at ioss							(33) +	(36) =			34.55	(37)

Ventila	tion hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	10.27	10.17	10.08	9.6	9.51	9.03	9.03	8.94	9.22	9.51	9.7	9.89		(38)
Heat tr	ansfer o	oefficier	nt, W/K						(39)m	= (37) + (3	38)m		•	
(39)m=	44.81	44.72	44.63	44.15	44.06	43.58	43.58	43.49	43.77	44.06	44.25	44.44		
Heat Ic	ss para	meter (H	HLP), W/	m²K				-		Average = = (39)m ÷	Sum(39) ₁	12 /12=	44.13	(39)
(40)m=	0.83	0.83	0.83	0.82	0.81	0.81	0.81	0.8	0.81	0.81	0.82	0.82		
Numbe	er of day	s in moi	nth (Tab	le 1a)		•	•	•	,	Average =	Sum(40) ₁	12 /12=	0.82	(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)
Assum	ed occu	ıpancy, İ			(-0.0003	849 y (TE	- Δ -13 9)2)] + 0.()013 x (⁻	ΓΕΔ -13		kWh/ye	ear:	(42)
if TF Annual	A £ 13.9 I averag	9, N = 1 e hot wa	ater usag	ge in litre	s per da	ay Vd,av	erage =	(25 x N)	+ 36		77	7.2		(43)
			not water person per			_	-	to achieve	a water us	se target o	Ī			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea						Зер	Oct	1404	Dec		
(44)m=	84.92	81.83	78.74	75.65	72.56	69.48	69.48	72.56	75.65	78.74	81.83	84.92		
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		926.35	(44)
(45)m=	125.93	110.14	113.65	99.08	95.07	82.04	76.02	87.24	88.28	102.88	112.3	121.95		
										Γotal = Su	m(45) ₁₁₂ =	=	1214.59	(45)
1			·	,				boxes (46)	, ,		·		l	
(46)m= Water	18.89 storage	16.52	17.05	14.86	14.26	12.31	11.4	13.09	13.24	15.43	16.85	18.29		(46)
	_		includin	na anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr Otherw Water	munity h vise if no storage	eating a stored loss:	ind no ta hot wate	ink in dw er (this ir	velling, e ncludes i	nter 110 nstantar	litres in neous co							` ,
•			eclared l		or is kno	wn (kWł	n/day):					0		(48)
•			m Table									0		(49)
			storage eclared o			or is not		(48) x (49)	=			0		(50)
Hot wa	iter stora	age loss	factor fr	om Tabl								0		(51)
	-	from Ta										0		(52)
Tempe	rature fa	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)
	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				

If cylinder contains	dedicated	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit I	loss (an	nual) fro	m Table	3	-	-	-	-	-		0		(58)
Primary circuit l	loss cal	culated f	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified by	factor fr	rom Tabl	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)	1	Ī	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss cald	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m	_	_	_			
(61)m= 14.01	12.64	13.97	13.49	13.92	13.45	13.88	13.91	13.47	13.95	13.53	14.01		(61)
Total heat requ	ired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 139.94	122.78	127.62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		(62)
Solar DHW input ca	alculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add additional	lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (G)	,			•	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from wa	ter hea					•	•					•	
(64)m= 139.94	122.78	127.62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		_
								out from w				1378.84	(64)
Heat gains from	n water	heating,	kWh/m	onth 0.2		× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m]	
(65)m= 45.37	39.78	41.28	36.32	35.09	30.64	28.75	32.48	32.72	37.7	40.72	44.05		(65)
in <mark>clude</mark> (57)m	n in calc	culation o	of (65)m	only if c	ylinder is	s in the	dwelling	or hot w	ate <mark>r is fr</mark>	om com	munity h	eating	
5. Internal gai	ins (see	Table 5	and 5a										
									_		_	_	
Metabolic gains	s (Table	5), Wat											
Met <mark>abolic</mark> gains Jan	s (Table Feb	5), Wat Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ts		Jun 90.52	Jul - 90.52	Aug 90.52	Sep 90.52	Oct 90.52	Nov 90.52	Dec 90.52	П	(66)
Jan	Feb 90.52	Mar 90.52	ts Apr 90.52	May 90.52	90.52	90.52	90.52	90.52			_		(66)
(66)m= Jan 90.52	Feb 90.52	Mar 90.52	ts Apr 90.52	May 90.52	90.52	90.52	90.52	90.52			_		(66) (67)
Jan (66)m= 90.52 Lighting gains (90.52 (calculated)	Mar 90.52 ted in Ap	Apr 90.52 ppendix 7.69	May 90.52 L, equat 5.75	90.52 ion L9 or 4.86	90.52 r L9a), a 5.25	90.52 Iso see	90.52 Table 5	90.52	90.52	90.52		` ,
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07	90.52 (calculated)	Mar 90.52 ted in Ap	Apr 90.52 ppendix 7.69	May 90.52 L, equat 5.75	90.52 ion L9 or 4.86	90.52 r L9a), a 5.25	90.52 Iso see	90.52 Table 5	90.52	90.52	90.52		` ,
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain	90.52 (calculat 12.5 ns (calc 159.45	90.52 ted in Ap 10.16 ulated in	Apr 90.52 ppendix 7.69 Append 146.54	May 90.52 L, equat 5.75 dix L, eq 135.45	90.52 ion L9 or 4.86 uation L	90.52 r L9a), a 5.25 13 or L1 118.06	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81	90.52 (calculat 12.5 ns (calc 159.45	Mar 90.52 ted in Ap 10.16 ulated in	Apr 90.52 ppendix 7.69 Append 146.54	May 90.52 L, equat 5.75 dix L, eq 135.45	90.52 ion L9 or 4.86 uation L	90.52 r L9a), a 5.25 13 or L1 118.06	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05	Mar 90.52 ted in Ap 10.16 ulated in 155.32 tted in Ap 32.05	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	90.52 ion L9 or 4.86 uation L 125.02 ion L15	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta 120.55	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67) (68)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05	Mar 90.52 ted in Ap 10.16 ulated in 155.32 tted in Ap 32.05	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	90.52 ion L9 or 4.86 uation L 125.02 ion L15	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta 120.55 ee Table	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67) (68)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05 s gains	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a)	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42), also se 32.05	90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05 s gains	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a)	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42), also se 32.05	90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva	reb 90.52 (calculat 12.5 ns (calculat 159.45 (calculat 32.05 as gains 3 aporatio -72.41	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva (71)m= -72.41	reb 90.52 (calculat 12.5 ns (calculat 159.45 (calculat 32.05 as gains 3 aporatio -72.41	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gains ((68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan ((70)m= 3 Losses e.g. eva ((71)m= -72.41 Water heating (reb 90.52 (calculated 12.5) ns (calculated 159.45) (calculated 32.05) s gains 3 aporation -72.41 gains (T	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 Table 5)	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	90.52 13.56 140.43 32.05 3 -72.41	90.52 14.46 150.85 32.05 3 -72.41		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva (71)m= -72.41 Water heating ((72)m= 60.99	reb 90.52 (calculated 12.5) ns (calculated 159.45) (calculated 32.05) s gains 3 aporation -72.41 gains (T	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 Table 5)	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	90.52 13.56 140.43 32.05 3 -72.41	90.52 14.46 150.85 32.05 3 -72.41		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gains ((68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan ((70)m= 3 Losses e.g. eva ((71)m= -72.41 Water heating ((72)m= 60.99 Total internal (90.52 (calcular 12.5) ns (calcular 32.05) s gains 3 aporatio -72.41 gains (T 59.2) gains = 284.3	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 able 5) 55.49	7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41 42.56 (66)	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05 3 -72.41 38.64 m + (67)m	90.52 Iso see 6.82 3a), also 116.42), also se 32.05 3 -72.41 43.66 1 + (68)m -	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41 45.45 + (69)m +	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41 50.67 (70)m + (7	90.52 13.56 140.43 32.05 3 -72.41 56.56 1)m + (72	90.52 14.46 150.85 32.05 3 -72.41 59.21		(67) (68) (69) (70) (71)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva (71)m= -72.41 Water heating ((72)m= 60.99 Total internal ((73)m= 286.02	Feb 90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05 as gains 3 aporatio -72.41 gains (T 59.2 gains = 284.3	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 Table 5) 55.49	7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41 50.44	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab -72.41 47.17	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41 42.56 (66) 225.59	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05 3 -72.41 38.64 m + (67)m 215.1	90.52 Iso see 6.82 3a), also 116.42), also se 32.05 3 -72.41 43.66 1 + (68)m - 220.06	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41 45.45 + (69)m + 228.31	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41 50.67 (70)m + (7	90.52 13.56 140.43 32.05 3 -72.41 56.56 1)m + (72) 263.71	90.52 14.46 150.85 32.05 3 -72.41 59.21	Gains	(67) (68) (69) (70) (71)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

N 4		,		,		,		ı				_
Northeast _{0.9x}	0.77	X	1.81	X	11.28	X	0.3	X	0.7	=	2.97	(75)
Northeast _{0.9x}	0.77	X	1.81	X	22.97	X	0.3	X	0.7	=	6.05	(75)
Northeast _{0.9x}	0.77	X	1.81	X	41.38	X	0.3	X	0.7	=	10.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	67.96	X	0.3	X	0.7	=	17.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.35	X	0.3	X	0.7	=	24.06	(75)
Northeast _{0.9x}	0.77	X	1.81	X	97.38	X	0.3	X	0.7	=	25.65	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.1	X	0.3	X	0.7	=	24	(75)
Northeast _{0.9x}	0.77	X	1.81	X	72.63	X	0.3	X	0.7	=	19.13	(75)
Northeast _{0.9x}	0.77	X	1.81	X	50.42	X	0.3	X	0.7	=	13.28	(75)
Northeast 0.9x	0.77	X	1.81	X	28.07	X	0.3	X	0.7	=	7.39	(75)
Northeast _{0.9x}	0.77	X	1.81	X	14.2	X	0.3	X	0.7	=	3.74	(75)
Northeast _{0.9x}	0.77	X	1.81	X	9.21	X	0.3	X	0.7	=	2.43	(75)
Southeast 0.9x	0.77	X	1.05	X	36.79	X	0.3	X	0.7	=	5.62	(77)
Southeast 0.9x	0.77	X	1.05	X	62.67	x	0.3	X	0.7	=	9.58	(77)
Southeast 0.9x	0.77	X	1.05	X	85.75	x	0.3	X	0.7	=	13.1	(77)
Southeast 0.9x	0.77	X	1.05	X	106.25	x	0.3	x	0.7	=	16.24	(77)
Southeast 0.9x	0.77	X	1.05	X	119.01	x	0.3	x	0.7	=	18.19	(77)
Southeast 0.9x	0.77	x	1.05	X	118.15	Х	0.3	X	0.7	-	18.05	(77)
Southeast 0.9x	0.77	x	1.05	х	113.91] x	0.3	x	0.7	=	17.41	(77)
Southeast _{0.9x}	0.77	x	1.05	x	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast _{0.9x}	0.77	x	1.05	X	92.85	x	0.3	x	0.7	=	14.19	(77)
Southeast _{0.9x}	0.77	x	1.05	X	69.27	Х	0.3	x	0.7	=	10.58	(77)
Southeast _{0.9x}	0.77	x	1.05	X	44.07	X	0.3	x	0.7	=	6.73	(77)
Southeast _{0.9x}	0.77	x	1.05	x	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x}	0.77	X	5.57	X	36.79]	0.3	X	0.7	=	29.83	(79)
Southwest _{0.9x}	0.77	X	5.57	X	62.67		0.3	X	0.7	=	50.8	(79)
Southwest _{0.9x}	0.77	X	5.57	X	85.75]	0.3	x	0.7	=	69.51	(79)
Southwest _{0.9x}	0.77	X	5.57	X	106.25]	0.3	X	0.7	=	86.13	(79)
Southwest _{0.9x}	0.77	X	5.57	X	119.01]	0.3	X	0.7	=	96.47	(79)
Southwest _{0.9x}	0.77	X	5.57	X	118.15]	0.3	x	0.7	=	95.77	(79)
Southwest _{0.9x}	0.77	X	5.57	X	113.91]	0.3	X	0.7	=	92.34	(79)
Southwest _{0.9x}	0.77	X	5.57	X	104.39]	0.3	X	0.7	=	84.62	(79)
Southwest _{0.9x}	0.77	X	5.57	X	92.85]	0.3	x	0.7	=	75.27	(79)
Southwest _{0.9x}	0.77	x	5.57	X	69.27]	0.3	x	0.7	=	56.15	(79)
Southwest _{0.9x}	0.77	X	5.57	X	44.07]	0.3	X	0.7	=	35.72	(79)
Southwest _{0.9x}	0.77	x	5.57	X	31.49]	0.3	x	0.7	=	25.52	(79)
Northwest _{0.9x}	0.77	x	6.09	x	11.28	x	0.3	x	0.7] =	10	(81)
Northwest _{0.9x}	0.77	x	6.09	×	22.97	x	0.3	x	0.7	=	20.35	(81)
Northwest _{0.9x}	0.77	×	6.09	x	41.38	x	0.3	x	0.7	=	36.67	(81)
Northwest _{0.9x}	0.77	x	6.09	X	67.96	x	0.3	x	0.7] =	60.23	(81)
Northwest _{0.9x}	0.77	X	6.09	X	91.35	X	0.3	X	0.7	=	80.96	(81)

Northwest 0.9x 0.77	x	6.09	,	(9	97.38	x		0.3	x	0.7	=	86.31	(81)
Northwest 0.9x 0.77	X	6.09	,	(91.1	x		0.3	x	0.7	=	80.74	(81)
Northwest 0.9x 0.77	х	6.09	,	7	72.63	x		0.3	x	0.7	=	64.37	(81)
Northwest 0.9x 0.77	x	6.09	,	(5	50.42	x		0.3	x [0.7	=	44.69	(81)
Northwest 0.9x 0.77	x	6.09	,	(2	28.07	x		0.3	x [0.7	=	24.88	(81)
Northwest 0.9x 0.77	X	6.09	,	(14.2	x		0.3	x	0.7	=	12.58	(81)
Northwest 0.9x 0.77	x	6.09	,	(9.21	x		0.3	_ x [0.7	=	8.17	(81)
													_
Solar gains in watts, cald	culated f	or each n	nonth		1	(83)m	n = Su	m(74)m .	(82)m		· · · · · · · · · · · · · · · · · · ·		
` '			19.68	225.79	214.48	184	.07	147.42	99	58.78	40.93		(83)
Total gains – internal and	<u>`</u>	<u> </u>	'	. ,	 			-					
(84)m= 334.44 371.08 4	404.31	438.32 4	61.2	451.38	429.58	404	.13	375.73	343.78	322.49	318.6		(84)
7. Mean internal tempe	rature (h	neating se	eason)										
Temperature during he	ating pe	riods in th	ne livin	g area	from Tal	ole 9,	, Th1	(°C)				21	(85)
Utilisation factor for gain	ns for liv	ring area,	h1,m	(see Ta	ble 9a)								
Jan Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.96 0.94	0.9	0.83	0.72	0.56	0.43	0.4	17	0.68	0.86	0.94	0.96		(86)
Mean internal temperat	ure in <mark>liv</mark>	ving area	T1 (fo	llow ste	ps 3 to 7	in T	able	9c)					
(87)m= 19.4 19.61	19.95	20.37 2	0.71	20.91	20.97	20.	96	20.82	20.39	19.83	19.35		(87)
Temperature during he	ating pe	riods in re	est of o	welling	from Ta	able 9	9, Th	2 (°C)					
(88)m= 20.23 20.23	20.23	20.24 2	20.24	20.25	20.25	20.:	25	20.25	20.24	20.24	20.23		(88)
Utilisation factor for gain	ns for re	st of dwe	lling, h	2.m (se	ee Table	9a)							
(89)m= 0.95 0.93	0.89		0.68	0.51	0.36	0.4	4	0.63	0.84	0.93	0.96		(89)
Mean internal temperat	ure in th	e rest of	dwellir	ng T2 (f	ollow ste	ns 3	to 7	in Tabl	e 9c)				
	18.85		19.9	20.16	20.23	20.:		20.06	19.49	18.69	18		(90)
	I_				<u> </u>			f	LA = Livir	ng area ÷ (4	1) =	0.6	(91)
Mean internal temperat	uro (for	the whole	dwell	ina) – f	ΙΛ ν Τ1	± /1	_ fl /	\\					
	19.51		0.38	20.6	20.67	20.		20.51	20.03	19.37	18.81		(92)
Apply adjustment to the													
· · · · · · · · · · · · · · · · · · ·	1		0.23	20.45	20.52	20.		20.36	19.88	19.22	18.66		(93)
8. Space heating requir	ement												
Set Ti to the mean inter				ed at st	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation factor for					<u> </u>		_			1	_		
Jan Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation factor for gain (94)m= 0.94 0.92	0.88	0.8	0.68	0.52	0.39	0.4	12 T	0.63	0.83	0.91	0.95		(94)
Useful gains, hmGm , V				0.52	0.59	0.4	**	0.03	0.03	0.91	0.93		(01)
	``		14.45	236.43	165.77	171	.74	238.44	284.17	294.63	301.14		(95)
Monthly average extern													
(96)m= 4.3 4.9	6.5	i	11.7	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean	interna	l tempera	ture, L	m , W :	=[(39)m	x [(93	3)m–	· (96)m]				
(97)m= 645.85 628.78 5	573.69	483.26 37	75.83	255.09	170.86	178	.78	274.15	408.74	536.18	642.41		(97)
Space heating requiren				/h/mon	th = 0.02	24 x [(97)r	m – (95))m] x (4	1)m			
(98)m= 247.06 194.08	163.16	95.23 4	5.67	0	0	0)	0	92.68	173.92	253.9		

Total per year (kWh/year) = Sum(98) _{15,912} =	1265.71	(98)
Space heating requirement in kWh/m²/year	23.4	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		_
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	1	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$	1	(204)
Efficiency of main space heating system 1	90.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	kWh/ye	ear
Space heating requirement (calculated above) 247.06		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		(211)
272.99 214.46 180.29 105.23 50.46 0 0 0 102.41 192.17 280.55		(211)
Total (kWh/year) =Sum(211) _{15,1012} =	1398.57	(211)
Space heating fuel (secondary), kWh/month		
$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		7(045)
Total (kWh/year) = Sum(215) _{15,1012} =	0	(215)
Water heating Output from water heater (calculated above)		
139.94 122.78 127.62 112.58 109 95.49 89.91 101.15 101.75 116.83 125.84 135.96		
Efficiency of water heater	87.3	(216)
(217)m= 89.32 89.23 89.07 88.74 88.22 87.3 87.3 87.3 87.3 88.69 89.13 89.36		(217)
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$		
(219)m= 156.68 137.59 143.29 126.86 123.55 109.38 102.99 115.86 116.56 131.74 141.19 152.15		
Total = Sum(219a) ₁₁₂ =	1557.83	(219)
Annual totals kWh/year	kWh/yea	<u></u>
Space heating fuel used, main system 1	1398.57	╛
Water heating fuel used	1557.83	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside 148.45		(230a)
central heating pump:		(230c)
boiler with a fan-assisted flue		(230e)
Total electricity for the above, kWh/year sum of (230a)(230g) =	223.45	(231)
Electricity for lighting	248.46	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	3428.31	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP		

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	302.09 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216	336.49 (264)
Space and water heating	(261) + (262) + (263) + (264) =		638.58 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	115.97 (267)
Electricity for lighting	(232) x	0.519 =	128.95 (268)
Total CO2, kg/year	sum	of (265)(271) =	883.51 (272)
Dwelling CO2 Emission Rate	(272	() ÷ (4) =	16.34 (273)
El rating (section 14)			88 (274)



			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Stroma Softwa	re Vei	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Var - TF, L			Address	i Bea v	var - TF				
1. Overall dwelling dimer	nsions:									
			Area	a(m²)		Av. He	ight(m)	7	Volume(m ³	_
Ground floor			5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+((1e)+(1r	1) 5	54.08	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	135.2	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	Ī + [0	Ī = [0	x 2	20 =	0	(6b)
Number of intermittent fan	s				, <u> </u>	0	x -	10 =	0	(7a)
Number of passive vents					Ė	0	x -	10 =	0	(7b)
Number of flueless gas fire	es				F	0	X 4	40 =	0	(7c)
					L					` '
								Air ch	nanges <mark>per</mark> ho	our
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be		nded, procee	d to (17), (otherwise o	ontinue fr	om (9) to ((16)			—
Number of storeys in the Additional infiltration	e dwelling (ns)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2	25 for steel or timbe	er frame or	0.35 fo	r masonr	y constr	uction	1(0)	.,,	0	(11)
if both types of wall are pre		responding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden flo	•	ealed) or 0	1 (seale	ad) else	enter ()				0	(12)
If no draught lobby, enter	,	,	i (ocaic	<i>Ju</i>), 0100	Critor o				0	(13)
Percentage of windows	•								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, o	•		•	•	•	etre of e	nvelope	area	2	(17)
If based on air permeabilit	•					ia haina u	aad		0.1	(18)
Air permeability value applies Number of sides sheltered		nas been don	ie or a deg	gree all pe	пеаышу	is being u	seu		2	(19)
Shelter factor				(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)	x (20) =				0.08	(21)
Infiltration rate modified fo	r monthly wind spe	ed								_
Jan Feb M	Mar Apr Ma	y Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7			•					1	
(22)m= 5.1 5	1.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effective of the Calculate of		•	rate for t	he appli	cable ca	se	-	-	_		-		(220)
If exhaust air h			endix N (2	3h) = (23a	a) x Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0.5	(23a)
If balanced with) - (20 0)			0.5	(23b)
a) If balance		-	-	_					2h\m + ('	23h) v [1 – (23c)	75.65 ± 1001	(23c)
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22]	(24a)
b) If balance	<u> </u>	<u> </u>			heat red	coverv (N	и ЛV) (24b		2b)m + (2	L 23b)		I	
(24b)m = 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h				•	•				.5 × (23b	<u> </u>		ı	
(24c)m = 0	0.5 7	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	ventilatio	n or wh	ole hous	e nositiv	ve input	ventilatio							` '
,					erwise (2				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)					
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
3. Heat losse	s and he	eat loss	paramete	er:								_	
ELEMENT	Gros area	ss	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²-l		X k I/K
Doo <mark>rs</mark>					3.57	х	1	=	3.57				(26)
Win <mark>dows</mark> Type	e 1				1.81	x	1/[1/(1)+	0.04] =	1.74				(27)
Windows Type	2				6.09	x	1/[1/(1)+	0.04] =	5.86				(27)
Windows Type	e 3				1.05	X	1/[1/(1)+	0.04] =	1.01				(27)
Windows Type	4				5.57	X	1/[1/(1)+	0.04] =	5.36				(27)
Walls	62.	5	18.09	9	44.41	x	0.18		7.99	$\overline{}$	14	621.7	4 (29)
Roof	54.0)8	0		54.08	3 x	0.11	<u> </u>	5.95		9	486.7	2 (30)
Total area of e	lements	, m²			116.5	8							(31)
Party wall					19.77	7 X	0	=	0		20	395.4	(32)
Party floor					54.08	3					40	2163.	2 (32a)
Internal wall **					63.3	一				Ì	9	569.7	7 (32c)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)) + (32) =				31.47	(33)
Heat capacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	4236.76	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			78.34	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	<						16.17	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	31)			(00)	(20)				
Total fabric he	at ioss							(33) +	(36) =			47.64	(37)

Ventila	ation hea	at loss ca	alculated	l monthly	у				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	10.27	10.17	10.08	9.6	9.51	9.03	9.03	8.94	9.22	9.51	9.7	9.89		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m=	57.91	57.82	57.72	57.25	57.15	56.68	56.68	56.58	56.87	57.15	57.34	57.53		
Heat Ic	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	57.22	(39)
(40)m=	1.07	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.06	1.06	1.06		
Numbe	er of day	s in moi	nth (Tab	le 1a)				•	,	Average =	Sum(40) ₁	12 /12=	1.06	(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)
Assum if TF	ned occu A > 13.9	ipancy, l 9, N = 1		irement:	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		kWh/ye	ear:	(42)
Annua <i>Redu<mark>ce</mark></i>	the annua	e hot wa al average	hot water	ge in litre usage by : day (all w	5% if the a	lwelling is	designed			se target o		7.2		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water				ach month					ООР	001	1404			
(44)m=	84.92	81.83	78.74	75.65	72.56	69.48	69.48	72.56	75.65	78.74	81.83	84.92		
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		926.35	(44)
(45)m=	125.93	110.14	113.65	99.08	95.07	82.04	76.02	87.24	88.28	102.88	112.3	121.95		
If instant	taneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1214.59	(45)
(46)m=	18.89	16.52	17.05	14.86	14.26	12.31	11.4	13.09	13.24	15.43	16.85	18.29		(46)
	storage													
If comr Otherw Water	munity h vise if no storage	eating a stored loss:	ind no ta hot wate	ng any so nk in dw er (this in	velling, e ncludes i	nter 110 nstantar	litres in	(47)				0		(47)
•				oss facto	or is kno	wn (kVVr	n/day):					0		(48)
•			m Table									0		(49)
• • • • • • • • • • • • • • • • • • • •			-	, kWh/ye cylinder l		or is not		(48) x (49)) =			0		(50)
Hot wa	ater stora	age loss		om Tabl								0		(51)
	e factor	_										0		(52)
Tempe	erature fa	actor fro	m Table	2b								0		(53)
• • • • • • • • • • • • • • • • • • • •			_	, 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 f	or each	month			((56)m = (55) × (41)	m				

If cylinder contains	dedicated	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit I	loss (an	nual) fro	m Table	3	-	-	-	-	-		0		(58)
Primary circuit l	loss cal	culated f	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified by	factor fr	rom Tabl	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)	1	Ī	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss cald	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m	_	_	_			
(61)m= 14.01	12.64	13.97	13.49	13.92	13.45	13.88	13.91	13.47	13.95	13.53	14.01		(61)
Total heat requ	ired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 139.94	122.78	127.62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		(62)
Solar DHW input ca	alculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add additional	lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (G)	,			•	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from wa	ter hea					•	•					•	
(64)m= 139.94	122.78	127.62	112.58	109	95.49	89.91	101.15	101.75	116.83	125.84	135.96		_
								out from w				1378.84	(64)
Heat gains from	n water	heating,	kWh/m	onth 0.2		× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m]	
(65)m= 45.37	39.78	41.28	36.32	35.09	30.64	28.75	32.48	32.72	37.7	40.72	44.05		(65)
in <mark>clude</mark> (57)m	n in calc	culation o	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ate <mark>r is fr</mark>	om com	munity h	eating	
5. Internal gai	ins (see	Table 5	and 5a										
									_		_	_	
Metabolic gains	s (Table	5), Wat											
Met <mark>abolic</mark> gains Jan	s (Table Feb	5), Wat Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ts		Jun 90.52	Jul - 90.52	Aug 90.52	Sep 90.52	Oct 90.52	Nov 90.52	Dec 90.52	П	(66)
Jan	Feb 90.52	Mar 90.52	ts Apr 90.52	May 90.52	90.52	90.52	90.52	90.52			_		(66)
(66)m= Jan 90.52	Feb 90.52	Mar 90.52	ts Apr 90.52	May 90.52	90.52	90.52	90.52	90.52			_		(66) (67)
Jan (66)m= 90.52 Lighting gains (90.52 (calculated)	Mar 90.52 ted in Ap	Apr 90.52 ppendix 7.69	May 90.52 L, equat 5.75	90.52 ion L9 or 4.86	90.52 r L9a), a 5.25	90.52 Iso see	90.52 Table 5	90.52	90.52	90.52		` ,
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07	90.52 (calculated)	Mar 90.52 ted in Ap	Apr 90.52 ppendix 7.69	May 90.52 L, equat 5.75	90.52 ion L9 or 4.86	90.52 r L9a), a 5.25	90.52 Iso see	90.52 Table 5	90.52	90.52	90.52		` ,
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain	90.52 (calculat 12.5 ns (calc 159.45	Mar 90.52 ted in Ap 10.16 ulated in	Apr 90.52 ppendix 7.69 Append 146.54	May 90.52 L, equat 5.75 dix L, eq 135.45	90.52 ion L9 or 4.86 uation L	90.52 r L9a), a 5.25 13 or L1 118.06	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81	90.52 (calculat 12.5 ns (calc 159.45	Mar 90.52 ted in Ap 10.16 ulated in	Apr 90.52 ppendix 7.69 Append 146.54	May 90.52 L, equat 5.75 dix L, eq 135.45	90.52 ion L9 or 4.86 uation L	90.52 r L9a), a 5.25 13 or L1 118.06	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05	Mar 90.52 ted in Ap 10.16 ulated in 155.32 tted in Ap 32.05	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	90.52 ion L9 or 4.86 uation L 125.02 ion L15	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta 120.55 ee Table	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67) (68)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05	Mar 90.52 ted in Ap 10.16 ulated in 155.32 tted in Ap 32.05	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	90.52 ion L9 or 4.86 uation L 125.02 ion L15	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	90.52 Iso see 6.82 3a), also 116.42	90.52 Table 5 9.15 see Ta 120.55 ee Table	9 <mark>0.52</mark> 11.62 ble 5 129.34	90.52	90.52		(67) (68)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05 s gains	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a)	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42), also se 32.05	90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3	90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05 s gains	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a)	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42), also se 32.05	90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva	reb 90.52 (calculat 12.5 ns (calculat 159.45 (calculat 32.05 as gains 3 aporatio -72.41	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva (71)m= -72.41	reb 90.52 (calculat 12.5 ns (calculat 159.45 (calculat 32.05 as gains 3 aporatio -72.41	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 3	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05	90.52 11.62 ble 5 129.34 5 32.05	90.52 13.56 140.43 32.05	90.52 14.46 150.85 32.05		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gains ((68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan ((70)m= 3 Losses e.g. eva ((71)m= -72.41 Water heating (reb 90.52 (calculated 12.5) ns (calculated 159.45) (calculated 32.05) s gains 3 aporation -72.41 gains (T	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 Table 5)	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	90.52 13.56 140.43 32.05 3 -72.41	90.52 14.46 150.85 32.05 3 -72.41		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva (71)m= -72.41 Water heating ((72)m= 60.99	reb 90.52 (calculated 12.5) ns (calculated 159.45) (calculated 32.05) s gains 3 aporation -72.41 gains (T	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 Table 5)	ppendix 7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	90.52 Iso see 6.82 3a), also 116.42 , also se 32.05	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41	90.52 13.56 140.43 32.05 3 -72.41	90.52 14.46 150.85 32.05 3 -72.41		(67) (68) (69) (70)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gains ((68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan ((70)m= 3 Losses e.g. eva ((71)m= -72.41 Water heating ((72)m= 60.99 Total internal (90.52 (calcular 12.5) ns (calcular 32.05) s gains 3 aporatio -72.41 gains (T 59.2) gains = 284.3	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 able 5) 55.49	7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41 42.56 (66)	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05 3 -72.41 38.64 m + (67)m	90.52 Iso see 6.82 3a), also 116.42), also se 32.05 3 -72.41 43.66 1 + (68)m -	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41 45.45 + (69)m +	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41 50.67 (70)m + (7	90.52 13.56 140.43 32.05 3 -72.41 56.56 1)m + (72	90.52 14.46 150.85 32.05 3 -72.41 59.21		(67) (68) (69) (70) (71)
Jan (66)m= 90.52 Lighting gains ((67)m= 14.07 Appliances gain (68)m= 157.81 Cooking gains ((69)m= 32.05 Pumps and fan (70)m= 3 Losses e.g. eva (71)m= -72.41 Water heating ((72)m= 60.99 Total internal ((73)m= 286.02	Feb 90.52 (calcular 12.5 ns (calcular 159.45 (calcular 32.05 as gains 3 aporatio -72.41 gains (T 59.2 gains = 284.3	Mar 90.52 ted in Ap 10.16 ulated in 155.32 ted in Ap 32.05 (Table 5 3 on (negat -72.41 Table 5) 55.49	7.69 Appendix 7.69 Appendix 32.05 5a) 3 tive valu -72.41 50.44	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 3 es) (Tab -72.41 47.17	90.52 ion L9 or 4.86 uation L 125.02 ion L15 32.05 3 lle 5) -72.41 42.56 (66) 225.59	90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05 3 -72.41 38.64 m + (67)m 215.1	90.52 Iso see 6.82 3a), also 116.42), also se 32.05 3 -72.41 43.66 1 + (68)m - 220.06	90.52 Table 5 9.15 See Ta 120.55 See Table 32.05 3 -72.41 45.45 + (69)m + 228.31	90.52 11.62 ble 5 129.34 5 32.05 3 -72.41 50.67 (70)m + (7	90.52 13.56 140.43 32.05 3 -72.41 56.56 1)m + (72) 263.71	90.52 14.46 150.85 32.05 3 -72.41 59.21	Gains	(67) (68) (69) (70) (71)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

N 4		,		,		,		ı				_
Northeast _{0.9x}	0.77	X	1.81	X	11.28	X	0.3	X	0.7	=	2.97	(75)
Northeast _{0.9x}	0.77	X	1.81	X	22.97	X	0.3	X	0.7	=	6.05	(75)
Northeast _{0.9x}	0.77	X	1.81	X	41.38	X	0.3	X	0.7	=	10.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	67.96	X	0.3	X	0.7	=	17.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.35	X	0.3	X	0.7	=	24.06	(75)
Northeast _{0.9x}	0.77	X	1.81	X	97.38	X	0.3	X	0.7	=	25.65	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.1	x	0.3	X	0.7	=	24	(75)
Northeast _{0.9x}	0.77	X	1.81	X	72.63	X	0.3	X	0.7	=	19.13	(75)
Northeast _{0.9x}	0.77	X	1.81	X	50.42	X	0.3	X	0.7	=	13.28	(75)
Northeast 0.9x	0.77	X	1.81	X	28.07	X	0.3	X	0.7	=	7.39	(75)
Northeast _{0.9x}	0.77	X	1.81	X	14.2	X	0.3	X	0.7	=	3.74	(75)
Northeast _{0.9x}	0.77	X	1.81	X	9.21	X	0.3	X	0.7	=	2.43	(75)
Southeast 0.9x	0.77	X	1.05	X	36.79	X	0.3	X	0.7	=	5.62	(77)
Southeast 0.9x	0.77	X	1.05	X	62.67	x	0.3	X	0.7	=	9.58	(77)
Southeast 0.9x	0.77	X	1.05	X	85.75	x	0.3	X	0.7	=	13.1	(77)
Southeast 0.9x	0.77	X	1.05	X	106.25	x	0.3	X	0.7	=	16.24	(77)
Southeast 0.9x	0.77	X	1.05	X	119.01	x	0.3	x	0.7	=	18.19	(77)
Southeast 0.9x	0.77	x	1.05	X	118.15	Х	0.3	X	0.7	-	18.05	(77)
Southeast 0.9x	0.77	x	1.05	х	113.91] x	0.3	x	0.7	=	17.41	(77)
Southeast _{0.9x}	0.77	x	1.05	x	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast _{0.9x}	0.77	x	1.05	X	92.85	x	0.3	x	0.7	=	14.19	(77)
Southeast _{0.9x}	0.77	x	1.05	X	69.27	Х	0.3	x	0.7	=	10.58	(77)
Southeast _{0.9x}	0.77	x	1.05	X	44.07	X	0.3	x	0.7	=	6.73	(77)
Southeast _{0.9x}	0.77	x	1.05	x	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x}	0.77	X	5.57	X	36.79]	0.3	X	0.7	=	29.83	(79)
Southwest _{0.9x}	0.77	X	5.57	X	62.67		0.3	X	0.7	=	50.8	(79)
Southwest _{0.9x}	0.77	X	5.57	X	85.75]	0.3	x	0.7	=	69.51	(79)
Southwest _{0.9x}	0.77	X	5.57	X	106.25]	0.3	X	0.7	=	86.13	(79)
Southwest _{0.9x}	0.77	X	5.57	X	119.01]	0.3	X	0.7	=	96.47	(79)
Southwest _{0.9x}	0.77	X	5.57	X	118.15]	0.3	x	0.7	=	95.77	(79)
Southwest _{0.9x}	0.77	X	5.57	X	113.91]	0.3	X	0.7	=	92.34	(79)
Southwest _{0.9x}	0.77	X	5.57	X	104.39]	0.3	X	0.7	=	84.62	(79)
Southwest _{0.9x}	0.77	X	5.57	X	92.85]	0.3	x	0.7	=	75.27	(79)
Southwest _{0.9x}	0.77	x	5.57	X	69.27]	0.3	x	0.7	=	56.15	(79)
Southwest _{0.9x}	0.77	X	5.57	X	44.07]	0.3	X	0.7	=	35.72	(79)
Southwest _{0.9x}	0.77	x	5.57	X	31.49]	0.3	x	0.7	=	25.52	(79)
Northwest _{0.9x}	0.77	x	6.09	x	11.28	x	0.3	x	0.7] =	10	(81)
Northwest _{0.9x}	0.77	x	6.09	×	22.97	x	0.3	x	0.7	=	20.35	(81)
Northwest _{0.9x}	0.77	×	6.09	x	41.38	x	0.3	x	0.7	=	36.67	(81)
Northwest _{0.9x}	0.77	x	6.09	X	67.96	x	0.3	x	0.7] =	60.23	(81)
Northwest _{0.9x}	0.77	X	6.09	X	91.35	X	0.3	X	0.7	=	80.96	(81)

Northwest _{0.9x}	0.77	x	6.0	9	X S	97.38	_ x [0.3	X	0.7	=	86.31	(81)
Northwest 0.9x	0.77	X	6.0	9	X	91.1	_ x [0.3	x	0.7	=	80.74	(81)
Northwest 0.9x	0.77	X	6.0	9	X	72.63] x [0.3	x	0.7	=	64.37	(81)
Northwest 0.9x	0.77	x	6.0	9	x .	50.42	_ x [0.3	x	0.7	=	44.69	(81)
Northwest 0.9x	0.77	X	6.0	9	x Z	28.07] x [0.3	x	0.7	=	24.88	(81)
Northwest _{0.9x}	0.77	x	6.0	9	x	14.2	x		0.3	_ x _	0.7		12.58	(81)
Northwest 0.9x	0.77	х	6.0	9	х	9.21	j × į		0.3	_ x [0.7	=	8.17	(81)
•		<u>_</u>					-							
Solar gains in	watts, ca	alculated	for eacl	n month			(83)m	= Su	m(74)m .	(82)m				
(83)m= 48.42	86.78	130.19	180.49	219.68	225.79	214.48	184.	07	147.42	99	58.78	40.93		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m	+ (83)m	, watts								
(84)m= 334.44	371.08	404.31	438.32	461.2	451.38	429.58	404.	13	375.73	343.78	322.49	318.6		(84)
7. Mean inter	nal temp	erature	(heating	season)									
Temperature	•		`		,	from Tal	ole 9,	Th1	(°C)				21	(85)
Utilisation fac	_				_				` ,					
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	Jg T	Sep	Oct	Nov	Dec		
(86)m= 0.94	0.93	0.9	0.84	0.75	0.62	0.5	0.5	- +	0.72	0.86	0.93	0.95		(86)
Mean interna	tompor	oturo in	living or	22 T1 /f/	llow etc	one 2 to -	l 7 in T	ablo	. 00\					
(87)m= 18.45	18.7	19.14	19.72	20.27	20.68	20.87	20.8		20.52	19.83	19.04	18.39		(87)
									\	10.00	10.01	10.00		(-)
Temperature								$\overline{}$	` '	00.04	T 00.00	00.00		(00)
(88)m= 20.02	20.03	20.03	20.03	20.04	20.04	20.04	20.0)4	20.04	20.04	20.03	20.03		(88)
Utilisation fac	ctor for g	ains for I	rest of d	welling,	h2,m (s	ee Table						1		
(89)m= 0.94	0.92	0.89	0.82	0.71	0.56	0.41	0.4	5	0.67	0.84	0.92	0.94		(89)
Mean interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3	to 7	in Tabl	e 9 <mark>c)</mark>				
(90)m= 16.6	16.96	17.59	18.43	19.19	19.73	19.94	19.9	91	19.53	18.59	17.46	16.52		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.6	(91)
Mean interna	ıl temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 -	– fL/	A) × T2					
(92)m= 17.7	18	18.52	19.2	19.83	20.3	20.49	20.4		20.12	19.33	18.4	17.63		(92)
Apply adjustr	nent to the	he mean	internal	temper	ature fro	m Table	4e, v	wher	re appro	priate	1			
(93)m= 17.55	17.85	18.37	19.05	19.68	20.15	20.34	20.3	31	19.97	19.18	18.25	17.48		(93)
8. Space hea	ating requ	uirement												
Set Ti to the					ed at st	ep 11 of	Table	e 9b	, so tha	t Ti,m=(76)m an	d re-cald	culate	
the utilisation	1					1		_	_	_		Ι	Ī	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisation fac	,			0.7	0.57	0.44	I 0.4	<u>.</u> Т	0.00	0.00	1 0 00	0.00		(94)
(94)m= 0.91	0.89	0.86	0.79	0.7	0.57	0.44	0.4	8	0.66	0.82	0.89	0.92		(94)
Useful gains, (95)m= 305.99		346.75	348.36	322.72	257.28	190.15	194.	01	248.52	280.37	287.38	293.8		(95)
Monthly aver						190.13	194.	01	240.02	200.37	207.30	293.0		(00)
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	L				l	Į					I	L	1	V 7
(97)m= 767.27	748.49	684.91	581.2	456.29	314.3	212.13	221.		333.8	490.2	639.38	764.19		(97)
Space heating					ı Wh/mon	<u> </u>					<u> </u>	I	ı	
(98)m= 343.19	280.2	251.59	167.65	99.38	0	0	0	Ť	0	156.11	253.44	349.97		
						-							1	

Total per year (kWh/year) = Sum(98) _{15,9}	12 = 1901.52	(98)
Space heating requirement in kWh/m²/year	35.16	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		7(204)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) =	0	(201)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$	1	(202)
Efficiency of main space heating system 1	90.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
	ec kWh/yea	」` ′
Space heating requirement (calculated above)	<u>so</u> kww.,,yss	۵۱
343.19 280.2 251.59 167.65 99.38 0 0 0 0 156.11 253.44 349	.97	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)		(211)
379.22 309.61 278 185.24 109.81 0 0 0 172.5 280.04 386		-
Total (kWh/year) =Sum(211) _{15,1012} =	2101.12	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)]} x 100 ÷ (208)		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	,	
Total (kWh/year) = Sum(215) _{15,1012} =	0	(215)
Water heating		
Output from water heater (calculated above) 139.94 122.78 127.62 112.58 109 95.49 89.91 101.15 101.75 116.83 125.84 135	.96	
Efficiency of water heater	87.3	(216)
(217)m= 89.55 89.5 89.4 89.19 88.8 87.3 87.3 87.3 87.3 89.1 89.41 89.	58	(217)
Fuel for water heating, kWh/month		
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 156.27 137.18 142.76 126.23 122.75 109.38 102.99 115.86 116.56 131.12 140.74 151 $.77	
Total = Sum(219a) ₁₁₂ =	1553.6	(219)
Annual totals kWh/year	kWh/year	-
Space heating fuel used, main system 1	2101.12	
Water heating fuel used	1553.6	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside 148	.45	(230a)
central heating pump:	0	(230c)
boiler with a fan-assisted flue	5	(230e)
Total electricity for the above, kWh/year sum of (230a)(230g) =	223.45	(231)
Electricity for lighting	248.46	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	4126.64	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP		

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	453.84 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	335.58 (264)
Space and water heating	(261) + (262) + (263) + (264) =		789.42 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	115.97 (267)
Electricity for lighting	(232) x	0.519	128.95 (268)
Total CO2, kg/year	sum	n of (265)(271) =	1034.34 (272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	19.13 (273)
El rating (section 14)			86 (274)



				User D	etails:						
Assessor Name: Software Name:	Stroma F	SAP 201			Strom Softwa	are Vei	rsion:		Versio	on: 1.0.5.41	
	0.0-1.5	5 1		roperty.	Address	2 Bed -	·EF				
Address: 1. Overall dwelling dime	2 Bed - E	F, London	, IBC								
1. Overall dwelling diffic	FIISIUIIS.			Δros	a(m²)		Av. He	iaht(m)		Volume(m³	١.
Ground floor						(1a) x		2.5	(2a) =	167.63) (3:
Γotal floor area TFA = (1	3)+(1b)+(1c	١ــ(١٨)ــ(١٥	ر1ء مايد (1ء	,		(4)](3/	107.00	``
•	a)+(1b)+(10))+(10)+(10	<i>i)</i> + (11	')	57.05) . (2-) . (2-l	1) . (2-) .	(0-1)		_
Owelling volume						(3a)+(3b))+(3c)+(3d	1)+(3e)+	.(3n) =	167.63	(5)
2. Ventilation rate:	main	6.	econdaı	**/	other		total			m³ per hou	-
	heatin		neating	у	outer	- <u>-</u>	lolai			per nou	' —
Number of chimneys	0	+	0	_ +	0] = [0	X 4	40 =	0	(6
Number of open flues	0	+	0] + [0] = [0	x 2	20 =	0	(61
Number of intermittent fa	ans					Γ	0	x '	10 =	0	(7
Number of passive vents	3					Ī	0	x -	10 =	0	(71
Number of flueless gas f	ires					F	0	X 4	40 =	0	(70
						L					`
									Air ch	nanges <mark>per</mark> ho	ur
nfilt <mark>ration</mark> due to chi <mark>mne</mark>	ys, flues and	d fans = (6	a)+(6b)+(7	7a)+(7b)+(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has I			ed, procee	d to (17),	otherwise o	ontinue fr	om (9) to ((16)			_
Number of storeys in t Additional infiltration	he dwelling ((ns)						r(0)	47.04	0	(9)
Structural infiltration: () 25 for steel	or timber	frame or	0.35 fo	r masoni	v constr	ruction	[(9)	-1]x0.1 =	0	(1)
if both types of wall are p						•	uction			0	('
deducting areas of open	• .								,		_
If suspended wooden		•	led) or 0	.1 (seale	ed), else	enter 0				0	(1:
If no draught lobby, er	•		rinned							0	= (1: - (1:
Percentage of window Window infiltration	's and doors	uraugni si	прреа		0.25 - [0.2	x (14) ÷ 1	001 =			0	(1:
Infiltration rate					(8) + (10)	. ,	•	+ (15) =		0	= \(\)
Air permeability value,	, q50, expres	sed in cub	oic metre	es per ho					area	2	= \(\)
f based on air permeabi				•		•		•		0.1) (1)
Air permeability value applie	es if a pressuris	ation test ha	s been dor	ne or a de	gree air pe	rmeability	is being us	sed	!		
Number of sides shelter	ed				(20) 4	0.075 /4	10)1			2	(1
Shelter factor	tina abalta: 1	ooto-			(20) = 1 -	`	19)] =			0.85	(2)
nfiltration rate incorpora	•		J		(21) = (18	x (20) =				0.08	(2
nfiltration rate modified		- 	i	11	۸۰۰۰	Son	Oct	Nov	Doo]	
Jan Feb	Mar Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	<u> </u>		20	20	27		4.2	1 5	17	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	0.92	1	1.08	1.12	1.18]	

0.11	ation rat	te (allowi	ing for sh	nelter an	d wind s	speed) = 0.08	(21a) x	(22a)m 0.08	1 0 00	l 0.1	0.1		
Calculate effe	i -				1		0.08	0.08	0.09	0.1	0.1		
If mechanica		_										0.5	(2:
If exhaust air he	eat pump	using App	endix N, (2	23b) = (23a	a) × Fmv (e	equation (l	N5)) , othe	rwise (23b) = (23a)			0.5	(2:
If balanced with	n heat reco	overy: effic	ciency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				75.65	(2:
a) If balance	d mech	anical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2)	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (I	MV) (24b	m = (22)	2b)m + (23b)			
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h if (22b)n			ntilation of then (24)	•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n			nole hous)m = (22t	•	•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losse	s and he	eat loss	paramet	er:							_	_	-
ELEMENT	Gros area	ss	Openin m	igs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-ł		A X k kJ/K
Doo <mark>rs</mark>					3.57	X	1	=	3.57				(2
Vin <mark>dows</mark> Type) 1				1.81	x	1/[1/(1)+	0.04] =	1.74				(2
Windows Type	2				2.1	x	1/[1/(1)+	0.04] =	2.02				(2
Vindows Type	3				1.05	X	1/[1/(1)+	0.04] =	1.01				(2
Vindows Type) 4				7.35	X	1/[1/(1)+	0.04] =	7.07				(2
loor					24.59) x	0.13	=	3.1967		75	184	4.25 (2
Valls	58.8	31	15.88	8	42.93	3 x	0.18	<u> </u>	7.73		14	601	.02 (2
Total area of e	lements	, m²			83.4								(3
Party wall					50.53	3 x	0		0		20	101	0.6 (3
Party floor					42.46	5					40	169	98.4 (3
Party ceiling					67.05	<u> </u>					30	201	1.5 (3
nternal wall **					87.34	4					9	786.	0599 (3
for windows and it include the area					alue calcui		g formula 1	/[(1/U-valu	ıe)+0.04] a	ı as given ir	n paragraph		,
abric heat los	ss, W/K	= S (A x	(U)				(26)(30) + (32) =				26.33	(3
leat capacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a)	(32e) =	7951.83	(3
hormal macc	parame	eter (TMI	P = Cm -	÷ TFA) ir	n kJ/m²K			= (34)	÷ (4) =			118.6	(3
Heimai mass													
For design assess an be used inste				construct	ion are no	t known pi	ecisely the	e indicative	e values of	TMP in T	able 1f		
or design assess	ad of a de	tailed calc	culation.			•	recisely the	e indicative	e values of	TMP in T	able 1f	15.91	(3

Ventilation heat loss calculated monthly	Total fabric he	at loss							(33) +	(36) =		ſ	40.04	(37)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec			alculated	d monthly	V					, ,	25)m x (5)	L	42.24	(37)
12,73 12,61 12,48 11,81 11,79 11,2 11,08 11,44 11,79 12,02 12,26 (38)		1		· ·		Jun	Jul	Aua	` ,					
Salign S								Ť						(38)
Salign S	Heat transfer of	coefficie	nt. W/K	<u>l</u>	l .		<u>!</u>	!	(39)m	= (37) + (37)				
Heat loss parameter (HLP), W/m²K (40)m= 0.82 0.82 0.82 0.81 0.81 0.81 0.8 0.8 0.8 0.8			<u> </u>	54.15	54.03	53.44	53.44	53.32				54.5		
Available Color		Į	Į	Į	ļ		Į		,	Average =	Sum(39) _{1.}	12 /12=	54.12	(39)
Average = Sum(40) 12 2 0.81 (40)		meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)	i		
Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(40)m= 0.82	0.82	0.82	0.81	0.81	0.8	0.8	0.8						_
### A. Water heating energy requirement: ### Assumed occupancy, N If TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) If TFA £ 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) If TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the divelling is designed to achieve a water use target or not more that 125 litres per person per day (all water usa, not and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) ### Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) ### Total = Sum(44) = 1029.54 (44) ### Total = Sum(44) = 1029.54 (44) ### Total = Sum(44) = 1029.54 (45) ### Instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) ### Instantaneous water heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): ### One of the properties o	Number of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	0.81	(40)
4. Water heating energy requirement: Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd.average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per pelson per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) (44)m= 94.37 90.94 97.51 84 98 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day [all water usa, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = rector from Table 1c x (43) (44)m = 84.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44) = 100.94 Total = Sum(44) = 100.94 Total = Sum(44) = 100.94 Is 39.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) = 1349.89	(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water usa, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) (44)m = 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44) = 102.54 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd.m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m = 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) = 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m = 20.99 18.36 18.95 16.52 15.85 13.88 12.67 14.54 14.72 17.15 18.72 20.33 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)		ı	ı	ı			ı							
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water usa, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) (44)m = 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44) = 102.54 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd.m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m = 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) = 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m = 20.99 18.36 18.95 16.52 15.85 13.88 12.67 14.54 14.72 17.15 18.72 20.33 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)	4 Water heat	ting ene	rav reau	irement								kWh/ve	ar.	
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) (44)m = 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44)	n water near	ang ono	.gy 10qu											
if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWt/month (see Tables 1b, 1c, 1d) (45)m= 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45)s 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99 18.36 18.95 16.52 15.85 13.68 12.67 14.54 14.72 17.15 18.72 20.33 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)				· [4 _ a.u.n	(0 0000	140 v /TI	-^ 400	\0\1 · 0 (0040 v /	FFA 40		17		(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per described in the second month Vd,m = factor from Table 1c x (43) (44)m= 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99 18.36 18.95 16.52 15.85 13.68 12.67 14.54 14.72 17.15 18.72 20.33 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)			+ 1.76 X	[1 - ехр	(-0.0003	649 X (11	-A -13.9)2)] + 0.0)013 X (IFA - 13.	9)			
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		,	ater usa	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		85	5.8		(43)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec						_	-	to achieve	a water us	se target o	f			
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m = 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44) _{1.12} = 1029.54 (44) (45)m = 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) _{1.12} = 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m = 20.99 18.36 18.95 16.52 15.85 13.68 12.67 14.54 14.72 17.15 18.72 20.33 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3	not more that 125	litres per	person per	r day (all w	ater use, I	not and co	la)							
(44)m= 94.37 90.94 87.51 84.08 80.65 77.22 77.22 80.65 84.08 87.51 90.94 94.37 Total = Sum(44) = 1029.54 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) = 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99 18.36 18.95 16.52 15.85 13.68 12.67 14.54 14.72 17.15 18.72 20.33 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)				<u> </u>					Sep	Oct	Nov	Dec		
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x mm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) ₁₋₁₂ = 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99 18.36 18.95 16.52 15.85 13.68 12.67 14.54 14.72 17.15 18.72 20.33 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3			day for ea			ctor from	able 1c x	(43)						
Energy content of hot water used - calculated monthly = 4.190 x Vd.m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 139.96 122.41 126.31 110.12 105.66 91.18 84.49 96.96 98.11 114.34 124.81 135.54 Total = Sum(45) ₁₁₂ = 1349.89 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99 18.36 18.95 16.52 15.85 13.68 12.67 14.54 14.72 17.15 18.72 20.33 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3	(44)m= 94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65						–
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99	Energy content of	hot water	used - cal	culated me	onthly = 4 .	190 x Vd,r	n x nm x L	OTm / 3600			. ,	L	1029.54	(44)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 20.99	(45)m= 139.96	122.41	126.31	110.12	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		
(46)m=20.9918.3618.9516.5215.8513.6812.6714.5414.7217.1518.7220.33Water storage loss:Storage volume (litres) including any solar or WWHRS storage within same vessel0(47)If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day):0(48)Temperature factor from Table 2b0(49)Energy lost from water storage, kWh/year(48) x (49) =0(50)b) If manufacturer's declared cylinder loss factor is not known:Hot water storage loss factor from Table 2 (kWh/litre/day)0(51)If community heating see section 4.3		<u>!</u>	!	!	!	<u> </u>	!			Γotal = Su	m(45) ₁₁₂ =	=	1349.89	(45)
Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating see section 4.3	If instantaneous w	/ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)) to (61)					
Storage volume (litres) including any solar or WWHRS storage within same vessel If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) o (50) If community heating see section 4.3		1	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) o (50) (51) If community heating see section 4.3	•				. 1	/\/\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		101.1		1				
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) o (51) If community heating see section 4.3	•	, ,		•			•		ame ves	sei		0		(47)
Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating see section 4.3	-	_			•			, ,	oro) onto	or 'O' in (47)			
a) If manufacturer's declared loss factor is known (kWh/day): Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating see section 4.3			not wate	ei (tilis ii	iciudes i	nstantai	ieous co	יווטט וטוווע	ers) erite	#I U III (47)			
Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) o (50) (51) If community heating see section 4.3	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3	,					,	• ,							
b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating see section 4.3	•				ear			(48) x (49)	· =					
If community heating see section 4.3			_	-		or is not	known:					<u> </u>		()
		-			e 2 (kWl	h/litre/da	ay)					0		(51)
Volume factor from Table 2a (52)	•	•		on 4.3										
Tomporature factor from Table 2b				2h										
Temperature factor from Table 2b 0 (53)												0		, ,
Energy lost from water storage, kWh/year $ (47) \times (51) \times (52) \times (53) = 0 $ $ (54)$ $ (57) \times (50) \times (54) = 0 $	= -		_	, kWh/ye	ear			(47) x (51)	x (52) x (53) =				
Enter (50) or (54) in (55) 0 (55)	Enter (50) of ((54) III (5)))									U		(55)

Water storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (an	nual) fro	m Table	3							0		(58)
Primary circuit	loss cal	culated t	for each	month (59)m = ((58) ÷ 36	65 × (41)	m				'	
(modified by	factor fi	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) ÷ 36	65 × (41)m						
(61)m= 14.07	12.69	14.02	13.54	13.96	13.48	13.91	13.94	13.51	14	13.59	14.06		(61)
Total heat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 154.03	135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	on to wate	er heating)		
(add additiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter	-		-	-	-	-			-		
(64)m= 154.03	135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		
						•	Outp	out from wa	ater heate	r (annual) ₁	12	1514.67	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.2	5 [0.85	× (45)m	+ (61)n	1] + 0.8 x	c [(46)m	+ (57)m	+ (59)m]	
(65)m= 50.05	43.87	45.5	40	38.62	33.69				44.50				(65)
		.0.0	70	30.02	33.09	31.57	35.72	36	41.52	44.9	48.58		(00)
in <mark>clude</mark> (57)	_				_						<u> </u>	eating	(00)
include (57) 5. Internal ga	m in calc	culation o	of (65)m	only if c	_						<u> </u>	eating	(00)
5. Internal ga	m in calc	culation of Table 5	of (65)m and 5a	only if c	_						<u> </u>	eating	(00)
	m in calc	culation of Table 5	of (65)m and 5a	only if c	_						<u> </u>	eating	(00)
5. Internal ga	m in calc ains (see as (Table	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	(66)
5. Internal games Metabolic gain Jan	m in calc ains (see as (Table Feb 108.62	Table 5 5), Wat Mar	of (65)m 5 and 5a ts Apr 108.62	only if constant of the consta	Jun 108.62	Jul 108.62	Aug 108.62	Sep	ater is fr	om com	munity h	eating	
5. Internal games Metabolic gain Jan (66)m= 108.62	m in calc ains (see as (Table Feb 108.62	Table 5 5), Wat Mar	of (65)m 5 and 5a ts Apr 108.62	only if constant of the consta	Jun 108.62	Jul 108.62	Aug 108.62	Sep	ater is fr	om com	munity h	eating	
5. Internal gammetabolic gain Jan (66)m= 108.62 Lighting gains	m in calcularing (Table Feb 108.62 (Calcular 15.07	Table 5 5), Wat Mar 108.62 ted in Ap	of (65)m 5 and 5a ts Apr 108.62 opendix 9.28	May 108.62 L, equati	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5	Oct 108.62	Nov	Dec 108.62	eating	(66)
5. Internal games Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97	m in calcularing (Table Feb 108.62 (Calcular 15.07	Table 5 5), Wat Mar 108.62 ted in Ap	of (65)m 5 and 5a ts Apr 108.62 opendix 9.28	May 108.62 L, equati	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5	Oct 108.62	Nov	Dec 108.62	eating	(66)
5. Internal gam Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances gam	m in calcains (see Feb 108.62 (calculations (calculations (calculations 192.29	Table 5 Table	of (65)m 5 and 5a ts Apr 108.62 opendix 9.28 Appendix 176.72	May 108.62 L, equati 6.94 dix L, eq	Jun 108.62 ion L9 of 5.86 uation L	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta	Oct 108.62 14.02 ble 5	Nov 108.62	Dec 108.62	eating	(66) (67)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32	m in calcains (see Feb 108.62 (calculations (calculations (calculations 192.29	Table 5 Table	of (65)m 5 and 5a ts Apr 108.62 opendix 9.28 Appendix 176.72	May 108.62 L, equati 6.94 dix L, eq	Jun 108.62 ion L9 of 5.86 uation L	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta	Oct 108.62 14.02 ble 5	Nov 108.62	Dec 108.62	eating	(66) (67)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains	m in calcains (see see (Table Feb 108.62) (calcula 15.07) ins (calcula 33.86)	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 ated in A 33.86	of (65)m 5 and 5a ts Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86	May 108.62 L, equati 6.94 dix L, equati 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 See Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	eating	(66) (67) (68)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86	m in calcains (see see (Table Feb 108.62) (calcula 15.07) ins (calcula 33.86)	Table 5 5), Wat Mar 108.62 ted in Ap 12.26 ulated in 187.31 ated in A 33.86	of (65)m 5 and 5a ts Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86	May 108.62 L, equati 6.94 dix L, equati 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 See Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	eating	(66) (67) (68)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fai	m in calc ains (see as (Table Feb 108.62 (calcula 15.07 ins (calc 192.29 (calcula 33.86 as gains 3	ted in Apulated in	of (65)m 5 and 5a ts Apr 108.62 ppendix 9.28 176.72 ppendix 33.86 5a) 3	only if control is a second of the control is a	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a; 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(66) (67) (68) (69)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3	m in calc ains (see as (Table Feb 108.62 (calcula 15.07 ins (calc 192.29 (calcula 33.86 as gains 3	ted in Apulated in	of (65)m 5 and 5a ts Apr 108.62 ppendix 9.28 176.72 ppendix 33.86 5a) 3	only if control is a second of the control is a	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a; 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(66) (67) (68) (69)
Metabolic gain Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. ev	m in calc ains (see as (Table Feb 108.62 (calcula 15.07 ins (calc 192.29 (calcula 33.86 as gains 3 raporatio	Table 5 Table 5 Table 5 Table 5 Table 5 Table 5 Table 5 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6	of (65)m 5 and 5a ts Apr 108.62 ppendix 9.28 Appendix 176.72 ppendix 33.86 5a) 3 tive valu	May 108.62 L, equati 6.94 dix L, equati 163.35 L, equati 33.86	Jun 108.62 ion L9 o 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(66) (67) (68) (69) (70)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fai (70)m= 3 Losses e.g. ev (71)m= -86.9	m in calc ains (see as (Table Feb 108.62 (calcula 15.07 ins (calc 192.29 (calcula 33.86 as gains 3 raporatio	Table 5 Table 5 Table 5 Table 5 Table 5 Table 5 Table 5 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6 Table 6	of (65)m 5 and 5a ts Apr 108.62 ppendix 9.28 Appendix 176.72 ppendix 33.86 5a) 3 tive valu	May 108.62 L, equati 6.94 dix L, equati 163.35 L, equati 33.86	Jun 108.62 ion L9 o 5.86 uation L 150.78 ion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(66) (67) (68) (69) (70)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and fa (70)m= 3 Losses e.g. ev (71)m= -86.9 Water heating (72)m= 67.28	m in calc ains (see as (Table Feb 108.62 (calcula 15.07 ins (calc 192.29 (calcula 33.86 as gains 3 vaporatio -86.9 gains (T	ted in April 12.26 rulated in 187.31 rated in April 133.86 (Table 5 april 156.9 rable 5) rable 5) rable 5)	of (65)m 5 and 5a ts Apr 108.62 ppendix 9.28 Appendix 176.72 ppendix 33.86 5a) 3 tive valu -86.9	only if control is a second of the control is control in the control is a second of the control is a s	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a; 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 See Ta 145.38 See Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86 3 -86.9	Nov 108.62 16.36 169.35 33.86 3	Dec 108.62 17.44 181.92 33.86 3	eating	(66) (67) (68) (69) (70) (71)
Metabolic gair Jan (66)m= 108.62 Lighting gains (67)m= 16.97 Appliances ga (68)m= 190.32 Cooking gains (69)m= 33.86 Pumps and far (70)m= 3 Losses e.g. ev (71)m= -86.9 Water heating	m in calc ains (see as (Table Feb 108.62 (calcula 15.07 ins (calc 192.29 (calcula 33.86 as gains 3 vaporatio -86.9 gains (T	ted in April 12.26 rulated in 187.31 rated in April 133.86 (Table 5 april 156.9 rable 5) rable 5) rable 5)	of (65)m 5 and 5a ts Apr 108.62 ppendix 9.28 Appendix 176.72 ppendix 33.86 5a) 3 tive valu -86.9	only if control is a second of the control is control in the control is a second of the control is a s	Jun 108.62 ion L9 of 5.86 uation L 150.78 ion L15 33.86 3 lle 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 See Ta 145.38 See Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86 3 -86.9	Nov 108.62 16.36 169.35 33.86 3	Dec 108.62 17.44 181.92 33.86 3	eating	(66) (67) (68) (69) (70) (71)

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

Orientation: Access F Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast 0.9x 0.77	x	1.81	x	22.97	x	0.3	x	0.7	=	6.05	(75)
Northeast 0.9x 0.77	x	1.81	x	41.38	x	0.3	x	0.7	j =	10.9	(75)
Northeast 0.9x 0.77	x	1.81	x	67.96	x	0.3	x	0.7	j =	17.9	(75)
Northeast 0.9x 0.77	x	1.81	x	91.35	x	0.3	x	0.7	j =	24.06	(75)
Northeast 0.9x 0.77	×	1.81	x	97.38	x	0.3	x	0.7] =	25.65	(75)
Northeast 0.9x 0.77	x	1.81	x	91.1	x	0.3	x	0.7] =	24	(75)
Northeast 0.9x 0.77	х	1.81	x	72.63	x	0.3	x	0.7] =	19.13	(75)
Northeast 0.9x 0.77	x	1.81	x	50.42	x	0.3	x	0.7] =	13.28	(75)
Northeast 0.9x 0.77	х	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast 0.9x 0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast 0.9x 0.77	х	1.81	x	9.21	x	0.3	X	0.7	=	2.43	(75)
Southeast 0.9x 0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x 0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x 0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x 0.77	X	1.05	X	106.25	X	0.3	X	0.7] =	16.24	(77)
Southeast 0.9x 0.77	x	1.05	х	119.01	x	0.3	x	0.7	-	18.19	(77)
Southeast 0.9x 0.77	x	1.05	х	118.15] x	0.3	x	0.7] =	18.05	(77)
Southeast 0.9x 0.77	X	1.05	x	113.91] x	0.3	x	0.7] =	17.41	(77)
Southeast 0.9x 0.77	x	1.05	x	104.39	x	0.3	x	0.7] =	15.95	(77)
Southeast 0.9x 0.77	X	1.05	x	92.85	X	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x 0.77	X	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x 0.77	X	1.05	x	44.07	x	0.3	x	0.7	=	6.73	(77)
Southeast 0.9x 0.77	X	1.05	x	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x} 0.77	X	7.35	X	36.79]	0.3	X	0.7	=	39.36	(79)
Southwest _{0.9x} 0.77	X	7.35	x	62.67]	0.3	x	0.7	=	67.04	(79)
Southwest _{0.9x} 0.77	X	7.35	X	85.75]	0.3	X	0.7	=	91.72	(79)
Southwest _{0.9x} 0.77	X	7.35	x	106.25]	0.3	x	0.7	=	113.65	(79)
Southwest _{0.9x} 0.77	х	7.35	x	119.01]	0.3	x	0.7] =	127.3	(79)
Southwest _{0.9x} 0.77	х	7.35	x	118.15]	0.3	x	0.7	=	126.38	(79)
Southwest _{0.9x} 0.77	х	7.35	x	113.91]	0.3	x	0.7	=	121.84	(79)
Southwest _{0.9x} 0.77	X	7.35	X	104.39]	0.3	X	0.7] =	111.66	(79)
Southwest _{0.9x} 0.77	X	7.35	X	92.85]	0.3	X	0.7	=	99.32	(79)
Southwest _{0.9x} 0.77	X	7.35	X	69.27]	0.3	X	0.7	=	74.09	(79)
Southwest _{0.9x} 0.77	х	7.35	x	44.07]	0.3	x	0.7	=	47.14	(79)
Southwest _{0.9x} 0.77	X	7.35	x	31.49]	0.3	x	0.7] =	33.68	(79)
Northwest 0.9x 0.77	X	2.1	x	11.28	x	0.3	x	0.7	<u> </u>	3.45	(81)
Northwest 0.9x 0.77	X	2.1	x	22.97	x	0.3	x	0.7] =	7.02	(81)
Northwest _{0.9x} 0.77	X	2.1	X	41.38	x	0.3	X	0.7	=	12.65	(81)

Northwest 0.9x 0.77	X	2.1		X	67.96	x_[0.3	x	0.7	=	20.77	(81)
Northwest 0.9x 0.77	X	2.1		x	91.35	x	0.3	x	0.7	=	27.92	(81)
Northwest 0.9x 0.77	X	2.1		x	97.38	x	0.3	x	0.7	=	29.76	(81)
Northwest 0.9x 0.77	X	2.1		x	91.1	x	0.3	x	0.7	=	27.84	(81)
Northwest 0.9x 0.77	X	2.1		x	72.63	x	0.3	x	0.7	=	22.2	(81)
Northwest 0.9x 0.77	X	2.1		х 🗌	50.42	x	0.3	x	0.7	=	15.41	(81)
Northwest 0.9x 0.77	X	2.1		x	28.07	x	0.3	x	0.7	=	8.58	(81)
Northwest 0.9x 0.77	X	2.1		x	14.2	x	0.3	x	0.7	=	4.34	(81)
Northwest 0.9x 0.77	X	2.1		x	9.21	x	0.3	x	0.7	=	2.82	(81)
			_									
Solar gains in watts, calcu	lated	for each	month			(83)m	= Sum(74)m	(82)m				
(83)m= 51.4 89.68 12	8.37	168.56	197.46	199.85	191.09	168.	94 142.2	100.65	61.95	43.74		(83)
Total gains – internal and	solar	(84)m =	(73)m -	+ (83)n	n , watts	•	•	•	•	•	•	
(84)m= 384.54 420.92 44	7.69	468.69	478.24	461.85	440.81	424.	17 407.2	385.03	368.6	366.98		(84)
7. Mean internal tempera	ture (heating	season)								
Temperature during heat		`			from Ta	ble 9.	Th1 (°C)				21	(85)
Utilisation factor for gains	•			•		,	(•)					(33)
	Mar	Apr	May	Jun	Jul	Au	ıg Sep	Oct	Nov	Dec		
	.94	0.9	0.81	0.66	0.51	0.5	-	0.91	0.96	0.98		(86)
	_											
Mean internal temperatur	-	20.37	20.69	20.9	-i	/ In I		20.42	10.02	10.51		(87)
` ').01				20.97	 		20.43	19.93	19.51		(07)
Temperature during heat			$\overline{}$			_						,,
(88)m= 20.24 20.24 20).24	20.25	20.25	20.26	20.26	20.2	26 20.25	20.25	20.25	20.24		(88)
Utilisation factor for gains	for <mark>r</mark>	est of dv	velling, l	n2,m (see Table	9a)				_		
(89)m= 0.97 0.96 0	.93	0.88	0.77	0.6	0.43	0.4	7 0.7	0.89	0.96	0.98		(89)
Mean internal temperatur	e in t	he rest o	of dwelli	ng T2	(follow ste	eps 3	to 7 in Tab	ole 9c)				
	3.93	19.45	19.89	20.16	20.24	20.2		19.54	18.83	18.22		(90)
	1			<u> </u>		-		fLA = Livir	ng area ÷ (4) =	0.54	(91)
Mana internal torresonation	/5	. 41	امنيات مان	U:\	£1 A	. (4	41 A) To					
Mean internal temperatur	<u> </u>					т <u>`</u>		1	10.42	10.01		(92)
` '	9.51	19.94	20.32	20.55	20.63	20.6	ļ	20.02	19.42	18.91		(92)
Apply adjustment to the r (93)m= 18.81 19.02 19	nean 9.36	19.79	20.17	20.4	20.48	20.4		19.87	19.27	18.76		(93)
		19.79	20.17	20.4	20.46	20.2	+1 20.33	19.67	19.27	10.76		(93)
8. Space heating require				a al a t a	.to= 11 of	Tabl	a Ob. aa 4b.	o4 T: /	70)	ما ہم ممام	loto	
Set Ti to the mean internate the utilisation factor for ga		•		ed at s	step 11 of	rabio	e 9b, so th	at 11,m=(76)m an	a re-caic	culate	
	Mar	Apr	May	Jun	Jul	Aı	ıg Sep	Oct	Nov	Dec		
Utilisation factor for gains			iviay	Odii	1 001	1 / "	<u> </u>	1 000	1101	200		
	.92	0.87	0.77	0.61	0.46	0.4	9 0.71	0.88	0.95	0.97		(94)
Useful gains, hmGm , W						<u> </u>						
	2.83	406.88	368.49	283.31	200.65	208	.2 287.2	338.02	348.64	355.31		(95)
Monthly average externa			from Ta	able 8		1		1	L	I	I	
	6.5	8.9	11.7	14.6	16.6	16.	4 14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean in			rature.	Lm , W	'=[(39)m	x [(93	3)m- (96)m	<u> </u>		<u>I</u>	l	
	3.75	589.87	457.43	310.22		217.	´ 	500.75	660.27	793.51		(97)
					1	-		1	1			

Space heating require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97])m – (95)m] x (4	1)m			
(98)m= 317.62 252.01	216.44	131.75	66.17	0	0	0	0	121.07	224.38	326.02		
			•	•	•	Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1655.46	(98)
Space heating require	ement in	kWh/m²	²/year]	24.69	(99)
9a. Energy requiremen	ts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating:										ı		-
Fraction of space hea				mentary	•					ļ	0	(201)
Fraction of space hea		-	` '			(202) = 1 -		(222)		ļ	1	(202)
Fraction of total heating	•	-				(204) = (204)	02) × [1 –	(203)] =		ļ	1	(204)
Efficiency of main spa		•								ļ	90.5	(206)
Efficiency of secondar	ry/suppl	ementar	y heating	g system	า, %	•			•		0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating require	216.44	alculate	d above)	0	0	0	0	121.07	224.38	326.02		
					0	U	0	121.07	224.30	320.02		(044)
$(211)m = \{[(98)m \times (204)] \\ 350.97 278.46 $	4)] } X I 239.17	145.58	73.12	0	0	0	0	133.78	247.93	360.24		(211)
								ar) =Sum(2			1829.24	(211)
Space heating fuel (se	econdar	y), kWh/	month									
= {[(98)m x (201)] } x 1	00 ÷ (20	8)										
(215)m= 0 0	0	0	0	0	0	0	0	0	0	0		_
						Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}		0	(215)
Water heating Output from water heat	or (colo	ulated a	hovo)									
154.03 135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		
Efficiency of water hea	ter										87.3	(216)
(217)m= 89.43 89.36	89.21	88.92	88.41	87.3	87.3	87.3	87.3	88.82	89.25	89.47		(217)
Fuel for water heating,												
(219)m = (64) m x 100 (219)m = 172.23 151.19) ÷ (217) 157.3	m 139.06	135.3	119.89	112.72	127.03	127.86	144.49	155.06	167.21		
()					<u> </u>	Tota	I = Sum(2	19a) ₁₁₂ =			1709.36	(219)
Annual totals								k\	Wh/year		kWh/year	
Space heating fuel use	d, main	system	1								1829.24	
Water heating fuel use	d									[1709.36	
Electricity for pumps, fa	ans and	electric	keep-ho	t								
mechanical ventilation	ı - balan	ced, ext	ract or p	ositive i	nput fron	n outside	€			184.05		(230a)
central heating pump:										30		(230c)
boiler with a fan-assis	ted flue									45		(230e)
Total electricity for the	above, I	kWh/yea	r			sum	of (230a).	(230g) =		 	259.05	(231)
Electricity for lighting		-								[299.64	<u> </u> (232)
Total delivered energy	for all u	ses (211)(221)	+ (231)	+ (232)	(237b)	=			ا [4097.29	(338)
. Star ashivered energy	.c. an a	222 (211	,···(<u></u> 1)	. (201)	. (202).	(2010)				l	7007.20	

12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	395.12 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	369.22 (264)
Space and water heating	(261) + (262) + (263) + (264) =		764.34 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	134.45 (267)
Electricity for lighting	(232) x	0.519 =	155.51 (268)
Total CO2, kg/year	sum	of (265)(271) =	1054.3 (272)
Dwelling CO2 Emission Rate	(272	() ÷ (4) =	15.72 (273)



El rating (section 14)

(274)

				User D	etails: _						
Assessor Name: Software Name:	Stroma FS	AP 2012			Strom Softwa	are Ve	rsion:		Versio	n: 1.0.5.41	
Address :	2 Bed - MF,	London,		торену	Address	. z beu ·	- IVII				
1. Overall dwelling dime	ensions:										
				Are	a(m²)	1	Av. He	ight(m)	,	Volume(m ³	<u>^</u>
Ground floor				6	37.05	(1a) x		2.5	(2a) =	167.63	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+((1d)+(1e))+(1r	1) 6	37.05	(4)					
Dwelling volume						(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	167.63	(5)
2. Ventilation rate:											
	main heating	se h	condar eating	У	other		total			m³ per hou	ır
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	ıns						0	x :	10 =	0	(7a)
Number of passive vents	;					Ē	0	x -	10 =	0	(7b)
Number of flueless gas fi	ires					F	0	X 4	40 =	0	(7c)
									Air ch	nanges per ho	our
Infiltration due to chimne							0		÷ (5) =	0	(8)
If a pressurisation test has b Number of storeys in t			d, procee	d to (17),	otherwise (continue fr	rom (9) to	(16)			7 (0)
Additional infiltration	ne aweiling (na	P)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0	.25 for steel or	timber f	rame or	0.35 fo	r masoni	ry consti	ruction	,	•	0	(11)
if both types of wall are p			oonding to	the great	ter wall are	a (after					
deducting areas of openii If suspended wooden t	• ,. ,		ed) or 0	1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, en		•	<i>5</i> a , 6. 6.	ir (ocaic	, oloo	ornor o				0	(13)
Percentage of windows	•		ripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,				•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabil	•									0.1	(18)
Air permeability value applie Number of sides sheltere		on test nas	been dor	ie or a de	gree air pe	rmeability	is being u	sea		2	(19)
Shelter factor	,				(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorporat	ting shelter fac	tor			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified f	or monthly win	d speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table	e 7								_	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2\m <i>≟ 4</i>										
	1.23 1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
				L						I	

•	ation rat	e (allowi	ing for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effe		•	rate for t	he appli	cable ca	se						0.5	(23
If exhaust air h			endix N (2	3h) = (23a	a) x Fmv (e	equation (N5)) othe	rwise (23h) = (23a)			0.5	==
If balanced with) - (20 0)			0.5	(23)
a) If balance		-	-	_					2h\m + ('	23h) ~ [1 _ (23c)	75.65 · 1001	(23
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22	+ 100j	(24
b) If balance		<u> </u>	ļ		Į	ļ	Į	Į	<u>. </u>				`
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h	OUSE EX	tract ver	ntilation o	or positiv	/e input	ventilatio	n from o	L outside					
,			then (24	•					.5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural	ventilatio	on or wh	ole hous	e positi	ve input	ventilati	on from I	loft				l	
if (22b)r	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25
3. Heat losse	s and he	eat loss	paramete	er:							_	_	
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	e 2 e 3		Openin m		Net Ar A ,r 3.57 1.81 2.1 1.05 7.35	x x x x	U-valu W/m2 1 1/[1/(1)+ 1/[1/(1)+ 1/[1/(1)+	= 0.04] = 0.04] =	A X U (W/k) 3.57 1.74 2.02 1.01 7.07	<) 	k-value kJ/m²-l		X k J/K (26 (27 (27 (27
Nalls	58.8	21	15.88		42.93	=	0.18		7.73	╡ ┌	14	601.0	
Fotal area of e	L		10.00		58.8	=	0.10		7.75		17		(31
Party wall					50.53	3 x	0		0	\neg	20	1010	.6 (32
Party floor					67.05	5					40	268	2 (32
Party ceiling					67.05	<u></u>				[30	2011	=
nternal wall **	•				87.34	=					9	╡	599 (32
for windows and	l roof wind				alue calcui		g formula 1	/[(1/U-valu	ıe)+0.04] a	L s given in			02
abric heat los				,			(26)(30)) + (32) =				23.13	(33
Heat capacity		,	,					((28)	(30) + (32	2) + (32a).	(32e) =	7091.18	(34
hermal mass		,	⊃ = Cm ÷	- TFA) ir	n kJ/m²K	,			÷ (4) =	. ,	• •	105.76	(35
	•	•		,			ecisely the		values of	TMP in T	able 1f		
ŭ		tailed calc											
can be used inste Thermal bridg	ad of a de		ulation.	using Ar	pendix l	K						8.29	(36
an be used inste	ead of a de es : S (L	x Y) cal	ulation. culated ı	•	•	K						8.29	(36

Ventila	ition hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	12.73	12.61	12.49	11.91	11.79	11.2	11.2	11.08	11.44	11.79	12.02	12.26		(38)
Heat tr	ansfer c	coefficier	nt, W/K	-	-	-	-	-	(39)m	= (37) + (37)	38)m			
(39)m=	44.15	44.04	43.92	43.33	43.21	42.63	42.63	42.51	42.86	43.21	43.45	43.68		
Heat lo	ss para	meter (H	HLP), W/	m²K						Average = = (39)m ÷	Sum(39) ₁ · (4)	12 /12=	43.3	(39)
(40)m=	0.66	0.66	0.66	0.65	0.64	0.64	0.64	0.63	0.64	0.64	0.65	0.65		
Numbe	er of day	s in moi	nth (Tab	le 1a)		•	•	•	,	Average =	Sum(40) ₁	12 /12=	0.65	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
•			-	-	-	-	-	-	-		-	-		
4. Wa	iter heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
Λ			NI.									-	1	(10)
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		.17		(42)
Annual	l averag	e hot wa						(25 x N)				5.8		(43)
			hot water person per			_	-	to achieve	a water us	se target o	f———			
not more			,				· ·				ı			
Hot water	Jan Jan	Feb	Mar day for ea	Apr	May	Jun	Jul Table 10 v	Aug	Sep	Oct	Nov	Dec		
		,						<i>/ / / / / / / / / / / / / / / / / / / </i>	04.00	07.54	00.04	04.07		
(44)m=	94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37	1000.54	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x E	Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1029.54	(44)
(45)m=	139.96	122.41	126.31	110 <mark>.12</mark>	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		_
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	=	1349.89	(45)
(46)m=	20.99	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
	storage	loss:										<u> </u>		
Storag	e volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	•	•	ind no ta		•			` '						
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage anufact		eclared l	oss facto	or is kno	wn (kW/	n/day).					0		(48)
•			m Table		51 10 11110	**** (144.4)	"day).					0		(49)
•			storage		aar			(48) x (49)	١ –					(50)
			eclared o			or is not		(40) X (40)	_			0		(30)
			factor fr	-								0		(51)
	-	_	ee secti	on 4.3									1	
		from Tal		Ol-							-	0		(52)
			m Table									0		(53)
			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
	` ,	(54) in (5	•	for oask	manth			(/EG\~~ '	EE\ (44\)	~		0		(55)
			culated f					((56)m = (1	 	ſ	
(56)m =	0	0	0	0	0	0	0	0	0	0	0	0		(56)

If cylinder conta	ins 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)
Primary circu	uit loss (ar	nnual) fro	m Table	3	-	-	-		-		0		(58)
Primary circu	iit loss cal	lculated t	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
(modified I	-	i	i		i	1			·		ı	I	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss o	alculated	for each	month	(61)m =	(60) ÷ 30	65 × (41))m						
(61)m= 14.07	12.69	14.02	13.54	13.96	13.48	13.91	13.94	13.51	14	13.59	14.06		(61)
Total heat re	quired for	water h	eating ca	alculated	I for eac	h month	(62)m =	: 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 154.0	3 135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		(62)
Solar DHW inpu	t calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add addition	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)				•	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	iter											
(64)m= 154.0	3 135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		_
							Outp	out from wa	ater heate	r (annual) ₁	12	1514.67	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	κ [(46)m	+ (57)m	+ (59)m]	
(65)m= 50.05	43.87	45.5	40	38.62	33.69	31.57	35.72	36	41.52	44.9	48.58		(65)
in <mark>clude</mark> (57	⁷)m in calc	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Internal	gains (se	e Ta <mark>ble 5</mark>	and 5a):									
Metabolic ga	ins (Table	e 5), Wat	ts										
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 108.6	2 108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 16.97	15.07	12.26	9.28	6.94	5.86	6.33	8.22	11.04	14.02	16.36	17.44		(67)
Appliances of	ains (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-	-	•	
(68)m= 190.3	2 192.29	187.31	176.72	163.35	150.78	142.38	140.4	145.38	155.98	169.35	181.92		(68)
Cooking gair	ns (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)	, also se	ee Table	5	•	•	·	
(69)m= 33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86		(69)
Pumps and f	ans gains	(Table 5	Ба)										
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatic	on (nega	tive valu	es) (Tab	le 5)	ı						l	
(71)m= -86.9		-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9		(71)
Water heatin	g gains (7	rable 5)	!	!	ļ.	!	ļ.	1	!	!	<u> </u>		
	9 9			E4 04	46.79	42.44	48.02	50	55.8	62.36	65.3		(72)
(72)m= 67.28	65.29	61.16	55.55	51.91	10.70			1	ı				
(72)m= 67.28		ļ	55.55	51.91		ım + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
	al gains =	ļ	300.14	280.78		m + (67)m 249.73	+ (68)m - 255.23	+ (69)m + ((70)m + (7 284.38	1)m + (72) 306.65	m 323.24		(73)
(72)m= 67.28 Total interna (73)m= 333.1	al gains =	! =		!	(66)			· · ·					(73)
(72)m= 67.28 Total interna	al gains = 5 331.23	319.32	300.14	280.78	(66) 262.01	249.73	255.23	265.01	284.38	306.65	323.24		(73)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

N 4		,				,		ı				_
Northeast _{0.9x}	0.77	X	1.81	X	11.28	X	0.3	X	0.7	=	2.97	(75)
Northeast _{0.9x}	0.77	X	1.81	X	22.97	X	0.3	X	0.7	=	6.05	(75)
Northeast _{0.9x}	0.77	X	1.81	X	41.38	X	0.3	X	0.7	=	10.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	67.96	x	0.3	X	0.7	=	17.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.35	X	0.3	X	0.7	=	24.06	(75)
Northeast _{0.9x}	0.77	X	1.81	x	97.38	X	0.3	x	0.7	=	25.65	(75)
Northeast 0.9x	0.77	X	1.81	x	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x}	0.77	X	1.81	X	72.63	X	0.3	X	0.7	=	19.13	(75)
Northeast _{0.9x}	0.77	X	1.81	X	50.42	X	0.3	X	0.7	=	13.28	(75)
Northeast 0.9x	0.77	X	1.81	x	28.07	x	0.3	x	0.7] =	7.39	(75)
Northeast _{0.9x}	0.77	x	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast _{0.9x}	0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x	0.77	x	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x	0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast _{0.9x}	0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x	0.77	x	1.05	x	106.25	x	0.3	x	0.7	=	16.24	(77)
Southeast 0.9x	0.77	X	1.05	x	119.01	x	0.3	x	0.7	=	18.19	(77)
Southeast 0.9x	0.77	X	1.05	X	118.15	Х	0.3	X	0.7	=	18.05	(77)
Southeast 0.9x	0.77	x	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast _{0.9x}	0.77	x	1.05	х	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast _{0.9x}	0.77	x	1.05	x	92.85	x	0.3	x	0.7	=	14.19	(77)
Southeast _{0.9x}	0.77	x	1.05	x	69.27	х	0.3	x	0.7	=	10.58	(77)
Southeast _{0.9x}	0.77	x	1.05	x	44.07	x	0.3	x	0.7	=	6.73	(77)
Southeast 0.9x	0.77	x	1.05	х	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x}	0.77	X	7.35	x	36.79]	0.3	x	0.7	=	39.36	(79)
Southwest _{0.9x}	0.77	X	7.35	x	62.67]	0.3	x	0.7	=	67.04	(79)
Southwest _{0.9x}	0.77	X	7.35	x	85.75]	0.3	x	0.7] =	91.72	(79)
Southwest _{0.9x}	0.77	X	7.35	x	106.25]	0.3	x	0.7	=	113.65	(79)
Southwest _{0.9x}	0.77	X	7.35	x	119.01]	0.3	x	0.7	=	127.3	(79)
Southwest _{0.9x}	0.77	X	7.35	x	118.15]	0.3	x	0.7] =	126.38	(79)
Southwest _{0.9x}	0.77	X	7.35	x	113.91]	0.3	x	0.7	=	121.84	(79)
Southwest _{0.9x}	0.77	X	7.35	x	104.39]	0.3	x	0.7	=	111.66	(79)
Southwest _{0.9x}	0.77	X	7.35	x	92.85]	0.3	x	0.7] =	99.32	(79)
Southwest _{0.9x}	0.77	X	7.35	x	69.27]	0.3	x	0.7	=	74.09	(79)
Southwest _{0.9x}	0.77	X	7.35	x	44.07]	0.3	x	0.7	=	47.14	(79)
Southwest _{0.9x}	0.77	X	7.35	x	31.49]	0.3	x	0.7] =	33.68	(79)
Northwest _{0.9x}	0.77	x	2.1	x	11.28	x	0.3	x	0.7] =	3.45	(81)
Northwest _{0.9x}	0.77	X	2.1	x	22.97	x	0.3	x	0.7] =	7.02	(81)
Northwest _{0.9x}	0.77	X	2.1	x	41.38	x	0.3	x	0.7	<u> </u>	12.65	(81)
Northwest 0.9x	0.77	x	2.1	x	67.96	x	0.3	x	0.7	j =	20.77	(81)
Northwest _{0.9x}	0.77	×	2.1	x	91.35	x	0.3	X	0.7] =	27.92	(81)

Northwest 0.9x	0.77	X	2.	1	X S	97.38] x	0.3	x	0.7	=	29.76	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	91.1	_ x [0.3	x	0.7	=	27.84	(81)
Northwest _{0.9x}	0.77	X	2.	1	X T	72.63	_ x [0.3	x	0.7	=	22.2	(81)
Northwest _{0.9x}	0.77	X	2.	1	X E	50.42	_ x [0.3	x	0.7	=	15.41	(81)
Northwest _{0.9x}	0.77	X	2.	1	x 2	28.07	x	0.3	x	0.7	=	8.58	(81)
Northwest _{0.9x}	0.77	x	2.	1	x	14.2	x	0.3	x	0.7		4.34	(81)
Northwest 0.9x	0.77	X	2.	1	х	9.21	וֹ × וֹ	0.3	х	0.7	=	2.82	(81)
•							-						
Solar gains in	watts, ca	alculated	for eacl	h month			(83)m	= Sum(74)ı	m(82)m				
(83)m= 51.4	89.68	128.37	168.56	197.46	199.85	191.09	168.	94 142.2	100.65	61.95	43.74		(83)
Total gains – i	nternal a	nd solar	(84)m =	= (73)m ·	+ (83)m	, watts						•	
(84)m= 384.54	420.92	447.69	468.69	478.24	461.85	440.81	424.	17 407.2	385.03	368.6	366.98		(84)
7. Mean inter	nal temp	erature	(heating	season)								
Temperature	during h	eating p	eriods ir	n the livii	ng area	from Tal	ble 9,	Th1 (°C)				21	(85)
Utilisation fac	ctor for ga	ains for I	iving are	ea, h1,m	(see Ta	able 9a)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ıg Sej	Oct	Nov	Dec		
(86)m= 0.96	0.94	0.91	0.84	0.73	0.56	0.42	0.4	5 0.66	0.86	0.94	0.97		(86)
Me <mark>an interna</mark>	l temper	atura in	living ar	22 T1 (fc	llow ste	ns 3 to 3	7 in T	ahla 9c)					
(87)m= 19.87	20.04	20.29	20.6	20.83	20.96	20.99	20.9		20.63	20.2	19.83		(87)
`	al carine at la				alus a Hisa a	- f	- - - 0	TI-0 (00	\		l		
Temperature (88)m= 20.38	20.38	20.38	20.39	20.39	20.4	20.4	20.4		_	20.39	20.38	1	(88)
								+ 20.38	20.39	20.39	20.38		(00)
Utilisation fac				-	<u> </u>		T ´			_		1	(00)
(89)m= 0.96	0.94	0.9	0.82	0.7	0.51	0.36	0.4	0.61	0.84	0.93	0.96		(89)
Mean interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3	to 7 in Ta	ble 9c)			1	
(90)m= 18.84	19.08	19.45	19.88	20.19	20.36	20.39	20.3	9 20.31	19.93	19.33	18.78		(90)
									fLA = Liv	ring area ÷ ((4) =	0.54	(91)
Mean interna	ıl tempera	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 -	- fLA) × ٦	2				
(92)m= 19.39	19.6	19.9	20.27	20.54	20.68	20.71	20.7	1 20.63	20.31	19.8	19.34		(92)
Apply adjustr	nent to th	ne mean	internal	temper	ature fro	m Table	4e, v	vhere ap	oropriate			•	
(93)m= 19.24	19.45	19.75	20.12	20.39	20.53	20.56	20.5	6 20.48	20.16	19.65	19.19		(93)
8. Space hea	iting requ	uirement											
Set Ti to the					ed at st	ep 11 of	Table	9b, so t	nat Ti,m=	∈(76)m ar	nd re-cald	culate	
the utilisation	Feb				مبيا	11	۱ ۸.		000	Nov	Doo	1	
Jan Utilisation fac		Mar	Apr	May	Jun	Jul	Αι	ıg Se	Oct	Nov	Dec		
(94)m= 0.95	0.93	0.89	0.82	0.69	0.52	0.38	0.4	1 0.62	0.83	0.92	0.95]	(94)
Useful gains,												J	, ,
(95)m= 364.38	- i	398.01	382.23	332.27	242.41	166.75	173.	85 252.9	6 319.03	339.85	350.21]	(95)
Monthly aver					<u> </u>	-						J	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	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= 659.58	640.54	582	486.06	375.32	252.65	168.84	176.	76 273.5	3 412.99	545.2	654.99		(97)
Space heating	g require	ement fo	r each n	nonth, k	/Vh/mon	th = 0.02	24 x [((97)m – (95)m] x (41)m		- 1	
(98)m= 219.63	168.37	136.89	74.76	32.03	0	0	0	0	69.9	147.86	226.75		

Space heating requirement in kWh/m²/year Space heat from secondary/supplementary systems C202 = 1 - (201) =					Tota	l per year	(kWh/year	r) = Sum(9	08) _{15,912} =	1076.19	(98)
Space Nation Nation Natio	Space heating requirement in	kWh/m²/yea	ar							16.05	(99)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of space heat from main system(s) Fraction of total heating from main system(s) Fraction of total heating from main system(s) Fraction of total heating from main system(s) Fraction of total heating from main system 1 2049 - (202) × (1 - (203)) =	9a. Energy requirements – Indi	vidual heati	ng systems i	ncluding	micro-C	HP)					
Fraction of space heat from main systems (s)	-			(ſ		
Companies Comp	•	•		•		(201) -			Į	-	===
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	•					, ,	(202)] _				
Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	_	•			(204) = (2	02) x [1 – 1	(203)] =				—
Space heating requirement (calculated above) 219.63 168.37 136.89 74.76 32.03 0 0 0 0 69.9 147.86 226.75 (211) = {([(98)m \times (204)] 17.16 82.6 35.39 0 0 0 0 0 0 77.24 163.38 250.56 (211)	•	•		o 0/							= ` ` `
Space heating requirement		<u> </u>	- i						<u> </u>		`
219.63 168.37 136.89 74.76 32.03 0 0 0 0 69.9 147.86 226.75				Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	ear
242.69 186.05 151.26 82.6 35.39 0 0 0 0 77.24 163.38 250.56	· · · · · · · · · · · · · · · · · · ·		- i	0	0	0	69.9	147.86	226.75		
242.69 186.05 151.26 82.6 35.39 0 0 0 0 77.24 163.38 250.56	$(211)m = \{[(98)m \times (204)] \} \times 10^{-1}$	00 ÷ (206)	I		l						(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			5.39 0	0	0	0	77.24	163.38	250.56		, ,
Section 10 10 10 10 10 10 10 1		•		•	Tota	l (kWh/yea	ar) =Sum(2	211) _{15,101}	2=	1189.16	(211)
Calcinomic Cal	· ·	•	nth								
Total (kWh/year) = Sum(215), Sum, F							0				
Water Heating Court From water Heater Calculated a bove From 154.03 135.1 140.33 123.66 119.63 104.66 98.4 110.9 111.62 128.34 138.4 149.6 149.6 126.03 135.1 140.33 123.66 119.63 104.66 98.4 110.9 111.62 128.34 138.4 149.6 126.03 127.03 127.03 127.03 127.03 127.03 127.03 127.03 127.03 127.03 127.03 127.03 127.03 127.04 145.18 155.64 167.72 157.72 157.74 139.76 136 119.89 112.72 127.03 127.03 127.86 145.18 155.64 167.72 1714.22 129.03 127.04 127.05 12	(215)m= 0 0 0	0	0	0	L.	·				0	(215)
Output from water heater (calculated above) 154.03 135.4 140.03 123.66 119.63 104.66 98.4 110.9 111.62 128.34 138.4 149.6 Efficiency of water heater 89.15 89.05 88.85 88.48 87.96 87.3 87.3 87.3 87.3 87.3 88.4 88.92 89.2 (217) Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m = 172.77 151.72 157.94 139.76 136 119.89 112.72 127.03 127.86 145.18 155.64 167.72 Annual totals kWh/year 5pace heating fuel used, main system 1 1189.16 Water heating fuel used 1189.16 1189.16 Water heating fuel used 1189.16 1189.16 1189.16 Water heating fuel used 1184.05 (230a) central heating pump: 30 (230c) boiler with a fan-assisted flue 360c	Water heating						,	715,1012	2	0	(213)
Efficiency of water heater		ulated above	e)								
C217 May S8.15 S8.05 S8.85 S8.48 S7.96 S7.3 S7.3 S7.3 S7.3 S8.4 S8.92 S9.2 C217	154.03 135.1 140.33	123.66 119	9.63 104.66	98.4	110.9	111.62	128.34	138.4	149.6		
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m = 172.77 151.72 157.94 139.76 136 119.89 112.72 127.03 127.86 145.18 155.64 167.72 Total = Sum(219a)_10 = 1714.22 (219) Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside central heating pump: Total electricity for the above, kWh/year Sum of (230a)(230g) = 259.05 (231) Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 3462.07 (338)	Efficiency of water heater									87.3	
(219)m = (64)m x 100 ÷ (217)m (219)m = 172.77 151.72 157.94 139.76 136 119.89 112.72 127.03 127.86 145.18 155.64 167.72 1714.22 (219)m = 172.77 151.72 157.94 139.76 136 119.89 112.72 127.03 127.86 145.18 155.64 167.72 1714.22 (219)m = 172.77 151.72 157.94 139.76 139.	` '		7.96 87.3	87.3	87.3	87.3	88.4	88.92	89.2		(217)
172.77 151.72 157.94 139.76 136 119.89 112.72 127.03 127.86 145.18 155.64 167.72											
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = kWh/year kWh/year 1189.16 (230a) (230a) (230a) (230c) 45 (230a) (230e	` '		36 119.89	112.72	127.03	127.86	145.18	155.64	167.72		
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 1189.16 1714.22 184.05 (230a) (230c) 45 (230e) 259.05 (231) 299.64 (232) 3462.07 (338)		•	-	•	Tota	I = Sum(21	19a) ₁₁₂ =			1714.22	(219)
Water heating fuel used Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 1714.22 184.05 (230a) (230c) 45 (230e) 259.05 (231) 299.64 (232) 3462.07 (338)							k\	Wh/yeaı	r		ar
Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 184.05 (230a) (230c) 45 (230e) 259.05 (231) 259.64 (232) 3462.07 (338)	-	system 1							Į	1189.16	ᆗ _
mechanical ventilation - balanced, extract or positive input from outside central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = [230a) (230a) (230c) 45 (230e) 259.05 (231) (232) (232) (232) (233e)	Water heating fuel used									1714.22	
central heating pump: 30 (230c) boiler with a fan-assisted flue 45 (230e) Total electricity for the above, kWh/year sum of (230a)(230g) = 259.05 (231) Electricity for lighting 299.64 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 3462.07 (338)	Electricity for pumps, fans and	electric kee	p-hot								
boiler with a fan-assisted flue Total electricity for the above, kWh/year Sum of (230a)(230g) = 259.05 (231) Electricity for lighting 299.64 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 3462.07 (338)	mechanical ventilation - balance	ced, extract	or positive in	nput fron	n outside	e			184.05		(230a)
Total electricity for the above, kWh/year sum of (230a)(230g) = 259.05 (231) Electricity for lighting 299.64 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 3462.07 (338)	central heating pump:								30		(230c)
Electricity for lighting 299.64 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 3462.07 (338)	boiler with a fan-assisted flue								45		(230e)
Electricity for lighting 299.64 (232) Total delivered energy for all uses (211)(221) + (231) + (232)(237b) = 3462.07 (338)	Total electricity for the above, k	:Wh/year			sum	of (230a).	(230g) =		 	259.05	(231)
	·	-							[299.64	(232)
12a. CO2 emissions – Individual heating systems including micro-CHP	Total delivered energy for all us	ses (211)(221) + (231)	+ (232).	(237b)	=			[3462.07	(338)
	12a. CO2 emissions – Individu	ual heating s	systems incl	uding mi	cro-CHF				L		

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	256.86 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216	370.27 (264)
Space and water heating	(261) + (262) + (263) + (264) =		627.13 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	134.45 (267)
Electricity for lighting	(232) x	0.519 =	155.51 (268)
Total CO2, kg/year	sum	of (265)(271) =	917.09 (272)
Dwelling CO2 Emission Rate	(272	?) ÷ (4) =	13.68 (273)
El rating (section 14)			89 (274)



		User D	Details:						
Assessor Name: Software Name:	Stroma FSAP 2012	le on out i	Strom Softwa	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	2 Bed - TF, London, TBC	торепу	Address	Z Bea ·	- I F				
1. Overall dwelling dime	ensions:								
0 10			a(m²)			ight(m)	٦	Volume(m ²	<u> </u>
Ground floor			67.05	(1a) x	2	2.5	(2a) =	167.63	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1i	ገ)	67.05	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	167.63	(5)
2. Ventilation rate:									
	main secondar heating heating	у	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0] = [0	X	40 =	0	(6a)
Number of open flues	0 + 0	7 + [0] = [0	X	20 =	0	(6b)
Number of intermittent fa	ins			-	0	X	10 =	0	(7a)
Number of passive vents	;				0	x	10 =	0	(7b)
Number of flueless gas fi	ires			F	0	X	40 =	0	(7c)
				L			Air ch	nanges per ho	
	ys, flues and fans = (6a)+(6b)+(7			antinua fi	0		\div (5) =	0	(8)
Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	a to (17),	otnerwise (continue ir	rom (9) to ((16)		0	(9)
Additional infiltration	(no)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame of	0.35 fo	r masoni	y consti	ruction			0	(11)
	resent, use the value corresponding to	the great	ter wall are	a (after					
deducting areas of openii If suspended wooden f	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	,	`	,,					0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	100] =			0	(15)
Infiltration rate					12) + (13)			0	(16)
•	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	2	(17)
·	lity value, then $(18) = [(17) \div 20] + (18)$ es if a pressurisation test has been do				is boing u	sod		0.1	(18)
Number of sides sheltere		ie oi a de	gree an pe	пеаышу	is being u	seu		2	(19)
Shelter factor			(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorporat	ting shelter factor		(21) = (18	x (20) =				0.08	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m <i>∸</i> 4								
	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18]	
, ,	1 1 1 2 2					<u> </u>		J	

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effective of the Calculate of		_	rate for t	he appli	cable ca	se	•					· 	7(00-)
If exhaust air h			andiv N (2	3h) - (23s	a) v Emy (e	aguation (1	NSN othe	rwica (23h	n) – (23a)			0.5	(23a)
If balanced with) = (23a)			0.5	(23b)
a) If balance		•	•	_					2h\m + /:	22h) v [1 (22a)	75.65	(23c)
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22	- 100]	(24a)
b) If balance	<u> </u>				ļ	<u> </u>	ļ	<u> </u>	ļ	<u> </u>	0.22		(/
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h		tract ver				ventilatio	n from o	L - outside					, ,
,				•	•				.5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural				•	•				0.51			1	
<u> </u>	r	en (24d)	m = (22l)		·		 					1	(24d)
(24d)m= 0	0		0	0	0	0	0	0 (05)	0	0	0		(24u)
Effective air	cnange _{0.23}	0.23	o.22) or (24) 0.21	0.2	c) or (24 0.2	a) in box	0.21	0.21	0.22	0.22]	(25)
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(23)
Windows Type Windows Type Windows Type Windows Type Walls Roof Total area of e Party wall Party floor Internal wall **	58.8 67.0 67.0	05 s, m²	15.86		3.57 1.81 2.1 1.05 7.35 42.93 67.05 125.8 50.53 67.05	x x x x 3 x x 66 x x 55 x	1 1/[1/(1)+ 1/[1/(1)+ 1/[1/(1)+ 1/[1/(1)+ 0.18 0.11	0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	3.57 1.74 2.02 1.01 7.07 7.73 7.38		14 9 20 40 9		(30)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valı	ue)+0.04] a	as given in	n paragraph	3.2	
Fabric heat los		,	U)				(26)(30)) + (32) =				30.51	(33)
Heat capacity		` ,						., ,	(30) + (32	2) + (32a)	(32e) =	5683.13	(34)
Thermal mass	•	•		,				` '	÷ (4) =			84.76	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	indicative	e values of	TMP in T	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	<						18.08	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	11)				(0.0)				_
Total fabric he	at loss							(33) +	- (36) =			48.59	(37)

Ventila	ition hea	at loss ca	alculated	l monthly	У				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	12.73	12.61	12.49	11.91	11.79	11.2	11.2	11.08	11.44	11.79	12.02	12.26		(38)
Heat tr	ansfer c	coefficier	nt, W/K			-	-	-	(39)m	= (37) + (3	38)m			
(39)m=	61.32	61.2	61.08	60.5	60.38	59.79	59.79	59.67	60.03	60.38	60.61	60.85		
Heat Ic	oss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	60.47	(39)
(40)m=	0.91	0.91	0.91	0.9	0.9	0.89	0.89	0.89	0.9	0.9	0.9	0.91		
Numbe	er of day	s in mor	nth (Tab	le 1a)			•	•	,	Average =	Sum(40) ₁	12 /12=	0.9	(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)
!							l	l			l			
4. Wa	iter heat	ina ener	rgy requi	rement:								kWh/ye	ear:	
		ipancy, I		[1 ovn	(0 0003	240 v /TI	-Λ 12 O)2)] + 0.0	1012 v /	Γ Γ Λ 12		.17		(42)
	A £ 13.9		+ 1.70 X	[ı - exp	(-0.0003	949 X (11	-A -13.9)2)] + 0.0) X 61 OC	IFA - 13.	.9)			
								(25 x N)				5.8		(43)
			hot water person per			_	-	to achieve	a water us	se target o	f			
iot more			,				· ·				ı			
Hot water	Jan Jan	Feb	Mar	Apr	May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
		,						<i>/ / / / / / / / / / / / / / / / / / / </i>					1	
(44)m=	94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37		7,,,
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1029.54	(44)
(45)m=	139.96	122.41	126.31	110 <mark>.12</mark>	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		
lf instant	taneous w	ater heatii	na at noint	of use (no	hot water	r storage)	enter () in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1349.89	(45)
(46)m=	20.99	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
	storage		10.93	10.52	15.65	13.00	12.07	14.54	14.72	17.13	10.72	20.33		(40)
	_		includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	munity h	eating a	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
	•	•			•			mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature fa	actor fro	m Table	2b								0		(49)
			storage					(48) x (49)) =			0		(50)
			eclared o	-									1	
		_	factor fr ee section		e∠(KVV	n/iitre/aa	iy)					0		(51)
	-	from Tal		511 4.5								0		(52)
			m Table	2b							-	0		(52)
•			storage		ear			(47) x (51)) x (52) x (53) =		0		(54)
		(54) in (5	-	,y((<i>) .</i> (• 1)	, (=) A (- - ,		0		(55)
	` ,	. , .	culated f	or each	month			((56)m = (55) × (41):	m		-		()
1	0	0	0	0	0	0	0	0	0	0	0	0		(56)
(56)m=	U	U	U			L "	L "	<u> </u>	<u> </u>	U	L "		I	(30)

If cylinder conta	ins 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)
Primary circu	uit loss (ar	nnual) fro	m Table	3	-	-	-		-		0		(58)
Primary circu	iit loss cal	lculated t	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
(modified I	-	i	i		i	1			·		ı	I	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss o	alculated	for each	month	(61)m =	(60) ÷ 30	65 × (41))m						
(61)m= 14.07	12.69	14.02	13.54	13.96	13.48	13.91	13.94	13.51	14	13.59	14.06		(61)
Total heat re	quired for	water h	eating ca	alculated	I for eac	h month	(62)m =	: 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 154.0	3 135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		(62)
Solar DHW inpu	t calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add addition	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)				•	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	iter											
(64)m= 154.0	3 135.1	140.33	123.66	119.63	104.66	98.4	110.9	111.62	128.34	138.4	149.6		_
							Outp	out from wa	ater heate	r (annual) ₁	12	1514.67	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	κ [(46)m	+ (57)m	+ (59)m]	
(65)m= 50.05	43.87	45.5	40	38.62	33.69	31.57	35.72	36	41.52	44.9	48.58		(65)
in <mark>clude</mark> (57	⁷)m in calc	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Internal	gains (se	e Ta <mark>ble 5</mark>	and 5a):									
Metabolic ga	ins (Table	e 5), Wat	ts										
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 108.6	2 108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 16.97	15.07	12.26	9.28	6.94	5.86	6.33	8.22	11.04	14.02	16.36	17.44		(67)
Appliances of	ains (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-	-	•	
(68)m= 190.3	2 192.29	187.31	176.72	163.35	150.78	142.38	140.4	145.38	155.98	169.35	181.92		(68)
Cooking gair	ns (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)	, also se	ee Table	5	•	•	·	
(69)m= 33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86		(69)
Pumps and f	ans gains	(Table 5	Ба)					•					
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatic	on (nega	tive valu	es) (Tab	le 5)	ı						l	
(71)m= -86.9		-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9		(71)
Water heatin	g gains (7	rable 5)		!		!	ļ.	1	!	!	<u> </u>		
	9 9			E4 04	46.79	42.44	48.02	50	55.8	62.36	65.3		(72)
(72)m= 67.28	65.29	61.16	55.55	51.91	10.70			1	ı				
(72)m= 67.28		ļ	55.55	51.91		ım + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
	al gains =	ļ	300.14	280.78		m + (67)m 249.73	+ (68)m - 255.23	+ (69)m + ((70)m + (7 284.38	1)m + (72) 306.65	m 323.24		(73)
(72)m= 67.28 Total interna (73)m= 333.1	al gains =	! =		!	(66)			· · ·					(73)
(72)m= 67.28 Total interna	al gains = 5 331.23	319.32	300.14	280.78	(66) 262.01	249.73	255.23	265.01	284.38	306.65	323.24		(73)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

N 4		,				,		ı				_
Northeast _{0.9x}	0.77	X	1.81	X	11.28	X	0.3	X	0.7	=	2.97	(75)
Northeast _{0.9x}	0.77	X	1.81	X	22.97	X	0.3	X	0.7	=	6.05	(75)
Northeast _{0.9x}	0.77	X	1.81	X	41.38	X	0.3	X	0.7	=	10.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	67.96	x	0.3	X	0.7	=	17.9	(75)
Northeast _{0.9x}	0.77	X	1.81	X	91.35	X	0.3	X	0.7	=	24.06	(75)
Northeast _{0.9x}	0.77	X	1.81	x	97.38	X	0.3	x	0.7	=	25.65	(75)
Northeast 0.9x	0.77	X	1.81	x	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x}	0.77	X	1.81	X	72.63	X	0.3	X	0.7	=	19.13	(75)
Northeast _{0.9x}	0.77	X	1.81	X	50.42	X	0.3	X	0.7	=	13.28	(75)
Northeast 0.9x	0.77	X	1.81	x	28.07	x	0.3	x	0.7] =	7.39	(75)
Northeast _{0.9x}	0.77	x	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast _{0.9x}	0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x	0.77	x	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x	0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast _{0.9x}	0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x	0.77	x	1.05	x	106.25	x	0.3	x	0.7	=	16.24	(77)
Southeast 0.9x	0.77	X	1.05	x	119.01	x	0.3	x	0.7	=	18.19	(77)
Southeast 0.9x	0.77	X	1.05	X	118.15	Х	0.3	X	0.7	=	18.05	(77)
Southeast 0.9x	0.77	x	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast _{0.9x}	0.77	x	1.05	х	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast _{0.9x}	0.77	x	1.05	x	92.85	x	0.3	x	0.7	=	14.19	(77)
Southeast _{0.9x}	0.77	x	1.05	x	69.27	Х	0.3	x	0.7	=	10.58	(77)
Southeast _{0.9x}	0.77	x	1.05	x	44.07	x	0.3	x	0.7	=	6.73	(77)
Southeast 0.9x	0.77	x	1.05	х	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x}	0.77	X	7.35	x	36.79]	0.3	x	0.7	=	39.36	(79)
Southwest _{0.9x}	0.77	X	7.35	x	62.67]	0.3	x	0.7	=	67.04	(79)
Southwest _{0.9x}	0.77	X	7.35	x	85.75]	0.3	x	0.7] =	91.72	(79)
Southwest _{0.9x}	0.77	X	7.35	x	106.25]	0.3	x	0.7	=	113.65	(79)
Southwest _{0.9x}	0.77	X	7.35	x	119.01]	0.3	x	0.7	=	127.3	(79)
Southwest _{0.9x}	0.77	X	7.35	x	118.15]	0.3	x	0.7] =	126.38	(79)
Southwest _{0.9x}	0.77	X	7.35	x	113.91]	0.3	x	0.7	=	121.84	(79)
Southwest _{0.9x}	0.77	X	7.35	x	104.39]	0.3	x	0.7	=	111.66	(79)
Southwest _{0.9x}	0.77	X	7.35	x	92.85]	0.3	x	0.7] =	99.32	(79)
Southwest _{0.9x}	0.77	X	7.35	x	69.27]	0.3	x	0.7	=	74.09	(79)
Southwest _{0.9x}	0.77	X	7.35	x	44.07]	0.3	x	0.7	=	47.14	(79)
Southwest _{0.9x}	0.77	X	7.35	x	31.49]	0.3	x	0.7] =	33.68	(79)
Northwest _{0.9x}	0.77	x	2.1	x	11.28	x	0.3	x	0.7] =	3.45	(81)
Northwest _{0.9x}	0.77	X	2.1	x	22.97	x	0.3	x	0.7] =	7.02	(81)
Northwest _{0.9x}	0.77	X	2.1	x	41.38	x	0.3	x	0.7	<u> </u>	12.65	(81)
Northwest 0.9x	0.77	x	2.1	x	67.96	x	0.3	x	0.7	j =	20.77	(81)
Northwest _{0.9x}	0.77	×	2.1	x	91.35	x	0.3	X	0.7] =	27.92	(81)

Northwest 0.9x	0.77	X	2.	1	X (97.38	x	0.3	x	0.7	=	29.76	(81)
Northwest 0.9x	0.77	X	2.	1	x	91.1	_ x [0.3	x	0.7	=	27.84	(81)
Northwest 0.9x	0.77	X	2.	1	X	72.63	_ x [0.3	x	0.7	=	22.2	(81)
Northwest 0.9x	0.77	X	2.	1	X (50.42	_ x [0.3	x	0.7	=	15.41	(81)
Northwest 0.9x	0.77	X	2.	1	x 2	28.07	_ x [0.3	x	0.7	=	8.58	(81)
Northwest 0.9x	0.77	X	2.	1	x	14.2	x	0.3	×	0.7	=	4.34	(81)
Northwest 0.9x	0.77	X	2.	1	х	9.21	i x	0.3	x [0.7		2.82	(81)
_							-						
Solar gains in	watts, ca	lculated	for eac	n month			(83)m	= Sum(74)m	ı(82)m				
(83)m= 51.4	89.68	128.37	168.56	197.46	199.85	191.09	168.	94 142.2	100.65	61.95	43.74		(83)
Total gains – ir	nternal a	nd solar	(84)m =	(73)m ·	+ (83)m	, watts							
(84)m= 384.54	420.92	447.69	468.69	478.24	461.85	440.81	424.	17 407.2	385.03	368.6	366.98		(84)
7. Mean inter	nal temp	erature	(heating	season)								
Temperature	•		`		,	from Tal	ole 9,	Th1 (°C)				21	(85)
Utilisation fac	_				_			` ,					
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ıg Sep	Oct	Nov	Dec		
(86)m= 0.96	0.94	0.92	0.87	0.79	0.66	0.53	0.50	* 	0.88	0.94	0.96		(86)
Me <mark>an interna</mark>	tompor	nturo in	living or	22 T1 /f/	llow etc	one 2 to -	l 7 in T						
(87)m= 18.88	19.1	19.47	19.95	20.4	20.75	20.9	20.8		20.06	19.39	18.83		(87)
` '										10.00	10.00		(- /
Temperature									_	1 00 40	00.40	1	(00)
(88)m= 20.16	20.16	20.16	20.17	20.17	20.17	20.17	20.1	8 20.17	20.17	20.16	20.16		(88)
Util <mark>isatio</mark> n fac		ains for I			h2,m (se		9a)		_				
(89)m= 0.95	0.93	0.91	0.85	0.76	0.61	0.45	0.48	0.69	0.86	0.93	0.96		(89)
Mean internal	l tempera	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3	to 7 in Tal	ole 9c)				
(90)m= 17.29	17.6	18.13	18.83	19.46	19.92	20.1	20.0	19.78	19	18.03	17.22		(90)
									fLA = Livi	ng area ÷ (4) =	0.54	(91)
Mean internal	l tempera	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 -	- fLA) × T:	2				
(92)m= 18.14	18.4	18.85	19.43	19.96	20.36	20.53	20.5		19.57	18.76	18.09		(92)
Apply adjustn	nent to th	ne mean	internal	temper	ature fro	m Table	4e, v	vhere app	ropriate	_1	1		
(93)m= 17.99	18.25	18.7	19.28	19.81	20.21	20.38	20.3	6 20.09	19.42	18.61	17.94		(93)
8. Space hea	ting requ	iirement											
Set Ti to the r					ed at st	ep 11 of	Table	e 9b, so th	at Ti,m=	(76)m an	d re-cald	culate	
the utilisation	1							<u> </u>	1 -	1		Ī	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ıg Sep	Oct	Nov	Dec		
Utilisation fac	Ť			0.74	0.64	0.47	0.5	0.60	1 0.84	0.01	1 0.04		(94)
(94)m= 0.93	0.91	0.88	0.83	0.74	0.61	0.47	0.5	0.69	0.84	0.91	0.94		(34)
Useful gains, (95)m= 358.11	384.22	395.15	388.46	354.66	281.28	207.01	212.	91 279.4	322.67	335.19	344.15		(95)
Monthly avera					<u> </u>	207.01	212.	273.4	322.07	333.13	1 044.10		(00)
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	4 14.1	10.6	7.1	4.2		(96)
Heat loss rate					l	L	<u> </u>				<u> </u>	1	• •
(97)m= 839.64	817.27	744.93	627.75	489.89	335.68	225.96	236.	´ 	-i	697.77	835.79		(97)
Space heating	g require	ment fo	r each n	nonth, k		th = 0.02	24 x [(97)m – (9	5)m] x (4	 l1)m		ı	
(98)m= 358.26	291.01	260.24	172.29	100.61	0	0	0	0	156	261.06	365.78		
					-			-	-	1		1	

Total per year (kWh/year) = Sum(98) _{15,912} =	1965.24	(98)
Space heating requirement in kWh/m²/year		29.31	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)			
Space heating:	г		(004)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) =	Į	0	(201)
Fraction of space heat from main system(s) $ (202) = 1 - (201) = $ Fraction of total heating from main system 1 $ (204) = (202) \times [1 - (203)] = $	Į	1	(202)
Efficiency of main space heating system 1	Į	1	(204)
Efficiency of secondary/supplementary heating system, %	ļ	90.5	(208)
		0	`
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Space heating requirement (calculated above)	Dec	kWh/y	ear
358.26 291.01 260.24 172.29 100.61 0 0 0 156 261.06	365.78		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)			(211)
395.87 321.56 287.56 190.37 111.17 0 0 0 0 172.37 288.46	404.18		
Total (kWh/year) =Sum(211) _{15,10}		2171.54	(211)
Space heating fuel (secondary), kWh/month			
$= \{[(98)m \times (201)]\} \times 100 \div (208)$ $(215)m = 0 $	0		
Total (kWh/year) =Sum(215) _{15,10,}		0	(215)
Water heating	L		
Output from water heater (calculated above)			
154.03 135.1 140.33 123.66 119.63 104.66 98.4 110.9 111.62 128.34 138.4	149.6		— , ,
Efficiency of water heater	1 00 55	87.3	(216)
(217)m= 89.51 89.46 89.35 89.13 88.73 87.3 87.3 87.3 89.03 89.37	89.55		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m			
(219)m= 172.07 151.01 157.06 138.73 134.81 119.89 112.72 127.03 127.86 144.16 154.87	167.07		
Total = $Sum(219a)_{112}$ =		1707.28	(219)
Annual totals Space heating fuel used, main system 1	ır Γ	kWh/yea 2171.54	ar
	L		=
Water heating fuel used	L	1707.28	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	184.05		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)(230g) =		259.05	(231)
Electricity for lighting	Ī	299.64	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	Ī	4437.51	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP	_		

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	469.05 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	368.77 (264)
Space and water heating	(261) + (262) + (263) + (264) =		837.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	134.45 (267)
Electricity for lighting	(232) x	0.519 =	155.51 (268)
Total CO2, kg/year	sum	n of (265)(271) =	1127.79 (272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	16.82 (273)
El rating (section 14)			87 (274)



Be Clean

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2		roporty	Stroma Softwa Address	are Ve	rsion:	-	Versic	on: 1.0.5.41	
Address :	1 Bed End - GF,			Address	i beu i	Ena - Gr				
1. Overall dwelling dime	nsions:									
			Are	a(m²)		Av. He	ight(m)	,	Volume(m ³	_
Ground floor			5	55.94	(1a) x	2	2.5	(2a) =	139.85	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	·(1e)+(1r	1) 5	55.94	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	139.85	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns					0	X	10 =	0	(7a)
Number of passive vents					Ē	0	x	10 =	0	(7b)
Number of flueless gas fir	res				F	0	X e	40 =	0	(7c)
					L					
								Air ch	nanges <mark>per</mark> ho	ur
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in th		ended, procee	d to (17),	otherwise (continue fr	om (9) to ((16)		0	¬(o)
Additional infiltration	ie dweiling (113)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masoni	y constr	ruction		•	0	(11)
if both types of wall are pr		erresponding to	the great	ter wall are	a (after					
deducting areas of openin If suspended wooden fl	• / .	sealed) or 0	1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, ent	,	•	(000	, o.oo	0.1101 0				0	(13)
Percentage of windows	and doors draugh	nt stripped							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,	•		•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili Air permeability value applies	,					is being u	sad		0.1	(18)
Number of sides sheltere		rnas been dor	ie or a de	gree all pe	THEADING	is being u	seu		2	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	ing shelter factor			(21) = (18	x (20) =				0.08	(21)
Infiltration rate modified for	or monthly wind sp	eed		1		1			1	
Jan Feb	Mar Apr M	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe				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		
Wind Factor (22a)m = (22	2)m ÷ 4									
	1.23 1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowii	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effe		_	rate for t	he appli	cable ca	se						ı	
If mechanic				ah) (aa-	· \		IC/\		\ (00-\			0.5	(23a
If exhaust air h) = (23a)			0.5	(23b
If balanced with		-	-	_								75.65	(23c
a) If balance						- ` 	- ^ ` ` - 	ŕ	 	- 	i i	· ÷ 100] I	(240
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(24a
b) If balance	1							``	r Ó T			1	(O.4h
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h	nouse ex n < 0.5 ×			•	•				5 v (23h	,)			
(24c)m = 0	0.5 x	0	0	0	0	0	0	0	0	0	0		(240
d) If natural			,										(= .0
,	n = 1, the				•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change	rate - en	iter (24a	or (24k	o) or (24	c) or (24	d) in box	· (25)		•		•	
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
2		21 1000	0.000										
3. Heat losse	s and ne				Net Ar	00	U-valı	10	AXU		k-value		λΧk
ELEMENT	area		Openin m		A,r		W/m2		(W/I	K)	kJ/m ² ·l		J/K
Doors					3.57	x	1	= [3.57				(26)
Windows Type	e 1				7.35	x .	1/[1/(1)+	0.04] =	7.07	Ħ			(27)
Windows Type	e 2				3.8	x	1/[1/(1)+	0.04] =	3.65	Ħ			(27)
Windows Type	e 3				2.21	x	1/[1/(1)+	0.04] =	2.13	5			(27)
Floor					55.94	=	0.13		7.2722	<u></u>	75	419	
Walls	64.9	13	16.93		48		0.18	╡ :	8.64	닄 ;	14	67:	= ` '
Total area of e			10.3		120.8	^	0.10		0.04		14		(31)
Party wall		,				=		— I					``
•					19.92	=	0	=	0		20	398	== `
Party ceiling	•				55.94	=				Ĺ	30	1678	==
Internal wall **			· · · ·		63.63			/F/4/11 1	1 0 0 4	. <u>.</u>	9	572.	67 (320
* for windows and ** include the are						ated using	tormula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapr	1 3.2	
Fabric heat los				,			(26)(30)) + (32) =				32.33	(33)
Heat capacity		,	,					((28)	(30) + (32	2) + (32a).	(32e) =	7516.77	(34)
Thermal mass	,	,	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			134.37	(35)
For design asses	sments wh	ere the de	tails of the	,			ecisely the	e indicative	values of	TMP in Ta	able 1f	1	\``
Thermal bridg				using Ap	pendix ł	<						11.84	(36)
if details of therma Total fabric he	al bridging	,			•			(33) +	(36) =				(37)
Ventilation he		عاديناعهما	monthly	,					$= 0.33 \times ($	'25)m v (5)	\ \	44.17	(37)
	Feb	Mar			lun	J. J.	Λιια				1	1	
Jan	Гер	ividi	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

	(0.0)
(38)m= 10.62 10.52 10.42 9.93 9.84 9.35 9.35 9.25 9.54 9.84 10.03 10.23	(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m	
(39)m= 54.79 54.69 54.59 54.1 54.01 53.52 53.52 53.42 53.71 54.01 54.2 54.4	7(20)
Average = $Sum(39)_{112}/12=$ 54.08 Heat loss parameter (HLP), W/m ² K (40)m = (39)m ÷ (4)	(39)
(40)m= 0.98 0.98 0.98 0.97 0.97 0.96 0.96 0.95 0.96 0.97 0.97 0.97	_
Average = $Sum(40)_{112}/12=$ 0.97 Number of days in month (Table 1a)	(40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(41)m= 31 28 31 30 31 30 31 30 31 30 31	(41)
4. Water heating energy requirement: kWh/year:	
Assumed occupancy, N $\begin{array}{c} 1.86 \\ \text{if TFA} > 13.9, \ N = 1 + 1.76 \ x \ [1 - exp(-0.000349 \ x \ (TFA -13.9)2)] + 0.0013 \ x \ (TFA -13.9) \\ \text{if TFA} \pounds 13.9, \ N = 1 \\ \end{array}$	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43)	
(44)m= 86.34 83.2 80.06 76.92 73.78 70.64 70.64 73.78 76.92 80.06 83.2 86.34 Total = Sum(44) ₁₋₁₇ = 941.88	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)	٦(٠٠/
(45)m= 128.04 111.98 115.56 100.75 96.67 83.42 77.3 88.7 89.76 104.61 114.19 124	
Total = Sum(45) ₁₁₂ = 1234.95	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	(40)
(46)m= 19.21 16.8 17.33 15.11 14.5 12.51 11.59 13.31 13.46 15.69 17.13 18.6 Water storage loss:	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)	
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)	
Water storage loss:	(40)
a) If manufacturer's declared loss factor is known (kWh/day): 0.54	(48)
Temperature factor from Table 2b Energy lost from water storage, kWh/year $(48) \times (49) = 0$ 0	(49)
b) If manufacturer's declared cylinder loss factor is not known:	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	(51)
If community heating see section 4.3	
Volume factor from Table 2a Temperature factor from Table 2b 0	(52)
	(53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ Enter (50) or (54) in (55)	(54) (55)
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	(00)
(56)m= 26.95 24.34 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95	(56)
If cylinder contains dedicated solar storage, (57) m = (56) m x $[(50)$ – $(H11)]$ ÷ (50) , else (57) m = (56) m where $(H11)$ is from Appendix H	` /
(57)m= 26.95 24.34 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95	(57)

Primary circuit loss (annual)	from Table 3						0		(58)
Primary circuit loss calculate		. , .	,	•					
(modified by factor from Ta		т т		 	r			I	(==)
(59)m= 0 0 0	0 0	0	0 0	0	0	0	0		(59)
Combi loss calculated for ea	ch month (61)m =	= (60) ÷ 365	5 × (41)m						
(61)m= 0 0 0	0 0	0	0 0	0	0	0	0		(61)
Total heat required for water	heating calculate	ed for each	month (62)m	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 154.99 136.33 142.5	1 126.83 123.62	2 109.5	104.25 115.65	115.84	131.56	140.27	150.95		(62)
Solar DHW input calculated using A	ppendix G or Append	dix H (negative	e quantity) (enter '	0' if no sola	r contribut	ion to wate	er heating)		
(add additional lines if FGHR	S and/or WWHR	S applies,	see Appendix	G)					
(63)m= 0 0 0	0 0	0	0 0	0	0	0	0		(63)
FHRS 0 0 0	0 0	0	0 0	0	0	0	0		(63) (G2
Output from water heater									
(64)m= 154.99 136.33 142.5	1 126.83 123.62	2 109.5	104.25 115.65	115.84	131.56	140.27	150.95		_
			Ou	put from w	ater heate	r (annual) ₁	12	1552.29	(64)
Heat gains from water heating	ıg, kWh/month 0.	25 ´ [0.85 ×	(45)m + (61)ı	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m= 42.57 37.23 38.42	33.5 32.14	27.74	25.7 29.49	29.85	34.78	37.97	41.23		(65)
in <mark>clude (57)m in calculatio</mark>	n of (65)m only if	cylinder is	in the dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Internal gains (see Table	e 5 and 5a):								
Metabolic gains (Table 5), W	'atts								
Jan Feb Ma		Jun	Jul Aug	Sep	Oct	Nov	Dec		
(66)m= 93.24 93.24 93.24	93.24 93.24	93.24	93.24 93.24	93.24	93.24	93.24	93.24		(66)
Lighting gains (calculated in	Appendix L, equa	ation L9 or I	L9a), also see	Table 5					
(67)m= 14.5 12.88 10.47	7 7.93 5.93	5	5.41 7.03	9.43	11.97	13.98	14.9		(67)
Appliances gains (calculated	in Appendix L, e	quation L13	3 or L13a), als	o see Ta	ble 5	•	•		
(68)m= 162.6 164.29 160.0	4 150.99 139.56	128.82	121.65 119.96	124.21	133.26	144.69	155.43		(68)
Cooking gains (calculated in	Appendix L, equ	ation L15 o	r L15a), also s	ee Table	5	•		ı	
(69)m= 32.32 32.32 32.32	2 32.32 32.32	32.32	32.32 32.32	32.32	32.32	32.32	32.32		(69)
Pumps and fans gains (Table	 e 5a)		<u> </u>					l	
(70)m = 0 0 0	0 0	0	0 0	0	0	0	0		(70)
Losses e.g. evaporation (neg	 ative values) (Ta	able 5)	<u> </u>	1	!	!	<u> </u>	l	
(71)m= -74.59 -74.59 -74.5		 _	-74.59 -74.59	-74.59	-74.59	-74.59	-74.59		(71)
Water heating gains (Table 5		<u> </u>	!	!			l		
(72)m= 57.22 55.41 51.64	` 	38.52	34.54 39.64	41.45	46.75	52.73	55.42		(72)
Total internal gains =			n + (67)m + (68)m	+ (69)m +	(70)m + (7		m		
(73)m= 285.29 283.55 273.1	3 256.41 239.66		212.57 217.6	226.07	242.96	262.37	276.72		(73)
6. Solar gains:				1 =====	1 = 1=100	1 =====			
Solar gains are calculated using so	olar flux from Table 6	a and associat	ted equations to o	onvert to th	ne applicat	ole orientat	ion.		
Orientation: Access Factor	Area	Flux		g_		FF		Gains	
Table 6d	m²	Tabl	e 6a	Table 6b	T	able 6c		(W)	
Southeast 0.9x 0.77	x 3.8	x 36.	.79 x	0.3	х	0.7	=	20.35	(77)
									_

				_		_						
Southeast 0.9x	0.77	X	3.8	X	62.67	X	0.3	X	0.7	=	34.66	(77)
Southeast 0.9x	0.77	X	3.8	X	85.75	X	0.3	x	0.7	=	47.42	(77)
Southeast 0.9x	0.77	X	3.8	X	106.25	X	0.3	x	0.7	=	58.76	(77)
Southeast 0.9x	0.77	X	3.8	X	119.01	X	0.3	x	0.7	=	65.81	(77)
Southeast 0.9x	0.77	X	3.8	X	118.15	X	0.3	x	0.7	=	65.34	(77)
Southeast 0.9x	0.77	X	3.8	X	113.91	X	0.3	x	0.7	=	62.99	(77)
Southeast 0.9x	0.77	X	3.8	X	104.39	X	0.3	x [0.7	=	57.73	(77)
Southeast 0.9x	0.77	X	3.8	X	92.85	X	0.3	x	0.7	=	51.35	(77)
Southeast 0.9x	0.77	X	3.8	X	69.27	X	0.3	x	0.7	=	38.31	(77)
Southeast 0.9x	0.77	X	3.8	X	44.07	X	0.3	x [0.7	=	24.37	(77)
Southeast 0.9x	0.77	X	3.8	x	31.49	X	0.3	x [0.7	=	17.41	(77)
Southwest _{0.9x}	0.77	X	2.21	x	36.79		0.3	x	0.7	=	11.83	(79)
Southwest _{0.9x}	0.77	X	2.21	x	62.67]	0.3	x	0.7	=	20.16	(79)
Southwest _{0.9x}	0.77	X	2.21	X	85.75]	0.3	x	0.7	=	27.58	(79)
Southwest _{0.9x}	0.77	X	2.21	X	106.25]	0.3	x	0.7	=	34.17	(79)
Southwest _{0.9x}	0.77	X	2.21	x	119.01	Ī	0.3	= x [0.7	=	38.28	(79)
Southwest _{0.9x}	0.77	X	2.21	x	118.15	Ī	0.3	x [0.7	=	38	(79)
Southwest _{0.9x}	0.77	X	2.21	X	113.91		0.3	Х	0.7	=	36.64	(79)
Southwest _{0.9x}	0.77	X	2.21	х	104.39	ĺ	0.3	x	0.7	=	33.57	(79)
Southwest _{0.9x}	0.77	X	2.21	х	92.85	i /	0.3	х	0.7	=	29.86	(79)
Southwest _{0.9x}	0.77	X	2.21	x	69.27	i /	0.3	х	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	X	2.21	x	44.07		0.3	x	0.7	=	14.17	(79)
Southwest _{0.9x}	0.77	X	2.21	x	31.49		0.3	х	0.7	=	10.13	(79)
Northwest _{0.9x}	0.77	X	7.35	х	11.28	X	0.3	х	0.7	=	12.07	(81)
Northwest _{0.9x}	0.77	x	7.35	x	22.97	X	0.3	x	0.7	<u> </u>	24.57	(81)
Northwest _{0.9x}	0.77	X	7.35	X	41.38	X	0.3	x	0.7	=	44.26	(81)
Northwest _{0.9x}	0.77	X	7.35	x	67.96	X	0.3	x	0.7	=	72.69	(81)
Northwest _{0.9x}	0.77	X	7.35	x	91.35	X	0.3	_ x [0.7	=	97.71	(81)
Northwest _{0.9x}	0.77	x	7.35	x	97.38	X	0.3	x	0.7	=	104.17	(81)
Northwest 0.9x	0.77	X	7.35	x	91.1	X	0.3	x [0.7	=	97.45	(81)
Northwest _{0.9x}	0.77	X	7.35	x	72.63	x	0.3	x [0.7	=	77.69	(81)
Northwest _{0.9x}	0.77	X	7.35	x	50.42	x	0.3	x [0.7	=	53.93	(81)
Northwest 0.9x	0.77	X	7.35	x	28.07	j×	0.3	x [0.7	=	30.02	(81)
Northwest _{0.9x}	0.77	X	7.35	x	14.2	j×	0.3	x [0.7		15.19	(81)
Northwest _{0.9x}	0.77	X	7.35	x	9.21	X	0.3	×	0.7	=	9.86	(81)
				•		_						_
Solar gains in wa	atts, calculat	ted	for each mon	th		(83)m	n = Sum(74)m	(82)m				
(83)m= 44.25	79.38 119.2	26	165.62 201.8	2	07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)
Total gains – inte	ernal and so	lar	(84)m = (73) n	า + (83)m , watts							
(84)m= 329.54 3	362.93 392.3	39	422.03 441.46	6 4	30.82 409.65	386	.59 361.21	333.57	316.1	314.11		(84)
7. Mean interna	al temperat <u>u</u>	re (heating seaso	n)								
Temperature d	uring heating	g pe	eriods in the li	ving	area from Tal	ble 9	Th1 (°C)				21	(85)
Utilisation facto	or for gains for	or li	ving area, h1,	m (s	ee Table 9a)							_
Jan	Feb Ma	ır	Apr Ma	у	Jun Jul	A	ug Sep	Oct	Nov	Dec		
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(86)m= 0	.98 0.97	0.96	0.91	0.83	0.69	0.54	0.58	0.79	0.93	0.97	0.99		(86)
Mean int	ernal tempe	erature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)				•	
	9.35 19.53	19.84	20.25	20.62	20.87	20.96	20.94	20.76	20.3	19.76	19.31		(87)
Tempera	ture during	heating p	periods ir	n rest of	dwelling	from Ta	able 9, T	 h2 (°C)				•	
· —	0.51 20.51	20.51	20.52	20.52	20.52	20.52	20.52	20.52	20.52	20.52	20.51		(88)
Utilisatio	n factor for	gains for	rest of d	welling,	h2,m (se	e Table	9a)					•	
	.98 0.97	0.95	0.91	0.81	0.65	0.49	0.53	0.76	0.92	0.97	0.98		(89)
Mean int	ernal tempe	erature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)	•	•		
	7.89 18.15	18.59	19.18	19.68	20	20.09	20.08	19.88	19.26	18.48	17.83		(90)
	•	•	!		!	!	!	f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean int	ernal tempe	erature (fo	or the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) × T2					
	3.77 18.98	19.34	19.82	20.25	20.52	20.62	20.6	20.41	19.88	19.25	18.73		(92)
Apply ad	justment to	the mear	n interna	temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m= 18	3.77 18.98	19.34	19.82	20.25	20.52	20.62	20.6	20.41	19.88	19.25	18.73		(93)
8. Space	heating re	quiremen	t										
	the mean in				ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	ation factor				lun	lul	Aug	Con	Oct	Nov	Doo		
_	lan Feb n factor for	_	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	.97 0.96	0.94	0.89	0.8	0.65	0.5	0.54	0.76	0.91	0.96	0.98		(94)
	ains, hmGn	1, W = (9		4)m									
	0.78 349.16	1	375.92	352.59	280.33	204.34	210.05	273.41	302.83	303.68	306.91		(95)
Monthly	average ex	ternal tem	perature	from T	able 8								
(96)m=	1.3 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	s rate for m	ean interr	nal tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	ı	ı	ı	
` ′	2.97 770.21		591.06	461.67	317.02	214.88	224.49	339.14	501.43	658.46	790.22		(97)
· —	eating requi				i e	i e	 ` - `	``	<u> </u>	 		l	
(98)m= 35	1.31 282.95	247.42	154.9	81.16	0	0	0	0	147.76	255.44	359.58		(OO)
							lota	l per year	(kwh/yeai	r) = Sum(9	8)15,912 =	1880.51	(98)
Space h	eating requi	rement ir	ı kWh/m²	² /year								33.62	(99)
9a. Energ	y requireme	ents – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space h	_	. a.t. fu a		ما مسلمان									(204)
	of space he				mentary	•		(204)				0	(201)
	of space he		•	` '			(202) = 1		(0.00)			1	(202)
	of total hea	_	•				(204) = (2	02) x [1 – ((203)] =			1	(204)
	y of main sp											100	(206)
Efficienc	y of second	ary/suppl	ementar	y heatin	g system	າ, %						0	(208)
	lan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
· —	eating requi	<u> </u>	1			1	1	ı		1		I	
35	1.31 282.95	247.42	154.9	81.16	0	0	0	0	147.76	255.44	359.58		
· · · —	{[(98)m x (2		· `	 				1				ı	(211)
35	1.31 282.95	247.42	154.9	81.16	0	0	0	0	147.76	255.44	359.58		
							lota	ıl (kWh/yea	ar) =5um(2	۲۱) _{15,1012}	=	1880.51	(211)

Space heating fuel (secondary), kWh/month								
= {[(98)m x (201)] } x 100 ÷ (208)		_					•	
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		_
		Tota	al (kWh/yea	ar) =Sum(2	215) _{15,1012}	<u>_</u>	0	(215)
Water heating								
Output from water heater (calculated above) 154.99	109.5 104.25	115.65	115.84	131.56	140.27	150.95]	
Efficiency of water heater	100.0 104.20	110.00	110.04	101.00	140.27	100.00	349.41	(216)
	349.41 349.41	349.41	349.41	349.41	349.41	349.41	0.0	(217)
Fuel for water heating, kWh/month	ļ .						I	
(219) m = (64) m x $100 \div (217)$ m	<u> </u>	1		ī	•		1	
(219)m= 44.36 39.02 40.79 36.3 35.38 3	31.34 29.84	33.1	33.15	37.65	40.14	43.2		_
		I ota	al = Sum(2				444.26	(219)
Annual totals Space heating fuel used, main system 1				K	Wh/year		kWh/yeai 1880.51	기
								_
Water heating fuel used							444.26	
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or pos	sitive input fro	m outsid	е			153.56		(230a)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =	:		153.56	(231)
Electricity for lighting							256.01	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b)	=				2734.33	(338)
12a. CO2 emissions – Individual heating system	s including m	icro-CHF						
	Energy kWh/yea			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x			0.5	19	=	975.98	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.5	19	=	230.57	(264)
Space and water heating	(261) + (262) + (263) +	(264) =				1206.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	79.7	(267)
Electricity for lighting	(232) x			0.5	19	=	132.87	(268)
Total CO2, kg/year			sum o	f (265)(2	271) =		1419.12	(272)
Dwelling CO2 Emission Rate			(272)	÷ (4) =			25.37	(273)

El rating (section 14)

(274)

				User D	etails:						
Assessor Name: Software Name:	Stroma	FSAP 201	2	0001 2	Strom	a Num are Vei			Versio	on: 1.0.5.41	
					Address	: 1 Bed I	End - TF				
Address :		nd - TF, Loi	ndon, TE	3C							
1. Overall dwelling dime	ensions:			Aro	n/m²\		Av. Ho	ight(m)		Volume(m	3)
Ground floor					a(m²) 55.94	(1a) x		2.5	(2a) =	139.85	(3a)
Total floor area TFA = (1	la)+(1b)+(1	c)+(1d)+(1e	e)+(1ı	ገ) 5	55.94	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d	d)+(3e)+	.(3n) =	139.85	(5)
2. Ventilation rate:											
Number of chimneys	mair heati	ng l	econdar neating	ry +	other 0	7 = [total 0	x	40 =	m³ per hou	ir (6a)
Number of open flues			0	╡╻┝	0	」	0	x :	20 =	0	(6b)
Number of intermittent fa				J L		_	0		10 =	0	(7a)
						Ļ			10 =		Ⅎ`′
Number of passive vents						Ļ	0			0	(7b)
Number of flueless gas t	rires					L	0	X	40 =	0	(7c)
									Air ch	nanges per ho	our
Infiltration due to chimne							0		÷ (5) =	0	(8)
If a pressurisation test has Number of storeys in t			ed, procee	d to (17), (otherwise (continue fr	om (9) to ((16)		0	(9)
Additional infiltration	inc awelling	J (113)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: ().25 for stee	el or timber	frame o	0.35 fo	r masoni	ry constr	uction			0	(11)
if both types of wall are p			sponding to	the great	er wall are	a (after					_
deducting areas of open If suspended wooden			led) or 0	1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, er		•	.04, 0. 0	(000.0	, o.oo	011101 0				0	(13)
Percentage of window			tripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13) -	+ (15) =		0	(16)
Air permeability value				•	•	•	etre of e	envelope	area	2	(17)
If based on air permeab	-									0.1	(18)
Air permeability value appli Number of sides shelter		isation test ha	s been doi	ne or a de	gree air pe	rmeability	is being u	sed			7(40)
Shelter factor	eu				(20) = 1 -	[0.075 x (1	19)] =			0.85	(19)
Infiltration rate incorpora	ıtina shelteı	factor			(21) = (18) x (20) =	,-			0.08	(21)
Infiltration rate modified	•		t		•	• •				0.00	()
Jan Feb	<u></u>	pr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s	1		•	•			•	•	•		
(22)m= 5.1 5	4.9 4.	i	3.8	3.8	3.7	4	4.3	4.5	4.7		
Mind Factor (00-))(2) _{mp} = 4									-	
Wind Factor (22a)m = (2^{23}) m = $(2^{23}$		1 100	0.05	0.95	0.02	1 4	1.08	1 10	1.18	1	
(22a)m= 1.27 1.25	1.23 1.	1 1.08	0.95	l o.aa	0.92	1	I 1.08	1.12	1.18	1	

usted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
0.11 0.11 0.1 0.09 0.09 0.08 0.08 0.08 0.08 0.09 0.1 0.1	
culate effective air change rate for the applicable case	
mechanical ventilation: 0.9	
exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0.8	
balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.4	65 (230
If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]	(0.4-
m= 0.23 0.23 0.22 0.21 0.2 0.2 0.21 0.21 0.22 0.22	(24a
) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)	10.11
)m= 0 0 0 0 0 0 0 0 0 0 0	(24h
If whole house extract ventilation or positive input ventilation from outside	
if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise $(24c) = (22b)m + 0.5 \times (23b)$	(240
	(240
) 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)m² x 0.5]	
)m= 0 0 0 0 0 0 0 0 0 0 0	(240
ffective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
n= 0.23 0.23 0.23 0.22 0.21 0.2 0.2 0.2 0.21 0.21 0.21 0.	(25)
Heat losses and heat loss parameter:	_
EMENT Gross Openings Net Area U-value A X U k-value	ΑΧk
area (m²) m² A ,m² W/m2K (W/K) kJ/m²·K	kJ/K
3.57 × 1 = 3.57	(26)
dows Type 1 7.35 x 1/[1/(1)+0.04] = 7.07	(27)
dows Type 2 3.8 x 1/[1/(1)+0.04] = 3.65	(27)
dows Type 3 2.21 x 1/[1/(1)+0.04] = 2.13	(27)
IS 64.93 16.93 48 x 0.18 = 8.64 14	672 (29)
	503.46 (30)
al area of elements, m ²	(31)
	398.4 (32)
	2237.6 (328
	572.67 (320
windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 clude the areas on both sides of internal walls and partitions	
ric heat loss, W/K = S (A x U) (26)(30) + (32) = 31	21 (33)
at capacity $Cm = S(A \times k)$ $((28)(30) + (32) + (32a)(32e) = 4384$	
rmal mass parameter (TMP = Cm \div TFA) in kJ/m ² K = (34) \div (4) = 78.	
design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f be used instead of a detailed calculation.	<u></u> (00)
rmal bridges : S (L x Y) calculated using Appendix K	6 (36)
tails of thermal bridging are not known (36) = $0.05 \times (31)$	<u> </u>
al fabric heat loss (33) + (36) = 46.	8 (37)
tilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$	

(00) = 40.00	40.50	T 40 40	0.00	0.04	0.05	0.05	0.05	0.54	0.04	10.00	1000		(20)
(38)m= 10.62	10.52	10.42	9.93	9.84	9.35	9.35	9.25	9.54	9.84	10.03	10.23		(38)
Heat transfer c	57.33	nt, W/K 57.23	56.74	56.64	56.15	56.15	56.05	(39)m 56.35	= (37) + (3 56.64	38)m 56.84	57.03		
(39)11= 37.43	37.33	37.23	30.74	30.04	30.13	30.13	30.03			Sum(39) ₁	l	56.71	(39)
Heat loss para	meter (I	HLP), W	m²K						= (39)m ÷				`
(40)m= 1.03	1.02	1.02	1.01	1.01	1	1	1	1.01	1.01	1.02	1.02		_
Number of day	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)
<u> </u>		•											
4. Water heat	ing ene	rgy requi	irement:								kWh/ye	ar:	
Assumed occu	nancy	N								1	.86		(42)
if TFA > 13.9 if TFA £ 13.9), N = 1		[1 - exp	(-0.0003	49 x (TF	A -13.9)2)] + 0.0	0013 x (T	ΓFA -13.		.00		(42)
Annual average	•	ater usaç	ge in litre	s per da	ıy Vd,av	erage =	(25 x N)	+ 36		78	3.49		(43)
Reduce the annua	l average	hot water	usage by	5% if the d	welling is	designed t			e target o				, ,
			, ,						0 1				
Jan Hot water usage in	Feb	Mar day for ea	Apr ach month	May Vd.m = fa	Jun	Jul Fable 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 86.34	83.2	80.06	76.92	73.78	70.64	70.64	73.78	76.92	80.06	83.2	86.34		
(11)112 00.01	00.2	00.00	70.02	70.70	7 0.0 1	10.01	10.70			m(44) ₁₁₂ =		941.88	(44)
Energy content of	hot wa <mark>te</mark> r	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x C)Tm / 3600	kWh/mon	th (see Ta	bles 1b, 1	c, 1d)		
(45)m= 128.04	111.98	115.56	100.75	96.67	83.42	77.3	88.7	89.76	104.61	114.19	124		_
If instantaneous wa	ater heati	na at point	of use (no	hot water	storage).	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	= [1234.95	(45)
(46)m= 19.21	16.8	17.33	15.11	14.5	12.51	11.59	13.31	13.46	15.69	17.13	18.6		(46)
Water storage		1			.2.0		10.01				10.0		()
Storage volume	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel	20	01		(47)
If community he	-			-			, ,		(01.1 /	47)			
Otherwise if no Water storage		not wate	er (tnis in	iciuaes ii	nstantar	ieous co	ilod idmo	ers) ente	er o in (47)			
a) If manufactu		eclared I	oss facto	or is kno	wn (kWh	n/day):				0.	.54		(48)
Temperature fa	actor fro	m Table	2b							0.8	3694		(49)
Energy lost from		_	-				(48) x (49)	=			0		(50)
b) If manufactureHot water stora			-								,]		(51)
If community h	-			C 2 (KVVI	1/11110/00	·y <i>)</i>					0		(31)
Volume factor t	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost from		_	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (, ,	•					((50) (FF) (44)		0.	.87		(55)
Water storage							((56)m = (T 1		(50)
(56)m= 26.95 If cylinder contains	24.34	d solar sto	26.08 rage. (57)	26.95 n = (56)m	26.08 x [(50) – (26.95 H11)] <i>÷ (</i> 5)	26.95 0), else (5	26.08 7)m = (56)	26.95 m where (26.08 H11) is fro	26.95 m Appendi	х Н	(56)
													(57)
(57)m= 26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)

Primary circuit loss (annual) f	rom Table 3							0		(58)
Primary circuit loss calculated		. , .	•	, ,						
(modified by factor from Ta						r	 		I	(==)
(59)m = 0 0 0	0 0	0	0	0	0	0	0	0		(59)
Combi loss calculated for each	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 heat required for water I	neating calculate	d for each	n month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 154.99 136.33 142.51	126.83 123.62	109.5	104.25	115.65	115.84	131.56	140.27	150.95		(62)
Solar DHW input calculated using Ap	pendix G or Append	ix H (negativ	e quantity	v) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add additional lines if FGHRS	S and/or WWHR	S applies,	see Ap	pendix (G)				•	
(63)m= 0 0 0	0 0	0	0	0	0	0	0	0		(63)
FHRS 0 0 0	0 0	0	0	0	0	0	0	0		(63) (G2
Output from water heater										
(64)m= 154.99 136.33 142.51	126.83 123.62	109.5	104.25	115.65	115.84	131.56	140.27	150.95		_
				Outp	out from w	ater heate	r (annual) ₁	12	1552.29	(64)
Heat gains from water heating	g, kWh/month 0.2	25 ´ [0.85	× (45)m	+ (61)m	1] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	
(65)m= 42.57 37.23 38.42	33.5 32.14	27.74	25.7	29.49	29.85	34.78	37.97	41.23		(65)
in <mark>clude (57)m in calcul</mark> ation	of (65)m only if	cylinder is	s in the	dwelling	or hot w	ate <mark>r is f</mark> ı	om com	munity h	eating	
5. Internal gains (see Table	5 and 5a):									
Metabolic gains (Table 5), Wa	atts									
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 93.24 93.24 93.24	93.24 93.24	93.24	93.24	93.24	93.24	93.24	93.24	93.24		(66)
Lighting gains (calculated in A	Appendix L, equa	ition L9 or	L9a), a	lso see	Table 5			-		
(67)m= 14.5 12.88 10.47	7.93 5.93	5	5.41	7.03	9.43	11.97	13.98	14.9		(67)
Appliances gains (calculated	in Appendix L, e	quation L1	13 or L1	3a), also	see Ta	ble 5			•	
(68)m= 162.6 164.29 160.04	150.99 139.56	128.82	121.65	119.96	124.21	133.26	144.69	155.43		(68)
Cooking gains (calculated in A	Appendix L, equa	ation L15	or L15a)	, also se	ee Table	5	•		•	
(69)m= 32.32 32.32 32.32	32.32 32.32	32.32	32.32	32.32	32.32	32.32	32.32	32.32		(69)
Pumps and fans gains (Table	5a)	-!			Į.			Į.		
(70)m= 0 0 0	0 0	0	0	0	0	0	0	0		(70)
Losses e.g. evaporation (negative	ative values) (Ta	ble 5)			l			ı		
(71)m= -74.59 -74.59 -74.59			-74.59	-74.59	-74.59	-74.59	-74.59	-74.59		(71)
Water heating gains (Table 5))				Į.	!			l	
(72)m= 57.22 55.41 51.64	46.52 43.2	38.52	34.54	39.64	41.45	46.75	52.73	55.42		(72)
Total internal gains =	<u> </u>	(66)	m + (67)m	ı + (68)m -	L + (69)m + ∈	(70)m + (7	1)m + (72)	m		
(73)m= 285.29 283.55 273.13	256.41 239.66	 	212.57	217.6	226.07	242.96	262.37	276.72		(73)
6. Solar gains:										
Solar gains are calculated using sol	ar flux from Table 6a	and associ	ated equa	tions to co	nvert to th	ne applicat	ole orienta	ion.		
Orientation: Access Factor	Area	Flu			g_		FF		Gains	
Table 6d	m²	Tab	ole 6a	Т	able 6b	Т	able 6c		(W)	
Southeast 0.9x 0.77	x 3.8	x 3	6.79	x	0.3	x	0.7	=	20.35	(77)
										

			_		_							
Southeast 0.9x	0.77 ×	3.8	X	62.67	X	0.3	X	0.7	=	34.66	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	85.75	X	0.3	X	0.7	=	47.42	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	106.25	X	0.3	X	0.7	=	58.76	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	119.01	x	0.3	X	0.7	=	65.81	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	118.15	x	0.3	x	0.7	=	65.34	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	113.91	x	0.3	X	0.7	=	62.99	(77)	
Southeast 0.9x	0.77 ×	3.8	X	104.39	x	0.3	x	0.7	=	57.73	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	92.85	x	0.3	x [0.7	=	51.35	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	69.27	x	0.3	X	0.7	=	38.31	(77)	
Southeast 0.9x	0.77 ×	3.8	x	44.07	x	0.3	x	0.7	=	24.37	(77)	
Southeast _{0.9x}	0.77 ×	3.8	X	31.49	х	0.3	x	0.7	=	17.41	(77)	
Southwest _{0.9x}	0.77 ×	2.21	X	36.79]	0.3	x	0.7	=	11.83	(79)	
Southwest _{0.9x}	0.77 ×	2.21	x	62.67]	0.3	x	0.7	=	20.16	(79)	
Southwest _{0.9x}	0.77 ×	2.21	x	85.75	Ī	0.3	X	0.7	=	27.58	(79)	
Southwest _{0.9x}	0.77 ×	2.21	x	106.25	ĺ	0.3	x [0.7	=	34.17	(79)	
Southwest _{0.9x}	0.77 ×	2.21	X	119.01	ĺ	0.3	x [0.7	=	38.28	(79)	
Southwest _{0.9x}	0.77 ×	2.21	X	118.15	ĺ	0.3	×	0.7	=	38	(79)	
Southwest _{0.9x}	0.77 X	2.21	X	113.91		0.3	Х	0.7	=	36.64	(79)	
Southwest _{0.9x}	0.77 ×	2.21	j x	104.39	i	0.3	x	0.7		33.57	(79)	
Southwest _{0.9x}	0.77 ×	2.21	х	92.85	i /	0.3	x	0.7		29.86	(79)	
Southwest _{0.9x}	0.77 ×	2.21	X	69.27	i/	0.3	x	0.7	=	22.28	(79)	
Southwest _{0.9x}	0.77 ×	2.21	x	44.07	ĺ	0.3	x	0.7	<u> </u>	14.17	(79)	
Southwest _{0.9x}	0.77 ×	2.21	j x	31.49		0.3	x	0.7		10.13	(79)	
Northwest _{0.9x}	0.77 X	7.35	x	11.28	x	0.3	x	0.7		12.07	(81)	
Northwest _{0.9x}	0.77 ×	7.35	x	22.97	x	0.3	x	0.7	-	24.57	(81)	
Northwest _{0.9x}	0.77 ×	7.35	X	41.38	x	0.3	×	0.7	=	44.26	(81)	
Northwest _{0.9x}	0.77 ×	7.35	j×	67.96	x	0.3	x	0.7	=	72.69	(81)	
Northwest _{0.9x}	0.77 ×	7.35	j×	91.35	x	0.3	x	0.7	-	97.71	(81)	
Northwest _{0.9x}	0.77 ×	7.35	X	97.38	x	0.3	x	0.7	=	104.17	(81)	
Northwest 0.9x	0.77 ×	7.35	j×	91.1	x	0.3	x	0.7	=	97.45	(81)	
Northwest _{0.9x}	0.77 ×	7.35	j×	72.63	x	0.3	x	0.7	_ =	77.69	(81)	
Northwest _{0.9x}	0.77 ×	7.35	j x	50.42	x	0.3	x	0.7		53.93	(81)	
Northwest 0.9x	0.77 ×	7.35	j×	28.07	x	0.3	x	0.7	-	30.02	(81)	
Northwest _{0.9x}	0.77 ×	7.35	X	14.2	x	0.3	- x	0.7	=	15.19	(81)	
Northwest _{0.9x}	0.77 ×	7.35	x	9.21	x	0.3	x	0.7	=	9.86	(81)	
			_		,						_	
Solar gains in wat	tts, calculated	for each mon	ıth		(83)m	n = Sum(74)m	(82)m					
(83)m= 44.25 79	9.38 119.26	165.62 201.8	3 2	07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)	
Total gains - inter	rnal and solar	(84)m = (73) r	n + (83)m , watts						•		
(84)m= 329.54 362.93 392.39 422.03 441.46 430.82 409.65 386.59 361.21 333.57 316.1 314.11 (84)												
7. Mean internal	temperature	(heating seas	on)									
Temperature du				area from Tal	ole 9	, Th1 (°C)				21	(85)	
Utilisation factor	for gains for l	living area, h1	,m (s	ee Table 9a)		-						
	Feb Mar	Apr Ma	Ť	Jun Jul	Α	ug Sep	Oct	Nov	Dec			
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							_	-	_					
(86)m=	0.95	0.93	0.91	0.85	0.77	0.64	0.52	0.56	0.73	0.87	0.93	0.95		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.5	18.74	19.17	19.74	20.27	20.68	20.87	20.83	20.52	19.84	19.08	18.45		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	20.49	20.49	20.49	20.49	20.49	20.5	20.5	20.5	20.5	20.49	20.49	20.49		(88)
Utilisa	ation fac	tor for g	ains for r	rest of d	welling,	h2,m (se	e Table	9a)					•	
(89)m=	0.95	0.93	0.9	0.84	0.75	0.61	0.47	0.51	0.71	0.86	0.93	0.95		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	ens 3 to 1	7 in Tabl	e 9c)			ı	
(90)m=	16.7	17.04	17.66	18.47	19.22	19.76	19.98	19.95	19.57	18.64	17.54	16.62		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	llina) = fl	I A × T1	+ (1 – fl	A) x T2					
(92)m=	17.79	18.07	18.57	19.23	19.85	20.31	20.51	20.48	20.14	19.37	18.47	17.73		(92)
Apply	adjustn	nent to t	he mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate	<u>Į</u>	Į.		
(93)m=	17.79	18.07	18.57	19.23	19.85	20.31	20.51	20.48	20.14	19.37	18.47	17.73		(93)
8. Sp	ace hea	ting requ	uirement											
			ernal ter			ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	_
tne u	Jan	Feb	or gains Mar	Apr		lup	Jul	Aug	Sep	Oct	Nov	Dec		
Utilis			ains, hm		May	Jun	Jui	Aug	Sep	Oct	NOV	Dec		
(94)m=	0.92	0.9	0.87	0.81	0.72	0.6	0.47	0.51	0.69	0.83	0.9	0.93		(94)
Usefu	ıl gains,	hmGm ,	, W = (9 ²	4)m x (8	4)m									
(95)m=	304.11	327.96	341.91	343.41	319.85	258.4	194.58	197.92	248.54	277.72	284.97	291.99		(95)
Mo <mark>nt</mark> l	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=		4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			an intern			1	r - `	-``	<u> </u>	ī	T		I	(07)
(97)m=		754.95	690.62	586.32	461.81	320.85	219.71	228.87	340.42	496.46	646.13	771.4		(97)
(98)m=		286.94	259.44	174.89	105.62	/vn/mon	$\ln = 0.02$	24 X [(97])m – (95 0)m] X (4 162.74	260.03	356.68		
(50)111=	000.00	200.04	200.44	174.00	100.02				l per year		l		1956.38	(98)
Span	o bootin	a roquir	omant in	k\\/b/m2	hoor			7010	ii poi youi	(RTTIII) OCI) = Ga m(G	0/15,912		(99)
-		• •	ement in)				34.97	(99)
			nts – Indi	vidual h	eating sy	ystems ı	ncluding	micro-C	HP)					
-	e heatir	_	at from se	econdar	v/supple	mentarv	svstem						0	(201)
			t from m			,	•	(202) = 1	- (201) =				1	(202)
	•		ng from i	-	• •			(204) = (2		(203)] =			1	(204)
			ace heati	•				(-) (- / [(/]			100	(206)
	•	-	ry/supple			a evetom	o 0/ ₋							(208)
LIIICK						- ·	ı —	Ι.			l		0	``
Snaa	Jan	Feb	Mar mont (c	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
Spac	350.03	286.94	ement (c 259.44	174.89	105.62	0	0	0	0	162.74	260.03	356.68		
(211\m			(4)] } x 1								1	1 -30.00		(211)
(411)[[350.03	286.94	259.44	174.89	105.62	0	0	0	0	162.74	260.03	356.68		(211)
							<u> </u>		l (kWh/yea				1956.38	(211)
											.,.			

Space heating fuel (secondary), kWh/month								
$= \{[(98)\text{m x } (201)] \} \text{ x } 100 \div (208)$ $(215)\text{m} = $	0 (0 0	T 0	0	0	0		
		То	tal (kWh/yea	ar) =Sum(2	215) _{15,1012}	<u> </u>	0	(215)
Water heating								
Output from water heater (calculated above)	100 5 1 10	1 05 1 445 65	145.04	104.50	140.07	450.05	1	
154.99 136.33 142.51 126.83 123.62 125.62 125.62 126.83 123.62 125	109.5 104	1.25 115.65	115.84	131.56	140.27	150.95	349.41	(216)
	349.41 349	9.41 349.41	349.41	349.41	349.41	349.41	349.41	(217)
Fuel for water heating, kWh/month			1					, ,
(219) m = (64) m x $100 \div (217)$ m			1	1	1		1	
(219)m= 44.36 39.02 40.79 36.3 35.38 3	31.34 29	.84 33.1	33.15	37.65	40.14	43.2		7,0,0
Annual totals		10	tal = Sum(2		Wh/year		444.26	(219)
Space heating fuel used, main system 1				K	wii/yeai		kWh/yea 1956.38	<u>'</u>
Water heating fuel used							444.26	\exists
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or pos	sitive input	from outei	40			153.56	1	(230a)
	sitive input		n of (230a).	(230a) -		133.30	452.50	(231)
Total electricity for the above, kWh/year		30	11 01 (2304)	(2009) =			153.56	
Electricity for lighting							2 <mark>56.01</mark>	(232)
Total delivered energy for all uses (211)(221) +							2810.21	(338)
12a. CO2 emissions – Individual heating system	s includin	g micro-CH	Р	_				
	Energ kWh/y			Emiss kg CO	ion fac 2/kWh	tor	Em<mark>issio</mark>ns kg CO2/ye	_
Space heating (main system 1)	(211) x			0.5	19	=	1015.36	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.5	19	=	230.57	(264)
Space and water heating	(261) + (262) + (263) +	(264) =				1245.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	79.7	(267)
Electricity for lighting	(232) x			0.5	19	=	132.87	(268)
Total CO2, kg/year			sum c	of (265)(2	271) =		1458.5	(272)
Dwelling CO2 Emission Rate			(272)	÷ (4) =			26.07	(273)

El rating (section 14)

(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 20			Stroma Softwa Address:	are Vei	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Mid - EF, Le		i í	Address.	i beu i	viia - EF				
1. Overall dwelling dimen	nsions:									
0 14				a(m²)		Av. He	ight(m)	٦	Volume(m³	_
Ground floor				55.83	(1a) x	2	2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1r	1) 5	55.83	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	Ī + [0	Ī = [0	x 2	20 =	0	(6b)
Number of intermittent fan	s					0	x -	10 =	0	(7a)
Number of passive vents					Ė	0	x ·	10 =	0	(7b)
Number of flueless gas fire	es				F	0	X 4	40 =	0	(7c)
					L					
								Air ch	nange <mark>s per</mark> ho	ur
Infiltration due to chimney	s, flues and fans =	(6a)+(6b)+(7	a)+(7b)+(7c) =		0		÷ (5) =	0	(8)
If a pressurisation test has be		nded, proceed	d to (17), d	otherwise o	ontinue fr	om (9) to ((16)			_
Number of storeys in the Additional infiltration	e dwelling (ns)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2	25 for steel or timbe	er frame or	0.35 for	r masonr	y constr	uction	[(0)	TJAOT -	0	(11)
if both types of wall are pre	esent, use the value corr				•					 ` ′
deducting areas of opening If suspended wooden flo		aled) or 0	1 (spale	معام (امد	antar N				0	(12)
If no draught lobby, ente	,	,	i (Scale	ou), 6136	enter o				0	(13)
Percentage of windows	·								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, o			•		•	etre of e	nvelope	area	2	(17)
If based on air permeabilit	•					ia haina	aad		0.1	(18)
Air permeability value applies Number of sides sheltered		nas been don	e or a deg	gree air pei	теаршту	is being us	sea		2	(19)
Shelter factor				(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporating	ng shelter factor			(21) = (18)	x (20) =				0.08	(21)
Infiltration rate modified fo	r monthly wind spe	ed							•	
Jan Feb M	Mar Apr Ma	y Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7					•	•	•	,	
(22)m= 5.1 5 4	1.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

ljusted infiltra	ation rate	(allowi	ng for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
a <i>lculate effed If mechanica</i>		-	rate for t	пе арріі	саріе са	ise					i	0.5	(
If exhaust air he			endix N, (2	3b) = (23a	a) × Fmv (equation (N5)) , othe	rwise (23b) = (23a)		[0.5	(
If balanced with	heat recove	ery: effic	iency in %	allowing t	for in-use f	actor (fror	n Table 4h) =			i	75.6	
a) If balance	d mechar	nical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2)	2b)m + (23b) × [ı (23c) – 1		`
a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(
b) If balance	d mechar	nical ve	ntilation	without	heat red	covery (l	MV) (24k	m = (22)	2b)m + (23b)	•		
-b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
c) If whole he if (22b)m	ouse extra 1 < 0.5 × (•	•				.5 × (23b))			
c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
d) If natural v if (22b)m	ventilation			•					0.5]		-		
-d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
Effective air	change ra	ate - er	iter (24a	or (24l	o) or (24	c) or (24	ld) in bo	x (25)					
i)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		
. Heat losses	and hea	t loss i	paramet	er:							_	_	-
EMENT	Gross area (r		Openin	gs	Net Ar A ,ı		U-val W/m2		A X U (W/	K)	k-value kJ/m²-ł		A X k kJ/K
oors					3.57	×	1	=	3.57				
in <mark>dows</mark> Type	1				7.35	x	1/[1/(1)+	0.04] =	7.07	П			
indows Type	2				3.8	x	1/[1/(1)+	0.04] =	3.65	П			
indows Type	3				2.21	x	1/[1/(1)+	0.04] =	2.13	<u> </u>			(
oor					13.8	5 x	0.13		1.8005		75	10	038.75
alls	44.98		16.9	3	28.0	5 x	0.18	=	5.05		14		392.7
tal area of e	lements, ı	m²			58.83	3							(
rty wall					39.86	5 x	0	=	0		20	7 7	797.2
arty floor					41.98	3				i	40		679.2
arty ceiling					55.83	3				j	30		674.9
ernal wall **					63.7	=				[9	╡ 늗	73.39
or windows and include the area						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	n paragraph	3.2	
bric heat los	s, W/K =	S (A x	U)				(26)(30) + (32) =				23.2	7
at capacity (Cm = S(A	xk)						((28).	(30) + (32	2) + (32a)	(32e) =	6156.	14
ermal mass	paramete	er (TMF	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			110.2	7
r design assess n be used instea	ad of a detai	iled calcı	ulation.				recisely the	e indicative	e values of	TMP in T	able 1f		
ermal bridge	•	•		• •	•	K						11.09	9 (
			own (36) =	0.05 (6	11								

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	44.96	44.86	44.76	44.27	44.17	43.68	43.68	43.59	43.88	44.17	44.37	44.57		
Heat Id	ss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	44.25	(39)
(40)m=	0.81	0.8	0.8	0.79	0.79	0.78	0.78	0.78	0.79	0.79	0.79	0.8		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	0.79	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assum	ed occu	ıpancy, l	N								1	86		(42)
if TF		9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	ΓFA -13.		00		(12)
								(25 x N)				.41		(43)
			not water person per				-	to achieve	a water us	e target o	I			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea						Зер	Oct	1407	Dec		
(44)m=	86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		
											m(44) ₁₁₂ =		940.97	(44)
Energy (content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	th (see Ta	bles 1b, 1	c, 1d)		
(45)m=	127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	• [1233.75	(45)
(46)m=	19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
	storage													
•		` ,		•			•	within sa	ame ves	sel	20	01		(47)
Otherw	ise if no	stored	nd no ta hot wate		_			(47) ombi boil	ers) ente	er '0' in (47)			
	storage anufact		eclared l	oss facto	or is kno	wn (kWł	n/dav):				0	54		(48)
,			m Table			(.,, , , .					694		(49)
•			· storage		ear			(48) x (49)) =			0		(50)
b) If m	anufact	urer's de	eclared o	cylinder l	oss fact									, ,
			factor fr		e 2 (kWl	h/litre/da	ıy)					0		(51)
	-	eating s from Ta	ee section	on 4.3										(52)
			m Table	2b								0		(53)
•			storage		ear			(47) x (51)	x (52) x (53) =		0		(54)
• • • • • • • • • • • • • • • • • • • •		(54) in (5	-	, , ,				, , , , , , , , , , , , , , , , , , ,	. , (,		87		(55)
Water	Water storage loss calculated for each month $((56)m = (55) \times (41)m$													
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(56)
										·				

If cylinder	contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
Primary	circuit	loss (ar	nual) fro	m Table	3							0		(58)
Primary		•	•			59)m = ((58) ÷ 36	65 × (41)	m				'	
(modi	fied by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)		1	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi lo	oss cal	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total he	at requ	uired for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	154.87	136.22	142.4	126.73	123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		(62)
Solar DHV	W input o	calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	on to wate	er heating)		
(add add	ditional	l lines if	FGHRS	and/or \	VWHRS	applies	, see Ap	pendix C	3)				•	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output f	rom wa	ater hea	ter			1	1						ı	
(64)m=	154.87	136.22	142.4	126.73	123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		,
										ater heatei			1551.09	(64)
Heat gai	_					5 ^[0.85	<u>``</u>		_	([(46)m	+ (57)m	+ (59)m]	
(65)m=	<mark>4</mark> 2.53	37.2	38.39	33.47	32.11	27.71	25.68	29.46	29.82	34.75	37.93	41.19		(65)
						ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	<mark>mu</mark> nity h	eating	
			Eulation of Table 5			ylinder i	s in the d	dwelling	or hot w	ate <mark>r is fr</mark>	om com	mu <mark>nity h</mark>	eating	
	rnal ga	ains (see s (Table	Table 5	and 5a):								eating	
5. Inte	rnal ga ic gain Jan	s (Table Feb	Table 5 5), Wat Mar	and 5a ts Apr	: May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	eating	
5. Inte	rnal ga ic gain Jan 93.08	s (Table Feb 93.08	Table 5 5), Wat Mar 93.08	and 5a ts Apr 93.08	May 93.08	Jun 93.08	Jul 93.08	Aug 93.08	Sep 93.08				eating	(66)
5. Inte Metabol (66)m= Lighting	ic gain Jan 93.08 gains	s (Table Feb 93.08 (calcula	5), Wat Mar 93.08	and 5a ts Apr 93.08 ppendix	May 93.08 L, equat	Jun 93.08 ion L9 o	Jul 93.08 r L9a), a	Aug 93.08	Sep 93.08	Oct 93.08	Nov 93.08	Dec	eating	, ,
5. Inte Metabol (66)m= Lighting (67)m=	ic gain Jan 93.08 gains 14.47	s (Table Feb 93.08 (calcula	93.08 ted in Ap	Apr 93.08 ppendix 7.91	93.08 L, equat	93.08 ion L9 o	Jul 93.08 r L9a), a 5.4	Aug 93.08 Iso see 7.01	93.08 Table 5	Oct 93.08	Nov	Dec	eating	(66)
5. Inte Metabol (66)m= Lighting (67)m= Appliance	ic gain Jan 93.08 gains 14.47 ces gai	s (Table Feb 93.08 (calcula 12.85	Mar 93.08 ted in Ap 10.45	Apr 93.08 ppendix 7.91 Append	May 93.08 L, equat 5.92	Jun 93.08 ion L9 o 4.99 uation L	93.08 r L9a), a 5.4 13 or L1	Aug 93.08 Iso see 7.01 3a), also	93.08 Table 5	Oct 93.08	Nov 93.08	Dec 93.08	eating	(67)
5. Inte Metabol (66)m= Lighting (67)m= Appliance	ic gain Jan 93.08 gains 14.47	s (Table Feb 93.08 (calcula	93.08 ted in Ap	Apr 93.08 ppendix 7.91	93.08 L, equat	93.08 ion L9 o	Jul 93.08 r L9a), a 5.4	Aug 93.08 Iso see 7.01	93.08 Table 5	Oct 93.08	Nov 93.08	Dec 93.08	eating	, ,
5. Inte Metabol (66)m= Lighting (67)m= Appliance	mal gain Jan 93.08 gains 14.47 ces gai	s (Table Feb 93.08 (calcula 12.85 ins (calcula 164.01	Table 5 5), Wat Mar 93.08 ted in Ap 10.45 ulated in 159.76	Apr 93.08 ppendix 7.91 Appendix 150.73	May 93.08 L, equat 5.92 dix L, eq	93.08 ion L9 of 4.99 uation L	93.08 r L9a), a 5.4 13 or L1	Aug 93.08 Iso see 7.01 3a), also	93.08 Table 5 9.41 see Ta	Oct 93.08 11.95 ble 5 133.03	Nov 93.08	Dec 93.08	eating	(67)
5. Inte Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking	mal gain Jan 93.08 gains 14.47 ces gai	s (Table Feb 93.08 (calcula 12.85 ins (calcula 164.01	Table 5 5), Wat Mar 93.08 ted in Ap 10.45 ulated in 159.76	Apr 93.08 ppendix 7.91 Appendix 150.73	May 93.08 L, equat 5.92 dix L, eq	93.08 ion L9 of 4.99 uation L	93.08 r L9a), a 5.4 13 or L1	Aug 93.08 Iso see 7.01 3a), also	93.08 Table 5 9.41 see Ta	Oct 93.08 11.95 ble 5 133.03	Nov 93.08	Dec 93.08	eating	(67)
5. Inte Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking	mal gain Jan 93.08 gains 14.47 ces gai 162.32 gains 32.31	s (Table Feb 93.08 (calcula 12.85 ins (calcula 164.01 (calcula 32.31	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a)	Aug 93.08 lso see 7.01 3a), also 119.75	Sep 93.08 Table 5 9.41 see Ta 124 ee Table	Oct 93.08 11.95 ble 5 133.03	Nov 93.08 13.95	Dec 93.08	eating	(67) (68)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m=	mal gain Jan 93.08 gains 14.47 ces gai 162.32 gains 32.31	s (Table Feb 93.08 (calcula 12.85 ins (calcula 164.01 (calcula 32.31	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a)	Aug 93.08 lso see 7.01 3a), also 119.75	Sep 93.08 Table 5 9.41 see Ta 124 ee Table	Oct 93.08 11.95 ble 5 133.03	Nov 93.08 13.95	Dec 93.08	eating	(67) (68)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m= Pumps a	yan gains 14.47 ces gains 162.32 gains 32.31 and far	s (Table Feb 93.08 (calcula 12.85 ins (calcula 164.01 (calcula 32.31 ins gains	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A 32.31 (Table §	93.08 ppendix 7.91 Appendix 150.73 ppendix 32.31 5a) 0	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat 32.31	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15 32.31	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	Aug 93.08 Iso see 7.01 3a), also 119.75), also se 32.31	93.08 Table 5 9.41 see Ta 124 ee Table 32.31	Oct 93.08 11.95 ble 5 133.03 5 32.31	Nov 93.08 13.95 144.44	Dec 93.08 14.87 155.16 32.31	eating	(67) (68) (69)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m= Pumps a (70)m= Losses a	yan gains 14.47 ces gains 162.32 gains 32.31 and far	s (Table Feb 93.08 (calcula 12.85 ins (calcula 164.01 (calcula 32.31 ins gains	Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A 32.31 (Table §	93.08 ppendix 7.91 Appendix 150.73 ppendix 32.31 5a) 0	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat 32.31	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15 32.31	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	Aug 93.08 Iso see 7.01 3a), also 119.75), also se 32.31	93.08 Table 5 9.41 see Ta 124 ee Table 32.31	Oct 93.08 11.95 ble 5 133.03 5 32.31	Nov 93.08 13.95 144.44	Dec 93.08 14.87 155.16 32.31	eating	(67) (68) (69)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m= Pumps a (70)m= Losses a	mal gain Jan 93.08 gains 14.47 ces gai 162.32 gains 32.31 and far 0 e.g. ev	s (Table Feb 93.08 (calcula 12.85 ins (calcula 32.31 ins gains 0 aporatio -74.47	Table 5 5), Wat Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A 32.31 (Table 5 0 on (negar	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 0	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat 32.31	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15 32.31	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	Aug 93.08 Iso see 7.01 3a), also 119.75 , also se 32.31	93.08 Table 5 9.41 9 see Ta 124 9 Table 32.31	Oct 93.08 11.95 ble 5 133.03 5 32.31	Nov 93.08 13.95 144.44 32.31	Dec 93.08 14.87 155.16 32.31	eating	(67) (68) (69) (70)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m= Pumps a (70)m= Losses e (71)m= Water he	mal gain Jan 93.08 gains 14.47 ces gai 162.32 gains 32.31 and far 0 e.g. ev	s (Table Feb 93.08 (calcula 12.85 ins (calcula 32.31 ins gains 0 aporatio -74.47	Table 5 5), Wat Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A 32.31 (Table 5 0 on (negar	Apr 93.08 ppendix 7.91 Append 150.73 ppendix 32.31 5a) 0	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat 32.31	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15 32.31	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31	Aug 93.08 Iso see 7.01 3a), also 119.75 , also se 32.31	93.08 Table 5 9.41 9 see Ta 124 9 Table 32.31	Oct 93.08 11.95 ble 5 133.03 5 32.31	Nov 93.08 13.95 144.44 32.31	Dec 93.08 14.87 155.16 32.31	eating	(67) (68) (69) (70)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m= Pumps a (70)m= Losses e (71)m= Water he	mal gain Jan 93.08 gains 14.47 ces gain 162.32 gains 32.31 and far 0 e.g. ev -74.47 eating 57.17	s (Table Feb 93.08 (calcula 12.85 ins (calcula 32.31 ins gains 0 aporatio -74.47 gains (T 55.35	Table 5 5), Wat Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A 32.31 (Table 5 0 on (nega) -74.47 able 5) 51.59	Apr 93.08 opendix 7.91 Appendix 150.73 opendix 32.31 5a) 0 tive valu	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat 32.31 0 es) (Tab	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15 32.31 0 ole 5) -74.47	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31 0	Aug 93.08 Iso see 7.01 3a), also 119.75), also se 32.31	Sep 93.08 Table 5 9.41 0 see Ta 124 ee Table 32.31 0	Oct 93.08 11.95 ble 5 133.03 5 32.31 0 -74.47	Nov 93.08 13.95 144.44 32.31 0	Dec 93.08 14.87 155.16 32.31 0 -74.47	eating	(67) (68) (69) (70) (71)
Metabol (66)m= Lighting (67)m= Applianc (68)m= Cooking (69)m= Pumps a (70)m= Losses e (71)m= Water he (72)m= Total in	mal gain Jan 93.08 gains 14.47 ces gain 162.32 gains 32.31 and far 0 e.g. ev -74.47 eating 57.17	s (Table Feb 93.08 (calcula 12.85 ins (calcula 32.31 ins gains 0 aporatio -74.47 gains (T 55.35	Table 5 5), Wat Mar 93.08 ted in Ap 10.45 ulated in 159.76 ated in A 32.31 (Table 5 0 on (nega) -74.47 able 5) 51.59	Apr 93.08 opendix 7.91 Appendix 150.73 opendix 32.31 5a) 0 tive valu	May 93.08 L, equat 5.92 dix L, eq 139.32 L, equat 32.31 0 es) (Tab	Jun 93.08 ion L9 of 4.99 uation L 128.6 tion L15 32.31 0 ole 5) -74.47	Jul 93.08 r L9a), a 5.4 13 or L1 121.44 or L15a) 32.31 0	Aug 93.08 Iso see 7.01 3a), also 119.75 0, also se 32.31	Sep 93.08 Table 5 9.41 0 see Ta 124 ee Table 32.31 0	Oct 93.08 11.95 ble 5 133.03 5 32.31 0 -74.47	Nov 93.08 13.95 144.44 32.31 0	Dec 93.08 14.87 155.16 32.31 0 -74.47	eating	(67) (68) (69) (70) (71)

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

Orientation: Access Factor Table 6d	-	Area m²		Flux Table 6a		g_ Table 6b	-	FF Table 6c		Gains (W)	
Southeast 0.9x 0.77	X	3.8	x	36.79	x	0.3	x [0.7	=	20.35	(77)
Southeast 0.9x 0.77	X	3.8	x	62.67	x	0.3	x	0.7	<u> </u>	34.66	(77)
Southeast 0.9x 0.77	X	3.8	х	85.75	X	0.3	x [0.7	<u> </u>	47.42	(77)
Southeast 0.9x 0.77	X	3.8	x	106.25	x	0.3	_ x [0.7	= [58.76	(77)
Southeast 0.9x 0.77	X	3.8	x	119.01	X	0.3	x	0.7	= [65.81	(77)
Southeast 0.9x 0.77	X	3.8	x	118.15	X	0.3	x	0.7	=	65.34	(77)
Southeast 0.9x 0.77	X	3.8	x	113.91	X	0.3	x	0.7	= [62.99	(77)
Southeast 0.9x 0.77	X	3.8	x	104.39	X	0.3	x	0.7	= [57.73	(77)
Southeast 0.9x 0.77	X	3.8	x	92.85	X	0.3	x [0.7	= [51.35	(77)
Southeast 0.9x 0.77	X	3.8	x	69.27	x	0.3	x [0.7	= [38.31	(77)
Southeast 0.9x 0.77	X	3.8	x	44.07	X	0.3	x [0.7	= [24.37	(77)
Southeast 0.9x 0.77	X	3.8	x	31.49	X	0.3	x [0.7	= [17.41	(77)
Southwest _{0.9x} 0.77	X	2.21	x	36.79]	0.3	x [0.7	= [11.83	(79)
Southwest _{0.9x} 0.77	X	2.21	x	62.67]	0.3	x [0.7	= [20.16	(79)
Southwest _{0.9x} 0.77	X	2.21	x	85.75		0.3	x	0.7	= [27.58	(79)
Southwest _{0.9x} 0.77	X	2.21	X	106.25		0.3	Х	0.7		34.17	(79)
Southwest _{0.9x} 0.77	X	2.21	х	119.01]	0.3	х	0.7		38.28	(79)
Southwest _{0.9x} 0.77	X	2.21	х	118.15		0.3	х	0.7	=	38	(79)
Southwest _{0.9x} 0.77	X	2.21	x	113.91		0.3	x	0.7	= [36.64	(79)
Southwest _{0.9x} 0.77	X	2.21	x	104.39		0.3	х	0.7	= [33.57	(79)
Southwest _{0.9x} 0.77	X	2.21	x	92.85		0.3	х	0.7	= [29.86	(79)
Southwest _{0.9x} 0.77	X	2.21	х	69.27]	0.3	х	0.7	= [22.28	(79)
Southwest _{0.9x} 0.77	X	2.21	x	44.07		0.3	x	0.7	= [14.17	(79)
Southwest _{0.9x} 0.77	X	2.21	x	31.49]	0.3	x [0.7	= [10.13	(79)
Northwest _{0.9x} 0.77	X	7.35	x	11.28	X	0.3	x [0.7	= [12.07	(81)
Northwest 0.9x 0.77	X	7.35	x	22.97	X	0.3	x [0.7	= [24.57	(81)
Northwest 0.9x 0.77	X	7.35	x	41.38	X	0.3	x [0.7	= [44.26	(81)
Northwest 0.9x 0.77	X	7.35	X	67.96	X	0.3	x [0.7	= [72.69	(81)
Northwest 0.9x 0.77	X	7.35	x	91.35	X	0.3	x [0.7	= [97.71	(81)
Northwest 0.9x 0.77	X	7.35	x	97.38	X	0.3	x [0.7	= [104.17	(81)
Northwest 0.9x 0.77	X	7.35	x	91.1	X	0.3	x [0.7	= [97.45	(81)
Northwest 0.9x 0.77	X	7.35	x	72.63	X	0.3	x [0.7	= [77.69	(81)
Northwest 0.9x 0.77	X	7.35	X	50.42	X	0.3	x [0.7	= [53.93	(81)
Northwest 0.9x 0.77	X	7.35	x	28.07	X	0.3	x [0.7	= [30.02	(81)
Northwest 0.9x 0.77	X	7.35	x	14.2	X	0.3	x [0.7	= [15.19	(81)
Northwest 0.9x 0.77	X	7.35	x	9.21	X	0.3	x [0.7	= [9.86	(81)
Solar gains in watts, calcula	_		_			n = Sum(74)m.		1			
(83)m= 44.25 79.38 119.3		165.62 201.8		07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)
Total gains – internal and so		· · · · ·	`			00 000 00	000.00	0.45 = 2	040 ==		(0.4)
(84)m= 329.13 362.52 391.	99	421.66 441.12	<u> 4</u>	30.51 409.34	386	.28 360.89	333.22	315.73	313.72		(84)

7 Me	an inter	nal temr	erature	(heating	season)								
		·			n the livii	•	from Tah	ole 9 Th	1 (°C)				21	(85)
		Ū	٠.		ea, h1,m	J)ic 0, 111	1 (0)				21	(00)
Otilise	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.97	0.95	0.93	0.86	0.75	0.59	0.45	0.49	0.71	0.89	0.95	0.97		(86)
` '	interna	l tompor	ature in	living ar	ea T1 (fo	llow sto	ne 3 to 7	L 7 in Tabl	0.00					
(87)m=	19.53	19.72	20.03	20.42	20.73	20.92	20.98	20.97	20.84	20.44	19.92	19.49		(87)
						l	l	<u> </u>	<u> </u>					` '
(88)m=	20.6	20.6	20.6	20.6	rest of	20.61	20.61	20.61	20.61	20.6	20.6	20.6		(88)
					<u> </u>	<u>l</u>	<u>l</u>							` '
(89)m=	0.97	tor for g	0.92	0.85	welling,	n2,m (se	0.42	9a) 0.46	0.68	0.88	0.95	0.97		(89)
					<u> </u>	<u>l</u>	<u>l</u>		<u> </u>	<u>l</u>	0.95	0.97		(00)
					of dwelli	- ` `	r	i 			1	ı	ı	
(90)m=	18.26	18.53	18.97	19.53	19.95	20.19	20.25	20.25	20.1	19.57	18.83	18.2		(90)
									1	fLA = Livin	g area ÷ (4	4) =	0.6	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	19.03	19.25	19.61	20.06	20.42	20.63	20.69	20.68	20.55	20.1	19.49	18.98		(92)
Apply	adjustn	nent to the	he mear	interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.03	19.25	19.61	20.06	20.42	20.63	20.69	20.68	20.55	20.1	19.49	18.98		(93)
8. Sp	ace hea	ting reવા	uire me nt											
						ed at st	ep 11 of	Table 9	o, so tha	it Ti,m=(76)m an	d re-calc	culate	
the u	tilisation Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilies	ation fac				Iviay	Juli	July	Aug	Зер	Oct	INOV	Dec		
(94)m=	0.96	0.94	0.91	0.84	0.73	0.57	0.42	0.46	0.68	0.86	0.94	0.96		(94)
	∟∟∟⊔ ul gains,	hmGm .	. W = (94	1)m x (8	4)m	<u> </u>	l			<u> </u>	<u> </u>	l		
(95)m=	314.54	340.15	354.97	353.69	320.29	244.04	173.47	179.41	245.11	287.11	295.57	301.57		(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	for mea	an intern	al tempe	erature,	Lm , W :	=[(39)m :	x [(93)m	– (96)m]	•			
(97)m=	662.17	643.76	586.82	494.19	385.33	263.4	178.63	186.61	282.9	419.47	549.79	658.68		(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=	258.63	204.03	172.49	101.16	48.39	0	0	0	0	98.48	183.04	265.69		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1331.91	(98)
Spac	e heatin	g require	ement in	kWh/m²	²/year								23.86	(99)
9a. En	ergy rec	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	e heatir	_			/		((co.v.
					y/supple	memary	•	(000) 4	(204)				0	(201)
	ion of sp			-	` '			(202) = 1	, ,	(000)1			1	(202)
	ion of to		_	-				(204) = (2	02) × [1 –	(203)] =			1	(204)
	ency of r	-											100	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	າ, %						0	(208)

	Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requirement (calculated above)				00.40	400.04	005.00	Ī	
258.63 204.03 172.49 101.16 48.39	0 0	0	0	98.48	183.04	265.69		
$ (211)m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ 258.63 204.03 172.49 101.16 48.39 $	0 0	0	0	98.48	183.04	265.69		(211)
230.03 204.03 172.49 101.10 40.39	0 0		-		211) _{15,1012}		1331.91	(211)
Space heating fuel (secondary), kWh/month					7 15, 10 12		1001.01	J` ′
= {[(98)m x (201)] } x 100 ÷ (208)								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		_
		Total	(kWh/yea	r) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating								
Output from water heater (calculated above) 154.87	09.42 104.17	115.57	115.75	131.46	140.16	150.83		
Efficiency of water heater	l	11_				l	349.41	(216)
(217)m= 349.41 349.41 349.41 349.41 349.41 3	49.41 349.41	349.41	349.41	349.41	349.41	349.41		(217)
Fuel for water heating, kWh/month	•	•	•					
(219) m = (64) m x $100 \div (217)$ m (219)m = 44.32 38.99 40.75 36.27 35.35 3	31.31 29.81	33.07	33.13	37.62	40.11	43.17		
(210)III 44.02 00.00 40.10 00.21 00.00 0	71.01 20.01		= Sum(21		40.11	40.17	443.92	(219)
Annual totals				k\	Wh/year		kWh/year	」 、
Spa <mark>ce he</mark> ating fuel <mark>used,</mark> main system 1							1331.91	
Water heating fuel used							443.92	1
Electricity for pumps, fans and electric keep-hot								_
mechanical ventilation - balanced, extract or pos	itive input from	n outside				153.25		(230a)
Total electricity for the above, kWh/year		sum o	of (230a)	(230g) =			153.25	(231)
Electricity for lighting							255.56] (232)
Total delivered energy for all uses (211)(221) +	(231) ± (232)	(237h) -	_				2184.65	(338)
	` , , ,	` ′	_				2104.03	
12a. CO2 emissions – Individual heating systems	s including mi	сто-СПР						
	Energy				ion fac	tor	Emissions	
	kWh/year			kg CO			kg CO2/yea	_
Space heating (main system 1)	(211) x			0.5	19	=	691.26	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.5	19	=	230.39	(264)
Space and water heating	(261) + (262)	+ (263) + (2	(64) =				921.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	79.54	(267)
Electricity for lighting	(232) x			0.5	19	=	132.64	(268)
Total CO2, kg/year							_	_
			sum of	(265)(2	271) =		1133.83	(272)
Dwelling CO2 Emission Rate			sum of (272) ÷		271) =			_
Dwelling CO2 Emission Rate El rating (section 14)					271) =		1133.83 20.31 85	(272) (273) (274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Mid - GF, I		i i	Address	. i beu i	ivila - Gr				
1. Overall dwelling dime	nsions:									
			Are	a(m²)	Ī	Av. He	ight(m)	7	Volume(m ³	_
Ground floor			5	55.83	(1a) x	2	2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	1) 5	55.83	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	r
Number of chimneys	0 +	0] + [0	_ = [0	X	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns				Ī	0	×	10 =	0	(7a)
Number of passive vents					Ī	0	x	10 =	0	(7b)
Number of flueless gas fin	res				Ė	0	X ·	40 =	0	(7c)
								Air ch	nanges per ho	
Infiltration due to objects	to flyes and fans	(62) L(6b) L(7	7a) ı (7b) ı (70) -	_		_			_
Infiltration due to chimney If a pressurisation test has be					continue fr	0 rom (9) to		÷ (5) =	0	(8)
Number of storeys in th		, , , , , , , ,				(0) 10 (, ,		0	(9)
Additional infiltration	· ·						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.					•	ruction			0	(11)
if both types of wall are pr deducting areas of openin		rresponding to	the great	ter wall are	a (after					
If suspended wooden f	• / .	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter	0							0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2		_	. (45)		0	(15)
Infiltration rate	aEO avaraged in	aubia matra	o por bo			12) + (13) ·		oroo	0	= (16)
Air permeability value, of the state of the			•	•	•	ietre or e	rivelope	alea	0.1	(17)
Air permeability value applies	•					is being u	sed		0.1	(10)
Number of sides sheltere	d								2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporati	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for		1	1. 1	۸	0	0.4	NI		1	
	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind specification (22)m= 5.1 5	eed from Table 7 4.9	3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)111- 3.1 3	7.0 4.7 4.0] 3.0] 3.0	J 3.7		4.3	I 4.3	I 4./	J	
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltra	tion rate (allowir	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.11	<u>`</u>	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1]	
Calculate effect		-	ate for t	he appli	cable ca	se						,	
If mechanical			" N (O	al.) (aa	\ - (15// (1	. (00)	\ (00.)			0.5	(23a
If exhaust air hea) = (23a)			0.5	(23b
If balanced with I		-	-	_								75.65	(230
a) If balanced						<u> </u>	- ^ ` `	í `	, 		1 ` '	÷ 100]	
(24a)m= 0.23	!	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(24a
b) If balanced			ntilation			overy (N	ЛV) (24b	``	r ´ `	- 		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole ho				•	•				5 (00)	,			
if (22b)m	<u>`</u>	 _		<u> </u>	ŕ	· · ·	ŕ	ŕ	· ` `	í –	Ι ,	1	(246
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(240
d) If natural v									0.5]			_	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air c	hange rat	te - en	ter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)				_	
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
3. Heat losses	and heat	loss n	aramete	or.					_				
ELEMENT	Gross	1000	Openin		Net Ar	ea	U-valı	16	AXU		k-value	9	ΑΧk
	area (m	1 ²)	m		A ,r		W/m2		(W/	K)	kJ/m²-		kJ/K
Doors					3.57	X	1	=	3.57				(26)
Windows Type	1				7.35	x .	1/[1/(1)+	0.04] =	7.07	П			(27)
Windows Type	2				3.8	x	1/[1/(1)+	0.04] =	3.65	П			(27)
Windows Type	3				2.21	x	1/[1/(1)+	0.04] =	2.13	5			(27)
Floor					55.83	x	0.13		7.2579		75	418	37.25 (28)
Walls	44.98	\neg	16.93	3	28.05	x	0.18	=	5.05	= ;	14		2.7 (29)
Total area of ele		 1 ²			100.8	=							(31)
Party wall	,				39.86	=	0		0		20	70	7.2 (32)
Party ceiling						=			0			= =	==
					55.83	=				Ĺ	30	= =	74.9 (32b
Internal wall **	f i l		ee - e:		63.71		. fa	/5/4/11			9		3.39 (320
* for windows and r ** include the areas						atea using	Tormula 1	/[(1/U-vail	ie)+0.04] a	as given in	paragrapr	1 3.2	
Fabric heat loss	s, W/K = S	S (A x !	U)				(26)(30)	+ (32) =				28.72	(33)
Heat capacity C	sm = S(A)	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	7625.44	
Thermal mass p	arameter	r (TMP) = Cm ÷	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			136.58	(35)
For design assessn	nents where	the det	ails of the	,			ecisely the	indicative	e values of	TMP in Ta	able 1f	135.50	(` ''
Thermal bridges				usina An	pendix k	<						11.28	(36)
if details of thermal	•	•			•							11.20	(00)
Total fabric hea			1/	. (-	,			(33) +	(36) =			40	(37)
Ventilation heat	loss calc	ulated	monthly	/				(38)m	= 0.33 × ((25)m x (5))		
											•		

(00)	100	40.5	10.4	0.04	0.00	0.00	0.00	0.00	0.50	2.00	1004	1001	1	(20)
(38)m=	10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21	ı	(38)
	ransfer o			40.00	40.00	40.00	40.00	40.00	` ′	= (37) + (37)		50.04		
(39)m=	50.6	50.51	50.41	49.92	49.82	49.33	49.33	49.23	49.53	49.82	50.02 Sum(39) ₁	50.21	49.89	(39)
Heat lo	oss para	meter (H	HLP), W	m²K						= (39)m ÷		12 / 12-	49.09	
(40)m=	0.91	0.9	0.9	0.89	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.9		_
Numbe	or of day	e in moi	nth (Tab	lo 1a)					,	Average =	Sum(40) ₁	12 /12=	0.89	(40)
Nullibe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
()														
4 Ws	ater heat	ing ener	rgy requi	irement:								kWh/ye	ear.	
T. VVC	ator ricat	ing crici	igy icqui	irement.								KVVII/ yC	, ai.	
	ned occu			[1 - avn	(<u>-</u> 0 0003	1/0 v (TE	- Δ -13 0)2)] + 0.()013 v (Γ Γ Δ -13		.86	I	(42)
	A £ 13.9		T 1.70 A	II - exb	(-0.0003	743 X (11	A - 13.8	<i>)</i> ∠)] + 0.0) X C10X	II A - 13.	.9)			
								(25 x N)				3.41		(43)
		•	not water person pe	0 ,		Ū	Ū	to achieve	a water us	se target o	t			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea						Seb	Oct	INOV	Dec		
(44)m=	86.26	83.12	79.98	76.85	73.71	70.57	70.57	73.71	76.85	79.98	83.12	86.26		
(,	00.20	551.12	70.00	1 0.00	10	. 0.0.					m(44) ₁₁₂ =		940.97	(44)
Energy	content of	hot wa <mark>ter</mark>	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	th (see Ta	bles 1b, 1	c, 1d)		`
(45)m=	127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		
15 : (1-1-1-1-1	()		h (40		Γotal = Su	m(45) ₁₁₂ =	=	1233.75	(45)
								boxes (46 ₎	` '		1	i	l	(40)
(46)m= Water	19.19 storage	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58	I	(46)
	•		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel	20	01		(47)
J		` ,	ind no ta	•			Ū					· .		()
		_			-			mbi boil	ers) ente	er '0' in (47)			
	storage													
•			eclared I		or is kno	wn (kWh	n/day):				0.	.54		(48)
•			m Table								8.0	8694	 	(49)
•			storage eclared o	-		or ic not		(48) x (49)) =			0	I	(50)
			factor fr	-								0		(51)
		_	ee secti		`		,					•		` ,
	e factor											0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
			storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	-	0		(54)
	(50) or (, ,	,					((50) (==> (44)		0.	.87	I	(55)
			culated f					((56)m = (, , ,		ı			,— · ·
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	 -	(56)
			,									m Append	IAП	,
(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	I	(57)

Primary circuit loss (annual) fro		50 \ ((50) - 00	·				0		(58)
Primary circuit loss calculated to (modified by factor from Tab	,		. ,	, ,		r thermo	stat)			
(59)m= 0 0 0	0 0	0	0	0	0	0	0	0		(59)
Combi loss calculated for each	month (61)m = ((60) ÷ 36	65 × (41)	ım						
(61)m= 0 0 0	0 0	0	0	0	0	0	0	0		(61)
Total heat required for water he	eating calculated	for each	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 154.87 136.22 142.4	126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		(62)
Solar DHW input calculated using App	endix G or Appendix	H (negativ	ve quantity) (enter '0	' if no sola	r contribut	ion to wate	er heating)	·	
(add additional lines if FGHRS	and/or WWHRS	applies,	, see Ap	pendix (3)					
(63)m= 0 0 0	0 0	0	0	0	0	0	0	0		(63)
FHRS 0 0 0	0 0	0	0	0	0	0	0	0		(63) (G2
Output from water heater			-					_		
(64)m= 154.87 136.22 142.4	126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		_
				Outp	out from wa	ater heate	r (annual)₁	12	1551.09	(64)
Heat gains from water heating,	kWh/month 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	
(65)m= 42.53 37.2 38.39	33.47 32.11	27.71	25.68	29.46	29.82	34.75	37.93	41.19		(65)
include (57)m in calculation	of (65)m only if c	ylinder is	s in the	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Internal gains (see Table 5	5 and 5a):					_				
Met <mark>abolic gains (Table 5),</mark> Wat	ts									
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 93.08 93.08 93.08	93.08 93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08		(66)
Lighting gains (calculated in Ap										
(67)m= 14.47 12.85 10.45	7.91 5.92	4.99	5.4	7.01	9.41	11.95	13.95	14.87		(67)
Appliances gains (calculated in									ı	
(68)m= 162.32 164.01 159.76	150.73 139.32	128.6	121.44	119.75	124	133.03	144.44	155.16		(68)
Cooking gains (calculated in A	 						1	1	1	(00)
(69)m= 32.31 32.31 32.31	32.31 32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31		(69)
Pumps and fans gains (Table 5	' 								İ	(70)
(70)m= 0 0 0	0 0	0	0	0	0	0	0	0		(70)
Losses e.g. evaporation (negation	 								I	(74)
(71)m= -74.47 -74.47 -74.47	-74.47 -74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47		(71)
Water heating gains (Table 5)		00.40	0.54			40.7		55.00	1	(70)
(72)m= 57.17 55.35 51.59	46.48 43.16	38.48	34.51	39.6	41.41	46.7	52.68	55.36		(72)
Total internal gains =	05004 00000		m + (67)m					1	İ	(72)
(73)m= 284.88 283.14 272.73	256.04 239.32	223	212.27	217.29	225.75	242.61	262	276.32		(73)
6. Solar gains:Solar gains are calculated using sola	r flux from Table 6a a	and associ	iated equa	tions to co	nvert to th	e applicat	ole orientat	ion		
Orientation: Access Factor	Area	Flu			g_	- applicat	FF		Gains	
Table 6d	m²		ole 6a	Т	able 6b	Т	able 6c		(W)	
Southeast 0.9x 0.77 x	3.8	x 3	6.79	х	0.3	x	0.7	=	20.35	(77)

				_		_						
Southeast _{0.9x}	0.77	X	3.8	X	62.67	X	0.3	X	0.7	=	34.66	(77)
Southeast 0.9x	0.77	x	3.8	X	85.75	X	0.3	x	0.7	=	47.42	(77)
Southeast 0.9x	0.77	x	3.8	X	106.25	X	0.3	x	0.7	=	58.76	(77)
Southeast _{0.9x}	0.77	x	3.8	X	119.01	X	0.3	x [0.7	=	65.81	(77)
Southeast 0.9x	0.77	X	3.8	×	118.15	X	0.3	x [0.7	=	65.34	(77)
Southeast 0.9x	0.77	x	3.8	×	113.91	X	0.3	x	0.7	=	62.99	(77)
Southeast 0.9x	0.77	X	3.8	X	104.39	X	0.3	x [0.7	=	57.73	(77)
Southeast _{0.9x}	0.77	X	3.8	X	92.85	X	0.3	x	0.7	=	51.35	(77)
Southeast _{0.9x}	0.77	X	3.8	X	69.27	X	0.3	x	0.7	=	38.31	(77)
Southeast 0.9x	0.77	X	3.8	X	44.07	X	0.3	x [0.7	=	24.37	(77)
Southeast 0.9x	0.77	X	3.8	x	31.49	X	0.3	x [0.7	=	17.41	(77)
Southwest _{0.9x}	0.77	X	2.21	X	36.79		0.3	x	0.7	=	11.83	(79)
Southwest _{0.9x}	0.77	X	2.21	X	62.67		0.3	x	0.7	=	20.16	(79)
Southwest _{0.9x}	0.77	X	2.21	x	85.75]	0.3	x	0.7	=	27.58	(79)
Southwest _{0.9x}	0.77	X	2.21	x	106.25]	0.3	x	0.7	=	34.17	(79)
Southwest _{0.9x}	0.77	X	2.21	x	119.01	Ī	0.3	x [0.7	=	38.28	(79)
Southwest _{0.9x}	0.77	X	2.21	x	118.15	Ī	0.3	x	0.7	=	38	(79)
Southwest _{0.9x}	0.77	X	2.21	×	113.91		0.3	х	0.7	=	36.64	(79)
Southwest _{0.9x}	0.77	x	2.21	х	104.39	j .	0.3	x	0.7	-	33.57	(79)
Southwest _{0.9x}	0.77	x	2.21	х	92.85	j /	0.3	x	0.7	=	29.86	(79)
Southwest _{0.9x}	0.77	x	2.21	x	69.27	i /	0.3	x	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	x	2.21	x	44.07		0.3	x	0.7	=	14.17	(79)
Southwest _{0.9x}	0.77	x	2.21	x	31.49		0.3	x	0.7	=	10.13	(79)
Northwest 0.9x	0.77	x	7.35	х	11.28	X	0.3	х	0.7	=	12.07	(81)
Northwest 0.9x	0.77	x	7.35	x	22.97	X	0.3	×	0.7	-	24.57	(81)
Northwest _{0.9x}	0.77	X	7.35	x	41.38	X	0.3	x	0.7	=	44.26	(81)
Northwest _{0.9x}	0.77	X	7.35	x	67.96	X	0.3	x	0.7	=	72.69	(81)
Northwest _{0.9x}	0.77	X	7.35	x	91.35	X	0.3	_ x [0.7	<u> </u>	97.71	(81)
Northwest 0.9x	0.77	X	7.35	×	97.38	X	0.3	x [0.7	=	104.17	(81)
Northwest 0.9x	0.77	X	7.35	x	91.1	X	0.3	= x [0.7	=	97.45	(81)
Northwest 0.9x	0.77	X	7.35	x	72.63	X	0.3	= x [0.7	=	77.69	(81)
Northwest 0.9x	0.77	X	7.35	x	50.42	X	0.3	x	0.7	=	53.93	(81)
Northwest 0.9x	0.77	X	7.35	x	28.07	x	0.3	x [0.7	=	30.02	(81)
Northwest 0.9x	0.77	X	7.35	x	14.2	x	0.3	x [0.7	=	15.19	(81)
Northwest 0.9x	0.77	X	7.35	x	9.21	x	0.3	x [0.7	=	9.86	(81)
				•		•		_				_
Solar gains in wa	atts, calculate	ed	for each mon	th		(83)m	n = Sum(74)m	(82)m				
(83)m= 44.25	79.38 119.26	3	165.62 201.8	2	07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)
Total gains – inte	ernal and sol	ar	(84)m = (73) n	า + (83)m , watts							
(84)m= 329.13 3	391.99)	421.66 441.12	2 4	30.51 409.34	386	.28 360.89	333.22	315.73	313.72		(84)
7. Mean interna	ıl temperatur	e (heating seaso	n)								
Temperature during heating periods in the living area from Table 9, Th1 (°C)												
Utilisation facto	r for gains fo	r li	ving area, h1,	m (s	ee Table 9a)							_
Jan	Feb Mar	$\cdot $	Apr Ma	у	Jun Jul	A	ug Sep	Oct	Nov	Dec		
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1												•		
(86)m=	0.98	0.97	0.95	0.91	0.81	0.66	0.51	0.55	0.77	0.93	0.97	0.99		(86)
Mean	interna	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.53	19.7	19.99	20.37	20.7	20.91	20.97	20.96	20.82	20.41	19.9	19.49		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.55	20.55	20.55	20.55	20.55	20.56	20.56	20.56	20.56	20.55	20.55	20.55		(88)
Utilisa	tion fac	tor for a	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.98	0.97	0.95	0.9	0.79	0.62	0.46	0.51	0.74	0.92	0.97	0.98		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (fa	ollow ste	ens 3 to	7 in Tabl	e 9c)	!			
(90)m=	18.18	18.43	18.85	19.4	19.84	20.1	20.16	20.16	20	19.45	18.73	18.13		(90)
			<u> </u>			<u> </u>			f	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Moon	intornal	tompor	ature (fo	r the wh	ala dwa	lling) – fl	Λ ~ T1	⊥ (1 _ fl	۸) ی T2					
(92)m=	18.99	19.2	19.54	19.99	20.36	20.59	20.65	20.64	20.5	20.03	19.44	18.95		(92)
				<u> </u>		<u> </u>		<u> </u>	ere appro			.0.00		, ,
(93)m=	18.99	19.2	19.54	19.99	20.36	20.59	20.65	20.64	20.5	20.03	19.44	18.95		(93)
8. Spa	ace hea	ting requ	uirement											
						ed at ste	ep 11 of	Table 9l	b, so tha	t Ti <u>,</u> m=(76)m an	d re-calc	ulate	
the ut			or gains									_		
1.1618	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.97	0.96	ains, hm 0.94	0.88	0.78	0.63	0.47	0.52	0.74	0.9	0.96	0.98		(94)
			, W = (94			0.03	0.47	0.52	0.74	0.9	0.90	0.90		(04)
(95)m=		348.82	367.8	373.17	345.98	269.58	193.31	199.58	266.78	301.16	303.34	306.76		(95)
			rnal tem			able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	743.61	722.14	657.34	553.39	431.51	295.33	199.94	208.96	316.78	469.67	617.06	740.63		(97)
Space	e heatin		ement fo	r each n	nonth, k	Wh/mont	h = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	314.71	250.87	215.42	129.76	63.63	0	0	0	0	125.38	225.87	322.8		
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1648.44	(98)
Space	e heating	g require	ement in	kWh/m²	/year								29.53	(99)
9a. En	ergy red	uiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir	_										ı		
Fracti	on of sp	ace hea	at from so	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) x [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								100	(206)
Efficie	ency of s	seconda	ry/supple	ementar	y heatin	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	 year
Space	e heating	g require	ement (c	<u> </u>									•	
	314.71	250.87	215.42	129.76	63.63	0	0	0	0	125.38	225.87	322.8		
(211)m	= {[(98)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	314.71	250.87	215.42	129.76	63.63	0	0	0	0	125.38	225.87	322.8		
•								Tota	I (kWh/yea	ar) =Sum(2	211),,,1012	- <u></u>	1648.44	(211)
												·		•

Space heating fuel (secondary), kWh/month														
= {[(98)m x (201)] } x 100 ÷ (208)														
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		_					
			Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)					
Water heating														
Output from water heater (calculated above) 154.87 136.22 142.4 126.73 123.52 1	09.42	104.17	115.57	115.75	131.46	140.16	150.83							
Efficiency of water heater			1,10101					349.41	(216)					
	349.41	349.41	349.41	349.41	349.41	349.41	349.41		(217)					
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
	31.31	29.81	33.07	33.13	37.62	40.11	43.17							
Total = $Sum(219a)_{112}$ = 443.92														
Annual totals kWh/year kWh/year kWh/year														
Space heating fuel used, main system 1 1648.44														
Space heating fuel used, main system 1 1648.44 Water heating fuel used 443.92														
Electricity for pumps, fans and electric keep-hot														
mechanical ventilation - balanced, extract or pos	sitive in	put fron	n outside	€			153.25		(230a)					
Total electricity for the above, kWh/year			sum	of (230a).	(2 30g) =			153.25	(231)					
Electricity for lighting								255.56	(232)					
Total delivered energy for all uses (211)(221) +	(231) -	+ (232).	(237b)	=				2501.17	(338)					
12a. CO2 emissions – Individual heating system	s inclu	ding mi	cro-CHP											
		ergy h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea						
Space heating (main system 1)	(211)) x			0.5	19	=	855.54	(261)					
Space heating (secondary)	(215)) x			0.5	19	=	0	(263)					
Water heating	(219)) x			0.5	19	=	230.39	(264)					
Space and water heating	(261)) + (262) -	+ (263) + (264) =				1085.93	(265)					
Electricity for pumps, fans and electric keep-hot	(231)) x			0.5	19	=	79.54	(267)					
Electricity for lighting	(232)) x			0.5	19	=	132.64	(268)					
Total CO2, kg/year				sum o	f (265)(2	271) =		1298.11	(272)					
Dwelling CO2 Emission Rate				(272)	÷ (4) =			23.25	(273)					

El rating (section 14)

(274)

			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 201	2		Strom Softwa				Versio	on: 1.0.5.41	
				Address	: 1 Bed I	Mid - MF				
Address :	1 Bed Mid - MF, Lor	ndon, TE	BC .							
1. Overall dwelling dime	nsions:		A ***	n/m 2\		Av. Ua	iaht/m\		Volume(m³)	
Ground floor				a(m²) 55.83	(1a) x		ight(m) 2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	2)+(1b)+(1c)+(1d)+(1c	\⊥ (1r							133.30	
	a)+(1b)+(1c)+(1u)+(1e	:)+(11	'/5	55.83	(4)) . (3c) . (3c	1) . (30) .	(2n) -		٦
Dwelling volume					(3a)+(3b))+(30)+(30	d)+(3e)+	.(311) =	139.58	(5)
2. Ventilation rate:	main s	econdar	37	other		total			m³ per houi	
	heating h	eating	у —	Other		lotai			, per nour	_
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	ns					0	X '	10 =	0	(7a)
Number of passive vents					Ī	0	x '	10 =	0	(7b)
Number of flueless gas fin	res				Ī	0	X 4	40 =	0	(7c)
		(01) (7							nanges per ho	_
Infiltration due to chimney If a pressurisation test has be					continuo fr	0 (0) to		÷ (5) =	0	(8)
Number of storeys in the		σα, ρισσσσ	u 10 (17), (Juliel Wise (Jonanae II	om (a) to ((10)		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber	frame or	0.35 for	r masoni	y constr	ruction			0	(11)
	resent, use the value corres	ponding to	the great	er wall are	a (after					
deducting areas of opening If suspended wooden f		ed) or 0.	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	,	,	(,,					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,	•		•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili	-								0.1	(18)
Air permeability value applie. Number of sides sheltere		s been don	e or a deg	gree air pe	rmeability	is being u	sed			(19)
Shelter factor	u			(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporat	ing shelter factor			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for	-	ł								┛`′
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp	eed from Table 7	•		-	•	•	•	•	•	
 	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
W. J. F. (00.)		-		•	-	•	•	•	•	
Wind Factor (22a)m = $(22a)$ m =	'	0.05	0.05	T 0.00	4	1.00	1 4 4 0	1 40	1	
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	J	

djusted infiltra	ation rat	e (allowi	ing for sl	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1]	
Calculate effect If mechanica		_	rate for t	he appli	icable ca	se						0.5	(2
If exhaust air he			endix N. (2	(23a) = (23a	a) × Fmv (e	eguation (N5)) . othe	rwise (23b	o) = (23a)			0.5	(2
If balanced with									, (,			75.65	(2
a) If balance		-	-	_					2h)m + (23b) × [1 – (23c)		(2
24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22]	(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (I	u MV) (24b	p)m = (22)	2b)m + (23b)	<u> </u>	ı	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
c) If whole h				•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
d) If natural if (22b)n				•	•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change	rate - er	nter (24a	or (24l	b) or (24	c) or (24	ld) in bo	x (25)	•		•	•	
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losse	s and he	eat loss i	naramet	er.									
LEMENT	Gros		Openin		Net Ar	rea	U-val	ue	AXU		k-value	e /	ΑΧk
	area		n		Α,		W/m2		(W/	K)	kJ/m²-		kJ/K
oors					3.57	х	1	=	3.57				(2
/in <mark>dows</mark> Type	1				7.35	x	1/[1/(1)+	0.04] =	7.07				(2
/indows Type	2				3.8	X	1/[1/(1)+	0.04] =	3.65				(2
indows Type	3	'			2.21	x	1/[1/(1)+	0.04] =	2.13				(2
/alls	44.9	98	16.9	3	28.0	5 X	0.18	=	5.05		14	392	2.7
otal area of e	lements	s, m²			44.98	3						_	(;
arty wall					39.86	5 x	0	=	0		20	797	7.2
arty floor					55.83	3					40	223	3.2
arty ceiling					55.83	3				Ī	30	167	4.9 (
ternal wall **					63.7					Ī	9	573	.39 (
for windows and include the area					alue calcu		g formula 1	I/[(1/U-valu	ue)+0.04] á	as given in	paragraph		,
abric heat los	s, W/K	= S (A x	U)				(26)(30) + (32) =				21.47	(:
eat capacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	5671.39	(
nermal mass	parame	eter (TMF	= Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			101.58	(
or design assess on be used instea	ad of a de	tailed calc	ulation.			•	recisely the	e indicative	e values of	TMP in Ta	able 1f		
nermal bridge	,	,			•	K						7.11	(:
details of therma		are not kn	nown (36) =	= 0.05 x (3	31)			(22) -	(26) -				<u> </u>
otal fabric he		ala lata:							$-(36) = 0.33 \times ($,		28.58	(;
entilation hea													

(38)m= 10.6 10.5 10.4 9.91 9.82 9.33 9.33 9.23 9.52 9.82 10.01 10.21	(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m	
(39)m= 39.18 39.08 38.98 38.49 38.39 37.9 37.9 37.81 38.1 38.39 38.59 38.78	
Heat loss parameter (HLP), W/m²K Average = Sum(39) ₁₁₂ /12= 38.4 $(40)m = (39)m \div (4)$	(39)
(40)m= 0.7 0.7 0.69 0.69 0.68 0.68 0.68 0.69 0.69 0.69	
Average = $Sum(40)_{112}/12=$ 0.69 Number of days in month (Table 1a)	(40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(41)m= 31 28 31 30 31 30 31 30 31 30 31	(41)
4. Water heating energy requirement: kWh/year:	
Assumed occupancy, N	(42)
Assumed occupancy, N = 1.86 if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	
(44)m= 86.26 83.12 79.98 76.85 73.71 70.57 70.57 73.71 76.85 79.98 83.12 86.26	
Total = Sum(44) ₁₁₂ = 940.9	7 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)	``
(45)m= 127.91 111.87 115.44 100.65 96.57 83.34 77.22 88.61 89.67 104.5 114.07 123.88	
Total = Sum(45) ₁₁₂ = 1233. If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	(45)
	(46)
(46)m= 19.19 16.78 17.32 15.1 14.49 12.5 11.58 13.29 13.45 15.68 17.11 18.58 Water storage loss:	(40)
Storage volume (litres) including any solar or WWHRS storage within same vessel 201	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)	
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)	
Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0.54	(48)
Town and an form Table 81	(49)
Energy lost from water storage, kWh/year (48) x (49) = 0.8694	(50)
b) If manufacturer's declared cylinder loss factor is not known:	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	(51)
If community heating see section 4.3	(==)
Volume factor from Table 2a Temperature factor from Table 2b 0	(52) (53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ Enter (50) or (54) in (55)	(54) (55)
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	(55)
(56)m= 26.95 24.34 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95	(56)
If cylinder contains dedicated solar storage, (57) m = (56) m x $[(50)$ – $(H11)]$ ÷ (50) , else (57) m = (56) m where $(H11)$ is from Appendix H	` '
(57)m= 26.95 24.34 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95 26.08 26.95	(57)

Primary circuit loss (annual) fro		50 \ ((50) - 00	·				0		(58)
Primary circuit loss calculated to (modified by factor from Tab	,		. ,	, ,		r thermo	stat)			
(59)m= 0 0 0	0 0	0	0	0	0	0	0	0		(59)
Combi loss calculated for each	month (61)m = ((60) ÷ 36	65 × (41)	ım						
(61)m= 0 0 0	0 0	0	0	0	0	0	0	0		(61)
Total heat required for water he	eating calculated	for each	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 154.87 136.22 142.4	126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		(62)
Solar DHW input calculated using App	endix G or Appendix	H (negativ	ve quantity) (enter '0	' if no sola	r contribut	ion to wate	er heating)	·	
(add additional lines if FGHRS	and/or WWHRS	applies,	, see Ap	pendix (3)					
(63)m= 0 0 0	0 0	0	0	0	0	0	0	0		(63)
FHRS 0 0 0	0 0	0	0	0	0	0	0	0		(63) (G2
Output from water heater			-					_		
(64)m= 154.87 136.22 142.4	126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		_
				Outp	out from wa	ater heate	r (annual)₁	12	1551.09	(64)
Heat gains from water heating,	kWh/month 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	
(65)m= 42.53 37.2 38.39	33.47 32.11	27.71	25.68	29.46	29.82	34.75	37.93	41.19		(65)
include (57)m in calculation	of (65)m only if c	ylinder is	s in the	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Internal gains (see Table 5	5 and 5a):					_				
Met <mark>abolic gains (Table 5),</mark> Wat	ts									
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 93.08 93.08 93.08	93.08 93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08		(66)
Lighting gains (calculated in Ap										
(67)m= 14.47 12.85 10.45	7.91 5.92	4.99	5.4	7.01	9.41	11.95	13.95	14.87		(67)
Appliances gains (calculated in									ı	
(68)m= 162.32 164.01 159.76	150.73 139.32	128.6	121.44	119.75	124	133.03	144.44	155.16		(68)
Cooking gains (calculated in A	 						1	1	1	(00)
(69)m= 32.31 32.31 32.31	32.31 32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31		(69)
Pumps and fans gains (Table 5	' 								İ	(70)
(70)m= 0 0 0	0 0	0	0	0	0	0	0	0		(70)
Losses e.g. evaporation (negation	 								I	(74)
(71)m= -74.47 -74.47 -74.47	-74.47 -74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47		(71)
Water heating gains (Table 5)		00.40	0.54			40.7		55.00	1	(70)
(72)m= 57.17 55.35 51.59	46.48 43.16	38.48	34.51	39.6	41.41	46.7	52.68	55.36		(72)
Total internal gains =	050 04 000 00		m + (67)m					1	İ	(72)
(73)m= 284.88 283.14 272.73	256.04 239.32	223	212.27	217.29	225.75	242.61	262	276.32		(73)
6. Solar gains:Solar gains are calculated using sola	r flux from Table 6a a	and associ	iated equa	tions to co	nvert to th	e applicat	ole orientat	ion		
Orientation: Access Factor	Area	Flu			g_	- applicat	FF		Gains	
Table 6d	m²		ole 6a	Т	able 6b	Т	able 6c		(W)	
Southeast 0.9x 0.77 x	3.8	x 3	6.79	х	0.3	x	0.7	=	20.35	(77)

				_		_						
Southeast _{0.9x}	0.77	X	3.8	X	62.67	X	0.3	X	0.7	=	34.66	(77)
Southeast 0.9x	0.77	x	3.8	X	85.75	X	0.3	x	0.7	=	47.42	(77)
Southeast 0.9x	0.77	x	3.8	X	106.25	X	0.3	x	0.7	=	58.76	(77)
Southeast _{0.9x}	0.77	x	3.8	X	119.01	X	0.3	x [0.7	=	65.81	(77)
Southeast 0.9x	0.77	X	3.8	×	118.15	X	0.3	x [0.7	=	65.34	(77)
Southeast 0.9x	0.77	x	3.8	×	113.91	X	0.3	x	0.7	=	62.99	(77)
Southeast 0.9x	0.77	X	3.8	X	104.39	X	0.3	x [0.7	=	57.73	(77)
Southeast _{0.9x}	0.77	X	3.8	X	92.85	X	0.3	x	0.7	=	51.35	(77)
Southeast _{0.9x}	0.77	X	3.8	X	69.27	X	0.3	x	0.7	=	38.31	(77)
Southeast 0.9x	0.77	X	3.8	X	44.07	X	0.3	x [0.7	=	24.37	(77)
Southeast 0.9x	0.77	X	3.8	x	31.49	X	0.3	x [0.7	=	17.41	(77)
Southwest _{0.9x}	0.77	X	2.21	X	36.79		0.3	x	0.7	=	11.83	(79)
Southwest _{0.9x}	0.77	X	2.21	X	62.67		0.3	x	0.7	=	20.16	(79)
Southwest _{0.9x}	0.77	X	2.21	x	85.75]	0.3	x	0.7	=	27.58	(79)
Southwest _{0.9x}	0.77	X	2.21	x	106.25]	0.3	x	0.7	=	34.17	(79)
Southwest _{0.9x}	0.77	X	2.21	x	119.01	Ī	0.3	x [0.7	=	38.28	(79)
Southwest _{0.9x}	0.77	X	2.21	x	118.15	Ī	0.3	x	0.7	=	38	(79)
Southwest _{0.9x}	0.77	X	2.21	×	113.91		0.3	х	0.7	=	36.64	(79)
Southwest _{0.9x}	0.77	x	2.21	х	104.39	j .	0.3	x	0.7	-	33.57	(79)
Southwest _{0.9x}	0.77	x	2.21	х	92.85	j /	0.3	x	0.7	=	29.86	(79)
Southwest _{0.9x}	0.77	x	2.21	x	69.27	i /	0.3	x	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	x	2.21	x	44.07		0.3	x	0.7	=	14.17	(79)
Southwest _{0.9x}	0.77	x	2.21	x	31.49		0.3	x	0.7	=	10.13	(79)
Northwest 0.9x	0.77	x	7.35	х	11.28	X	0.3	х	0.7	=	12.07	(81)
Northwest 0.9x	0.77	x	7.35	x	22.97	X	0.3	×	0.7	-	24.57	(81)
Northwest _{0.9x}	0.77	X	7.35	x	41.38	X	0.3	x	0.7	=	44.26	(81)
Northwest _{0.9x}	0.77	X	7.35	x	67.96	X	0.3	x	0.7	=	72.69	(81)
Northwest _{0.9x}	0.77	X	7.35	x	91.35	X	0.3	_ x [0.7	=	97.71	(81)
Northwest 0.9x	0.77	X	7.35	×	97.38	X	0.3	x [0.7	=	104.17	(81)
Northwest 0.9x	0.77	X	7.35	x	91.1	X	0.3	= x [0.7	=	97.45	(81)
Northwest 0.9x	0.77	X	7.35	x	72.63	X	0.3	= x [0.7	=	77.69	(81)
Northwest 0.9x	0.77	X	7.35	x	50.42	X	0.3	x	0.7	=	53.93	(81)
Northwest 0.9x	0.77	X	7.35	x	28.07	x	0.3	x [0.7	=	30.02	(81)
Northwest 0.9x	0.77	X	7.35	x	14.2	x	0.3	x [0.7	=	15.19	(81)
Northwest 0.9x	0.77	X	7.35	x	9.21	x	0.3	x	0.7	=	9.86	(81)
				•		•		_				_
Solar gains in wa	atts, calculate	ed	for each mon	th		(83)m	n = Sum(74)m	(82)m				
(83)m= 44.25	79.38 119.26	3	165.62 201.8	2	07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)
Total gains – inte	ernal and sol	ar	(84)m = (73) n	า + (83)m , watts							
(84)m= 329.13 3	391.99)	421.66 441.12	2 4	30.51 409.34	386	.28 360.89	333.22	315.73	313.72		(84)
7. Mean interna	ıl temperatur	e (heating seaso	n)								
Temperature du	uring heating	ре	eriods in the li	ving	area from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisation facto	r for gains fo	r li	ving area, h1,	m (s	ee Table 9a)							_
Jan	Feb Mar	$\cdot $	Apr Ma	у	Jun Jul	A	ug Sep	Oct	Nov	Dec		
Stroma FSAP 2012 \	/ersion: 1 0 5 4	1 (9	SAP 9 92) - http://	\A/\A/\A/	stroma com						Page	5 of 7

(86)m= 0.96 0.94 0.9 0.83 0.7 0.53 0.4 0.44 0.65 0.85 0.94 0.96 0.96 Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.73 19.92 20.21 20.56 20.82 20.95 20.99 20.98 20.89 20.57 20.1 19.69 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.65 20.65 20.66
(87)m= 19.73 19.92 20.21 20.56 20.82 20.95 20.99 20.98 20.89 20.57 20.1 19.69 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.65 20.65 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.65 20.65 20.65 20.65 20.65 20.66 20
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 20.65 20.65 20.65 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.65 20.65 Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)
(88)m= 20.65 20.65 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.65 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)
(88)m= 20.65 20.65 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.66 20.65 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)
(90)m= 18.61 18.88 19.3 19.79 20.14 20.31 20.35 20.35 19.82 19.15 18.56 (90)m= 18.61 18.88 19.3 19.79 20.14 20.31 20.35 20.25 19.82 19.15 18.56
fLA = Living area \div (4) = 0.6 (91)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.29 19.51 19.85 20.25 20.55 20.7 20.73 20.73 20.64 20.27 19.72 19.24 (92)
(92)m= 19.29 19.51 19.85 20.25 20.55 20.7 20.73 20.73 20.64 20.27 19.72 19.24 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate
(93)m= 19.29 19.51 19.85 20.25 20.55 20.7 20.73 20.73 20.64 20.27 19.72 19.24 (93)m= 19.29 19.51 19.85 20.25 20.55 20.7 20.73 20.73 20.64 20.27 19.72 19.24
8. Space heating requirement
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
the utilisation factor for gains using Table 9a
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Utilisation factor for gains, hm:
(94)m= 0.94 0.92 0.88 0.8 0.68 0.51 0.38 0.41 0.63 0.83 0.92 0.95
Useful gains, hmGm , W = (94)m x (84)m
(95)m= 310.73 334.38 345.81 338.35 298.23 220.3 154.09 159.96 225.96 276.31 290.31 298.35 (95)m= 310.73 334.38 345.81 338.35 298.23 220.3 154.09 159.96 225.96 276.31 290.31 298.35
Monthly average external temperature from Table 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)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m–(96)m]
(97)m= 587.18 570.88 520.29 437.04 339.69 231.11 156.71 163.7 249.09 371.24 486.99 583.32 (97)m= 587.18 570.88 520.29 437.04 339.69 231.11 156.71 163.7 249.09 371.24 486.99 583.32
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m
(98)m= 205.68 158.93 129.81 71.06 30.85 0 0 0 70.63 141.61 212.02
Total per year (kWh/year) = Sum(98) _{15,912} = 1020.58 (98
Space heating requirement in kWh/m²/year 18.28 (99
9a. Energy requirements – Individual heating systems including micro-CHP)
Space heating:
Fraction of space heat from secondary/supplementary system 0 (20
Fraction of space heat from main system(s) $(202) = 1 - (201) =$ 1 (20
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] = 1$ 1 (20
Efficiency of main space heating system 1
Efficiency of secondary/supplementary heating system, % 0 (20
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year
Space heating requirement (calculated above) 205.68 158.93 129.81 71.06 30.85 0 0 0 70.63 141.61 212.02
$ (211)m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ 205.68 158.93 129.81 71.06 30.85 0 0 0 70.63 141.61 212.02 $
Total (kWh/year) =Sum(211) _{15,1012} = 1020.58 (21

Space heating fuel (secondary), kWh/month									
$= \{[(98)m \times (201)] \} \times 100 \div (208)$ $(215)m = $	0	0	0	0	0	0	0		
	·	•	Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,1012}	2=	0	(215)
Water heating									_
Output from water heater (calculated above) 154.87 136.22 142.4 126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		
Efficiency of water heater	109.42	104.17	115.57	113.73	131.40	140.10	130.03	349.41	(216)
(217)m= 349.41 349.41 349.41 349.41 349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	0.10.11	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m	1	1						I	
(219)m= 44.32 38.99 40.75 36.27 35.35	31.31	29.81	33.07	33.13	37.62	40.11	43.17		
	-		Tota	ıl = Sum(2	19a) ₁₁₂ =	-		443.92	(219)
Annual totals					k'	Wh/yeaı	r	kWh/year	_
Space heating fuel used, main system 1								1020.58	╛
Water heating fuel used								443.92	
Electricity for pumps, fans and electric keep-h	ot								
mechanical ventilation - balanced, extract or	positive i	nput fror	n outside	е			153.25		(230a)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			153.25	(231)
Electricity for lighting								255.56	(232)
Total delivered energy for all uses (211)(22) + (231)	+ (232).	(237b)	=				1873.32	(338)
12a. CO2 emissions – Individual heating sys	Er	uding mi nergy Vh/year	cro-CHF		Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(21	1) x			0.5	19	=	529.68	(261)
Space heating (secondary)	(21	5) x			0.5	19	=	0	(263)
Water heating	(21	9) x			0.5	19	=	230.39	(264)
Space and water heating	(26	1) + (262)	+ (263) + ((264) =				760.07	(265)
Electricity for pumps, fans and electric keep-h	ot (23	1) x			0.5	19	=	79.54	(267)
Electricity for lighting	(23	2) x			0.5	19	=	132.64	(268)
Total CO2, kg/year				sum o	f (265)(2	271) =		972.25	(272)
Dwelling CO2 Emission Rate				(272)	÷ (4) =			17.41	(273)

El rating (section 14)

(274)

			User D	etai <u>ls:</u>						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	1 Bed Mid - TF, L		i i	Address	i beu i	viia - TF				
1. Overall dwelling dime	nsions:									
			Are	a(m²)		Av. He	ight(m)	7	Volume(m ³	_
Ground floor			5	55.83	(1a) x	2	2.5	(2a) =	139.58	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	1) 5	55.83	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	139.58	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns					0	x	10 =	0	(7a)
Number of passive vents					Ē	0	x '	10 =	0	(7b)
Number of flueless gas fir	res				F	0	X e	40 =	0	(7c)
					L					
								Air ch	nanges <mark>per</mark> ho	ur
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in th		ended, procee	d to (17),	otherwise (continue fr	om (9) to ((16)		0	(9)
Additional infiltration	ie aweiling (115)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pr		rresponding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden fl	• / .	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	•	•	`	,,					0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	_			0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value, of the state of the			•	•	•	etre of e	nvelope	area	2	(17)
Air permeability value applies	•					is being u	sed		0.1	(18)
Number of sides sheltere			·	,	·	ŭ			2	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for		i							1	
L	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe		20	3.8	27	<i>A</i>	4.3	1 F	4.7	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	ა.ఠ	3.7	4	4.3	4.5	4./	I	
Wind Factor (22a)m = $(22a)$ m =	2)m ÷ 4								_	
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

djusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
<i>Calculate effec</i> If mechanica		_	rate for t	ne appıı	cable ca	se						0.5	(23
If exhaust air he			endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with		•		, ,	,	. ,	,,	,	, , ,			75.65	
a) If balance		-	-	_					2b)m + (23b) x [1	ا (23c) – 1		(20
24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22	00]	(24
b) If balance	d mech	anical ve	ntilation	without	heat red	overv (N	ı ЛV) (24b)m = (22	2b)m + (23b)			
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole he				•	•				5 x (23h) '		l	
$\frac{1}{24c} = 0$	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	/entilatio	n or wh	ole hous	e nositiv		ventilatio	n from l	l					`
if (22b)m									0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)		-	-		
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losses	and he	eat loss r	paramete	ir.							_	_	
LEMENT	Gros area	ss	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-value kJ/m²-ł		A X k kJ/K
oo <mark>rs</mark>					3.57	x	1	= [3.57	Ď.			(20
/indows Type	1				7.35	X	1/[1/(1)+	0.04] =	7.07	Ħ			(27
/indows Type	2				3.8	X	1/[1/(1)+	0.04] =	3.65	Ħ			(27
Vindows Type	3				2.21	×	1/[1/(1)+	0.04] =	2.13	5			(27
Valls	44.9	98	16.93	3	28.05	x	0.18	 	5.05	=	14		92.7 (29
loof	55.8		0		55.83	=	0.11	<u>-</u>	6.14	=	9	국 누	02.47 (30
otal area of el					100.8	=	<u> </u>						(3′
arty wall		,			39.86	=	0		0	— г	20		97.2 (3
arty floor					55.83	=	<u> </u>				40	= =	233.2 (32
nternal wall **					63.71	=				L T	9	= =	73.39 (32
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	re)+0.04] a	L as given in			(02
abric heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				27.61	(33
leat capacity (Cm = S((Axk)						((28)	.(30) + (32)	2) + (32a).	(32e) =	4498.9	96 (34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			80.58	3 (3
or design assess an be used instea				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge	s : S (L	x Y) cal	culated (using Ap	pendix l	<						14.72	2 (30
details of therma otal fabric hea		are not kn	own (36) =	= 0.05 x (3	11)			(33) +	(36) =			42.32	2 (3
entilation hea	t loss ca	alculated	l monthly	/				(38)m	= 0.33 × ((25)m x (5)))		
		Mar	Apr	May	Jun	Jul	Aug	Sep		i .	Dec	l	

													l	(22)
(38)m=	10.6	10.5	10.4	9.91	9.82	9.33	9.33	9.23	9.52	9.82	10.01	10.21	I	(38)
Heat tr	ansfer o		nt, W/K	·				-	(39)m	= (37) + (38)m		1	
(39)m=	52.92	52.82	52.73	52.24	52.14	51.65	51.65	51.55	51.84	52.14	52.33	52.53		7,00
Heat lo	ss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	52.21	(39)
(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	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	0.94	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
											•			
4. Wa	ater heat	ing ene	rgy requi	irement:								kWh/ye	ear:	
Assum	ned occu	inancy I	N								1	86		(42)
if TF		9, N = 1		[1 - exp	(-0.0003	49 x (TF	FA -13.9))2)] + 0.0	0013 x (ΓFA -13.		00		(42)
Annua	l averag	e hot wa						(25 x N)				.41		(43)
		-		• •	5% if the a ater use, l	-	•	to achieve	a water us	se target o	f			
notmon			,					1	0	0.1	NI.	D		
Hot wate	Jan er usage ir	Feb	Mar day for ea	Apr ach month	Vd,m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
		83.12		76.85		70.57			76.05	70.00	02.12	96.26		
(44)m=	86.26	63.12	79.98	70.00	73.71	70.57	70.57	73.71	76.85	79.98	83.12 m(44) ₁₁₂ =	86.26	940.97	(44)
Energy	content of	hot wa <mark>ter</mark>	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x C)Tm / 3600			. ,		340.01	(/
(45)m=	127.91	111.87	115.44	100.65	96.57	83.34	77.22	88.61	89.67	104.5	114.07	123.88		_
If instan	taneous w	rater heati	na at point	of use (no	hot water	storage).	enter 0 in	boxes (46)		Γota <mark>l = Su</mark>	m(45) ₁₁₂ =	=	1233.75	(45)
(46)m=	19.19	16.78	17.32	15.1	14.49	12.5	11.58	13.29	13.45	15.68	17.11	18.58		(46)
` '	storage		17.02	10.1	14.40	12.0	11.00	10.20	10.40	10.00	''''	10.00		(12)
Storag	e volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel	20)1		(47)
	•	_			elling, e			, ,						
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage		eclared I	oss facto	or is kno	wn (k\N/h	n/day).					54		(48)
•			m Table		JI 10 KI10	WII (ICVVI	i, ady).					694		(49)
•			storage		ear			(48) x (49)) =			0		(50)
•			_	-	oss fact	or is not		(10) // (10)	,			U		(50)
		-			e 2 (kWl	n/litre/da	ıy)					0		(51)
	-	-	ee secti	on 4.3									ı	
	e factor			2h								0		(52)
•			m Table					()	>	>		0		(53)
٠.	/ lost fro (50) or (storage	, KVVh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
	` '	, ,	culated f	for each	month			((56)m = (55) v (41):	m	0.	87		(55)
						20.00		, ,	, , , ,		20.00	20.05		(56)
(56)m=	26.95 er contains	24.34 dedicate	26.95 d solar sto	26.08 rage, (57)	26.95 m = (56)m	26.08 x [(50) – (26.95 H11)] ÷ (5)	26.95 0), else (57	26.08 7)m = (56)	26.95 m where (26.08 H11) is fro	26.95 m Append	ix H	(56)
(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
(37)m=	20.95	24.34	20.95	20.08	20.95	20.08	20.95	20.95	20.08	20.95	20.08	20.95		(01)

Primary circuit loss (annual) fro		50 \ ((50) - 00	·				0		(58)
Primary circuit loss calculated to (modified by factor from Tab	,		. ,	, ,		r thermo	stat)			
(59)m= 0 0 0	0 0	0	0	0	0	0	0	0		(59)
Combi loss calculated for each	month (61)m = ((60) ÷ 36	65 × (41)	ım						
(61)m= 0 0 0	0 0	0	0	0	0	0	0	0		(61)
Total heat required for water he	eating calculated	for each	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 154.87 136.22 142.4	126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		(62)
Solar DHW input calculated using App	endix G or Appendix	H (negativ	ve quantity) (enter '0	' if no sola	r contribut	ion to wate	er heating)	·	
(add additional lines if FGHRS	and/or WWHRS	applies,	, see Ap	pendix (3)					
(63)m= 0 0 0	0 0	0	0	0	0	0	0	0		(63)
FHRS 0 0 0	0 0	0	0	0	0	0	0	0		(63) (G2
Output from water heater			-					_		
(64)m= 154.87 136.22 142.4	126.73 123.52	109.42	104.17	115.57	115.75	131.46	140.16	150.83		_
				Outp	out from wa	ater heate	r (annual)₁	12	1551.09	(64)
Heat gains from water heating,	kWh/month 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	
(65)m= 42.53 37.2 38.39	33.47 32.11	27.71	25.68	29.46	29.82	34.75	37.93	41.19		(65)
include (57)m in calculation	of (65)m only if c	ylinder is	s in the	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Internal gains (see Table 5	5 and 5a):					_				
Met <mark>abolic gains (Table 5),</mark> Wat	ts									
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 93.08 93.08 93.08	93.08 93.08	93.08	93.08	93.08	93.08	93.08	93.08	93.08		(66)
Lighting gains (calculated in Ap										
(67)m= 14.47 12.85 10.45	7.91 5.92	4.99	5.4	7.01	9.41	11.95	13.95	14.87		(67)
Appliances gains (calculated in									ı	
(68)m= 162.32 164.01 159.76	150.73 139.32	128.6	121.44	119.75	124	133.03	144.44	155.16		(68)
Cooking gains (calculated in A	 						1	1	1	(00)
(69)m= 32.31 32.31 32.31	32.31 32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31		(69)
Pumps and fans gains (Table 5	' 								İ	(70)
(70)m= 0 0 0	0 0	0	0	0	0	0	0	0		(70)
Losses e.g. evaporation (negation	 								I	(74)
(71)m= -74.47 -74.47 -74.47	-74.47 -74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47	-74.47		(71)
Water heating gains (Table 5)		00.40	0.54			40.7		55.00	1	(70)
(72)m= 57.17 55.35 51.59	46.48 43.16	38.48	34.51	39.6	41.41	46.7	52.68	55.36		(72)
Total internal gains =	050 04 000 00		m + (67)m					1	İ	(72)
(73)m= 284.88 283.14 272.73	256.04 239.32	223	212.27	217.29	225.75	242.61	262	276.32		(73)
6. Solar gains:Solar gains are calculated using sola	r flux from Table 6a a	and associ	iated equa	tions to co	nvert to th	e applicat	ole orientat	ion		
Orientation: Access Factor	Area	Flu			g_	- applicat	FF		Gains	
Table 6d	m²		ole 6a	Т	able 6b	Т	able 6c		(W)	
Southeast 0.9x 0.77 x	3.8	x 3	6.79	х	0.3	x	0.7	=	20.35	(77)

				_		_						
Southeast _{0.9x}	0.77	X	3.8	X	62.67	X	0.3	X	0.7	=	34.66	(77)
Southeast 0.9x	0.77	x	3.8	X	85.75	X	0.3	x	0.7	=	47.42	(77)
Southeast 0.9x	0.77	x	3.8	X	106.25	X	0.3	x	0.7	=	58.76	(77)
Southeast _{0.9x}	0.77	x	3.8	X	119.01	X	0.3	x [0.7	=	65.81	(77)
Southeast 0.9x	0.77	X	3.8	×	118.15	X	0.3	x [0.7	=	65.34	(77)
Southeast 0.9x	0.77	x	3.8	×	113.91	X	0.3	x	0.7	=	62.99	(77)
Southeast 0.9x	0.77	X	3.8	X	104.39	X	0.3	x [0.7	=	57.73	(77)
Southeast _{0.9x}	0.77	X	3.8	X	92.85	X	0.3	x	0.7	=	51.35	(77)
Southeast _{0.9x}	0.77	X	3.8	X	69.27	X	0.3	x	0.7	=	38.31	(77)
Southeast 0.9x	0.77	X	3.8	X	44.07	X	0.3	x [0.7	=	24.37	(77)
Southeast 0.9x	0.77	X	3.8	x	31.49	X	0.3	x [0.7	=	17.41	(77)
Southwest _{0.9x}	0.77	X	2.21	X	36.79]	0.3	x	0.7	=	11.83	(79)
Southwest _{0.9x}	0.77	X	2.21	X	62.67		0.3	x	0.7	=	20.16	(79)
Southwest _{0.9x}	0.77	X	2.21	x	85.75]	0.3	x	0.7	=	27.58	(79)
Southwest _{0.9x}	0.77	X	2.21	x	106.25]	0.3	x	0.7	=	34.17	(79)
Southwest _{0.9x}	0.77	X	2.21	x	119.01	Ī	0.3	x [0.7	=	38.28	(79)
Southwest _{0.9x}	0.77	X	2.21	x	118.15	Ī	0.3	x	0.7	=	38	(79)
Southwest _{0.9x}	0.77	X	2.21	×	113.91		0.3	х	0.7	=	36.64	(79)
Southwest _{0.9x}	0.77	x	2.21	х	104.39	j .	0.3	x	0.7	-	33.57	(79)
Southwest _{0.9x}	0.77	x	2.21	х	92.85	j /	0.3	x	0.7	=	29.86	(79)
Southwest _{0.9x}	0.77	x	2.21	x	69.27	i /	0.3	x	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	x	2.21	x	44.07		0.3	x	0.7	=	14.17	(79)
Southwest _{0.9x}	0.77	x	2.21	x	31.49		0.3	x	0.7	=	10.13	(79)
Northwest 0.9x	0.77	x	7.35	х	11.28	X	0.3	х	0.7	=	12.07	(81)
Northwest 0.9x	0.77	x	7.35	x	22.97	X	0.3	×	0.7	-	24.57	(81)
Northwest _{0.9x}	0.77	X	7.35	x	41.38	X	0.3	x	0.7	=	44.26	(81)
Northwest _{0.9x}	0.77	X	7.35	x	67.96	X	0.3	x	0.7	=	72.69	(81)
Northwest _{0.9x}	0.77	X	7.35	x	91.35	X	0.3	_ x [0.7	<u> </u>	97.71	(81)
Northwest 0.9x	0.77	X	7.35	×	97.38	X	0.3	x [0.7	=	104.17	(81)
Northwest 0.9x	0.77	X	7.35	x	91.1	X	0.3	= x [0.7	=	97.45	(81)
Northwest 0.9x	0.77	X	7.35	x	72.63	X	0.3	= x [0.7	=	77.69	(81)
Northwest 0.9x	0.77	X	7.35	x	50.42	X	0.3	x	0.7	=	53.93	(81)
Northwest 0.9x	0.77	х	7.35	x	28.07	x	0.3	x [0.7	=	30.02	(81)
Northwest 0.9x	0.77	X	7.35	x	14.2	X	0.3	x [0.7	=	15.19	(81)
Northwest 0.9x	0.77	X	7.35	x	9.21	x	0.3	x	0.7	=	9.86	(81)
				•		•		_				_
Solar gains in wa	atts, calculate	ed	for each mon	th		(83)m	n = Sum(74)m	(82)m				
(83)m= 44.25	79.38 119.26	3	165.62 201.8	2	07.51 197.07	168	.99 135.14	90.61	53.73	37.4		(83)
Total gains – inte	ernal and sol	ar	(84)m = (73) n	า + (83)m , watts							
(84)m= 329.13 3	391.99)	421.66 441.12	2 4	30.51 409.34	386	.28 360.89	333.22	315.73	313.72		(84)
7. Mean interna	ıl temperatur	e (heating seaso	n)								
Temperature du	uring heating	ре	eriods in the li	ving	area from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisation facto	r for gains fo	r li	ving area, h1,	m (s	ee Table 9a)							_
Jan	Feb Mar	$\cdot $	Apr Ma	у	Jun Jul	A	ug Sep	Oct	Nov	Dec		
Stroma FSAP 2012 \	/ersion: 1 0 5 4	1 (9	SAP 9 92) - http://	\A/\A/\A/	stroma com						Page	5 of 7

							-	-			_	-		
(86)m=	0.95	0.93	0.9	0.85	0.76	0.62	0.49	0.53	0.72	0.87	0.93	0.95		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.75	18.98	19.38	19.91	20.4	20.75	20.9	20.88	20.61	20	19.29	18.7		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	20.53	20.53	20.53	20.53	20.53	20.54	20.54	20.54	20.54	20.53	20.53	20.53		(88)
Utilisa	ation fac	tor for a	ains for r	rest of d	welling.	h2.m (se	ee Table	9a)			•			
(89)m=	0.95	0.93	0.9	0.84	0.74	0.59	0.45	0.49	0.69	0.86	0.93	0.95		(89)
Mean	interna	l temner	ature in	the rest	of dwelli	na T2 (f	ollow ste	ns 3 to	7 in Tahl	 _	Į.	l		
(90)m=	17.09	17.42	18	18.76	19.43	19.9	20.07	20.05	19.73	18.89	17.87	17.02		(90)
, ,							ļ	ļ	lf	LA = Livin	g area ÷ (4	4) =	0.6	(91)
Moon	intorno	l tompor	oturo (fo	r tha wh	مام طبیره	lling\ f	I A T 4	. /4 fl	Λ) Το					
(92)m=	18.09	18.36	ature (fo	19.46	20.02	20.41	20.57	20.55	20.26	19.56	18.73	18.03		(92)
			he mean			<u> </u>					10.75	10.00		(02)
(93)m=	18.09	18.36	18.84	19.46	20.02	20.41	20.57	20.55	20.26	19.56	18.73	18.03		(93)
		ting requ	uirement											
					e obtain	ed at st	ep 11 of	Table 9l	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm		0.70	0.50		0.40	0.00	0.00	0.0	0.00		(04)
(94)m=	0.92	0.91	0.87	0.81	0.72	0.58	0.46	0.49	0.68	0.83	0.9	0.93	ı	(94)
(95)m=		328.14	W = (94)	341.74	315.75	251.56	186.81	190.81	244.44	276.76	285.08	292.35		(95)
			rnal tem				100.01	190.01	244.44	270.70	200.00	292.55		(50)
(96)m=		4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		e for mea	an intern	al tempe	erature,	L Lm , W :	 =[(39)m :	x [(93)m	– (96)m]	<u> </u>	l		
(97)m=		711.23	650.4	551.43	433.57	300.2	205.15	213.85	319.4	467.15	608.42	726.55		(97)
Spac	e heatin	g require	ement fo	r each n	nonth, k\	/Vh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	316.53	257.44	229.75	150.98	87.66	0	0	0	0	141.65	232.8	323.05		
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	1739.86	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								31.16	(99)
9a. En	ergy rec	uiremer	nts – Indi	vidual h	eating s	ystems i	ncluding	micro-C	CHP)					
	e heatir					,			,					
Fract	ion of sp	ace hea	nt from se	econdar	y/supple	mentary	system						0	(201)
Fract	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from i	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heati	ing syste	em 1								100	(206)
Efficie	ency of s	seconda	ry/supple	ementar	y heating	g systen	ո, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	l vear
Spac			ement (c			<u> </u>	I Jui	ı Aug	І Обр		1100	l Dec	IXVVII/	your
	316.53	257.44	229.75	150.98	87.66	0	0	0	0	141.65	232.8	323.05		
(211)m	 n = {[(98)m x (20	u——— 4)] } x 1	00 ÷ (20)6)	<u> </u>					!			(211)
(///	316.53	257.44	229.75	150.98	87.66	0	0	0	0	141.65	232.8	323.05		` '
					<u> </u>	ı	<u> </u>	Tota	l ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1739.86	(211)

Space heating fuel (secondary), kWh/month								
= {[(98)m x (201)] } x 100 ÷ (208)		_		•			•	
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		_
		Tota	al (kWh/yea	ar) =Sum(2	215) _{15,1012}	2=	0	(215)
Water heating								
Output from water heater (calculated above) 154.87 136.22 142.4 126.73 123.52 1	09.42 104.17	115.57	115.75	131.46	140.16	150.83		
Efficiency of water heater		1	1		1	100.00	349.41	(216)
	349.41 349.4°	349.41	349.41	349.41	349.41	349.41		(217)
Fuel for water heating, kWh/month		!	!	<u> </u>				
(219) m = (64) m x $100 \div (217)$ m		T	T				1	
(219)m= 44.32 38.99 40.75 36.27 35.35 3	31.31 29.81	33.07	33.13 al = Sum(2	37.62	40.11	43.17		7(0.40)
Annual totals		1018	ai = Suili(2		Mhhraai		443.92 kWh/yea i	(219)
Space heating fuel used, main system 1				K	Wh/year		1739.86	
Water heating fuel used							443.92	╡
-							440.02	
Electricity for pumps, fans and electric keep-hot							1	(000)
mechanical ventilation - balanced, extract or pos	sitive input fro					153.25		(230a)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			153.25	(231)
Electricity for lighting							255.56	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232	.)(237b)	=				2592.59	(338)
12a. CO2 emissions – Individual heating system	s including r	nicro-CHF						
	Energy			Emiss	ion fac	tor	Em <mark>issio</mark> ns	;
	kWh/yea	r		kg CO	2/kWh		kg CO2/ye	ar
Space heating (main system 1)	(211) x			0.5	19	=	902.99	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.5	19	=	230.39	(264)
Space and water heating	(261) + (262	2) + (263) +	(264) =				1133.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	79.54	(267)
Electricity for lighting	(232) x			0.5	19	=	132.64	(268)
Total CO2, kg/year			sum o	f (265)(271) =		1345.56	(272)
Dwelling CO2 Emission Rate			(272)	÷ (4) =			24.1	(273)

El rating (section 14)

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			User D	etails:						
Assessor Name: Software Name:	Stroma FSAP 2			Strom Softwa Address	are Ve	rsion:		Versio	n: 1.0.5.41	
Address :	1 Bed Var - EF, L		i i	Address	. i beu	vai - Er				
1. Overall dwelling dime	nsions:									
			Are	a(m²)	•	Av. He	ight(m)	_	Volume(m ³	_
Ground floor			5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	n)	54.08	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	135.2	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0] + [0	= [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	T + F	0	= [0	x 2	20 =	0	(6b)
Number of intermittent far	ns					0	x -	10 =	0	(7a)
Number of passive vents					F	0	x -	10 =	0	(7b)
Number of flueless gas fir	res				ř	0	X 4	40 =	0	(7c)
					L					` '
								Air ch	nanges per ho	our
Infiltration due to chimne						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in the		ended, procee	d to (17),	otherwise (continue fr	rom (9) to ((16)		0	(9)
Additional infiltration	ie dweiling (113)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 fo	r masonı	ry consti	ruction	,	•	0	(11)
if both types of wall are pr		rresponding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden f	• / .	ealed) or 0.	.1 (seale	ed). else	enter 0				0	(12)
If no draught lobby, ent	•	•	(,,					0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate						12) + (13) -			0	(16)
Air permeability value,			•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabili Air permeability value applies	•					is beina u	sed		0.1	(18)
Number of sides sheltere				g <i> </i>					2	(19)
Shelter factor				(20) = 1 -	[0.075 x ([*]	19)] =			0.85	(20)
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for		i		<u> </u>			·		1	
	Mar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp			2.0	1 2 7	1 4	1 40	1 45	4.7	1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18		

O.11 Calculate effec If mechanica If exhaust air he If balanced with a) If balanced 24a)m= 0.23 b) If balanced	I ventilat at pump u	ion:	0.09 rate for t	0.09 he appli	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
If exhaust air he If balanced with a) If balanced 24a)m= 0.23 b) If balanced	at pump u				cabie ca	se			!	!		•	
If balanced with a) If balanced 24a)m= 0.23 b) If balanced		-: A										0.5	(2:
a) If balanceo	heat recov	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(2
0.23 b) If balanced		very: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				75.65	(2
b) If balance	d mecha	nical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
· — —	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
?4b)m= 0	d mecha	nical ve	entilation	without	heat red	covery (N	ЛV) (24b	m = (22)	2b)m + (23b)	_	•	
	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole ho				•	•				.5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural v if (22b)m				•	•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change r	ate - er	nter (24a) or (24h	o) or (24	c) or (24	d) in box	x (25)				_	
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losses	and he	at loss i	paramet	er:							_	_	
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-l		A X k kJ/K
)oo <mark>rs</mark>					3.57	X	1	= [3.57				(2
Vin <mark>dows</mark> Type	1				1.81	X	1/[1/(1)+	0.04] =	1.74				(2
Vindows Type	2				6.09	x	1/[1/(1)+	0.04] =	5.86				(2
Vindows Type	3	'			1.05	X	1/[1/(1)+	0.04] =	1.01				(2
Vindows Type	4				5.57	X	1/[1/(1)+	0.04] =	5.36				(2
loor					13.85	5 X	0.13		1.8005	<u> </u>	75	10	38.75 (2
Valls	62.5		18.0	9	44.4	1 X	0.18	=	7.99		14	62	21.74 (2
otal area of el	ements,	m²			76.35	5							(3
arty wall					19.77	7 X	0		0		20] [3	95.4 (3
arty floor					40.23	3					40	<u> </u>	609.2 (3
arty ceiling					54.08	<u></u>				[30		622.4 (3
nternal wall **					63.3	=				[9		69.7
for windows and i					alue calcui		ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	n paragraph		,
abric heat los	s, W/K =	S (A x	U)				(26)(30)) + (32) =				27.33	(3
leat capacity (Cm = S(A)	Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	5857.1	9 (3
hermal mass	paramet	er (TMF	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			108.3	1 (3
or design assessi an be used instea				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
	s : S (L :	x Y) cal	culated i	using Ap	pendix l	K						13	(3

Total fabric heat loss	(33) + (36) =		40.33	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 ×	: (25)m x (5)	40.55	
Jan Feb Mar Apr May Jun Jul	Aug Sep Oct	Nov Dec	1	
(38)m= 10.27 10.17 10.08 9.6 9.51 9.03 9.03	8.94 9.22 9.51	9.7 9.89	-	(38)
Heat transfer coefficient, W/K	(39)m = (37) +	(38)m	J	
(39)m= 50.59 50.5 50.41 49.93 49.84 49.36 49.36	49.27 49.55 49.84	50.03 50.22]	
Heat loss parameter (HLP), W/m²K	Average (40)m = (39)m	= Sum(39) ₁₁₂ /12= ÷ (4)	49.91	(39)
(40)m= 0.94 0.93 0.93 0.92 0.92 0.91 0.91	0.91 0.92 0.92	0.93 0.93]	
Number of days in month (Table 1a)	Average	= Sum(40) ₁₁₂ /12=	0.92	(40)
Jan Feb Mar Apr May Jun Jul	Aug Sep Oct	Nov Dec]	
(41)m= 31 28 31 30 31 30 31	31 30 31	30 31		(41)
	-	-	-	
4. Water heating energy requirement:		kWh/y	ear:	
			1	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - $exp(-0.000349 \times (TFA - 13.9))]$	9)2)] + 0 0013 x (TFA -1:	1.81		(42)
if TFA £ 13.9, N = 1	0,2)] · 0.00 · 0 × (· · · · · ·	5.0)		
Annual average hot water usage in litres per day Vd, average		77.2		(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed not more that 125 litres per person per day (all water use, hot and cold)	to achieve a water use target	Of		
Jan Feb Mar Apr May Jun Jul	Aug Sep Oct	Nov Dec	1	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c		NOV Dec		
(44)m= 84.92 81.83 78.74 75.65 72.56 69.48 69.48	72.56 75.65 78.74	81.83 84.92]	
	Total = S	um(44) ₁₁₂ =	926.35	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x	DTm / 3600 kWh/month (see	Tables 1b, 1c, 1d)		_
(45)m= 125.93 110.14 113.65 99.08 95.07 82.04 76.02	87.24 88.28 102.88	112.3 121.95		_
Minutes the second content is a second of the second content of th		um(45) ₁₁₂ =	1214.59	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0		т т	1	(40)
(46)m= 18.89 16.52 17.05 14.86 14.26 12.31 11.4 Water storage loss:	13.09 13.24 15.43	16.85 18.29		(46)
Storage volume (litres) including any solar or WWHRS storage	e within same vessel	201	1	(47)
If community heating and no tank in dwelling, enter 110 litres				. ,
Otherwise if no stored hot water (this includes instantaneous	` ,	(47)		
Water storage loss:			_	
a) If manufacturer's declared loss factor is known (kWh/day):		0.54		(48)
Temperature factor from Table 2b		0.8694		(49)
Energy lost from water storage, kWh/year	$(48) \times (49) =$	0		(50)
b) If manufacturer's declared cylinder loss factor is not known Hot water storage loss factor from Table 2 (kWh/litre/day)	ı.	0]	(51)
If community heating see section 4.3 Volume factor from Table 2a			1	(50)
Temperature factor from Table 2b		0	1	(52) (53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =]]	(54)
Enter (50) or (54) in (55)	() x (0) x (02) x (00) =	0.87	+	(54)
			1	. ,

Water storag	e loss cal	culated t	for each	month			((56)m = (55) × (41)	m				
(56)m= 26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(56)
If cylinder contai	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
Primary circu	it loss (ar	nual) fro	om Table	3	•	•					0]	(58)
Primary circu	,	,			59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified b	y 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 c	alculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat red	quired for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 152.88	134.48	140.6	125.17	122.02	108.12	102.97	114.19	114.36	129.83	138.39	148.91		(62)
Solar DHW inpu	t calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)	•	
(add addition	al lines if	FGHRS	and/or V	WWHRS	applies	, see Ap	pendix C)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS 0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output from v	water hea	ter										_	
(64)m= 152.88	134.48	140.6	125.17	122.02	108.12	102.97	114.19	114.36	129.83	138.39	148.91		_
							Outp	ut from wa	ater heate	r (annual) ₁	12	1531.92	(64)
Heat gains fr	om water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m) + 0.8 >	([(46)m	+ (57)m	+ (59)m]	
(65)m= 41.87	36.62	37.79	32.95	31.61	27.28	25.28	29.01	29.35	34.21	37.34	40.55		(65)
include (57)m in cald	culation (of (65)m	only if c	vlinder i	s in the	dwelling	or bot w	otor io fr	om 00m	munitus b	4!	
5. Internal o				,	ymraci i		aweiling	or not w	aler is ii	om com	munity i	neating	
	gains (see	Table 5	and 5a	-	yiirider is		aweiling	or not w	ater is ir	om com	munity r	neating	
Metabolic gai				-	yiirider k		aweiling	or not w	aler is ir	om com	munity r	neating	
Met <mark>abolic ga</mark> Jan				-	Jun	Jul	Aug	Sep	Oct	Nov	Dec	neating	
	reb	5), Wat	ts):								leating	(66)
Jan	Feb	5), Wat Mar 90.52	Apr 90.52	May 90.52	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	Oct	Nov	Dec	neating	(66)
(66)m= 90.52	Feb 90.52 s (calcula	5), Wat Mar 90.52	Apr 90.52	May 90.52	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	Oct	Nov	Dec	leating	(66) (67)
Jan (66)m= 90.52 Lighting gains	Feb 90.52 s (calcula 12.5	90.52 ted in Ap	Apr 90.52 opendix 7.69	May 90.52 L, equat 5.75	Jun 90.52 ion L9 or 4.86	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	Sep 90.52 Table 5 9.15	Oct 90.52	Nov 90.52	Dec 90.52	leating	` '
(66)m= 90.52 Lighting gain: (67)m= 14.07	Feb 90.52 s (calcula 12.5 ains (calcula	90.52 ted in Ap	Apr 90.52 opendix 7.69	May 90.52 L, equat 5.75	Jun 90.52 ion L9 or 4.86	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	Sep 90.52 Table 5 9.15	Oct 90.52	Nov 90.52	Dec 90.52	leating	` '
Jan (66)m= 90.52 Lighting gain: (67)m= 14.07 Appliances g	Feb 90.52 s (calcula 12.5 ains (calcula 159.45	90.52 ted in Ap 10.16 ulated in 155.32	Apr 90.52 ppendix 7.69 Appendix 146.54	May 90.52 L, equat 5.75 dix L, eq	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1 118.06	Aug 90.52 Iso see 6.82 3a), also	Sep 90.52 Table 5 9.15 see Ta 120.55	Oct 90.52 11.62 ble 5 129.34	Nov 90.52 13.56	Dec 90.52	neating	(67)
Jan (66)m= 90.52 Lighting gain: (67)m= 14.07 Appliances g (68)m= 157.81	reb 90.52 s (calcula 12.5 ains (calcula 159.45 s (calcula	90.52 ted in Ap 10.16 ulated in 155.32	Apr 90.52 ppendix 7.69 Appendix 146.54	May 90.52 L, equat 5.75 dix L, eq	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1 118.06	Aug 90.52 Iso see 6.82 3a), also	Sep 90.52 Table 5 9.15 see Ta 120.55	Oct 90.52 11.62 ble 5 129.34	Nov 90.52 13.56	Dec 90.52	leating	(67)
Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances g (68)m= 157.81 Cooking gain	Feb 90.52 s (calcula 12.5 ains (calcula 159.45 s (calcula 32.05	90.52 ted in Ap 10.16 ulated in 155.32 tted in A 32.05	Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	Jun 90.52 ion L9 or 4.86 uation L 125.02	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table	Oct 90.52 11.62 ble 5 129.34	Nov 90.52 13.56	Dec 90.52 14.46 150.85	leating	(67) (68)
Jan 90.52	Feb 90.52 s (calcula 12.5 ains (calcula 159.45 s (calcula 32.05	90.52 ted in Ap 10.16 ulated in 155.32 tted in A 32.05	Apr 90.52 opendix 7.69 Appendix 146.54 opendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	Jun 90.52 ion L9 or 4.86 uation L 125.02	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table	Oct 90.52 11.62 ble 5 129.34	Nov 90.52 13.56	Dec 90.52 14.46 150.85	leating	(67) (68)
Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances g (68)m= 157.81 Cooking gain (69)m= 32.05 Pumps and fa	reb 90.52 s (calcula 12.5 ains (calcula 159.45 s (calcula 32.05 ans gains 0	90.52 ted in Ap 10.16 ulated ir 155.32 ted in A 32.05 (Table \$	Apr 90.52 opendix 7.69 n Append 146.54 opendix 32.05 5a)	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	leating	(67) (68) (69)
Jan 90.52	reb 90.52 s (calcula 12.5 ains (calcula 159.45 s (calcula 32.05 ans gains 0	90.52 ted in Ap 10.16 ulated ir 155.32 ted in A 32.05 (Table \$	Apr 90.52 opendix 7.69 n Append 146.54 opendix 32.05 5a)	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	leating	(67) (68) (69)
Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances g (68)m= 157.81 Cooking gain (69)m= 32.05 Pumps and fa (70)m= 0 Losses e.g. 6	reb Feb 90.52 (calcula 12.5 ains (calcula 159.45 s (calcula 32.05 ans gains 0 evaporatio -72.41	90.52 ted in Ap 10.16 ulated ir 155.32 ted in A 32.05 (Table \$ 0 on (nega	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 0	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43 32.05	Dec 90.52 14.46 150.85 0	leating	(67) (68) (69) (70)
Jan 90.52	rebins (Table 90.52 s (calcula 12.5 ains (calcula 32.05 ains gains 0 evaporatio -72.41 g gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains gains (Table 90.52 ains (Table 90.52	90.52 ted in Ap 10.16 ulated ir 155.32 ted in A 32.05 (Table \$ 0 on (nega	Apr 90.52 ppendix 7.69 Appendix 146.54 ppendix 32.05 5a) 0	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43 32.05	Dec 90.52 14.46 150.85 0	leating	(67) (68) (69) (70)
Jan 90.52	reb Section	90.52 ted in Ap 10.16 ulated in 155.32 ted in A 32.05 (Table \$ 0 on (negation of the context) 50.79	Apr 90.52 opendix 7.69 n Appendix 32.05 5a) 0 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 0 es) (Tab	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15 32.05 0 ole 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05 0 -72.41	Oct 90.52 11.62 ble 5 129.34 5 32.05 0 -72.41	Nov 90.52 13.56 140.43 32.05 0 -72.41	Dec 90.52 14.46 150.85 32.05 0 -72.41	leating	(67) (68) (69) (70) (71)
Jan (66)m= 90.52 Lighting gains (67)m= 14.07 Appliances g (68)m= 157.81 Cooking gain (69)m= 32.05 Pumps and fa (70)m= 0 Losses e.g. 6 (71)m= -72.41 Water heating (72)m= 56.28	S (Table Feb 90.52 S (calcula 12.5 159.45 S (calcula 32.05 ans gains 0 0 0 0 0 0 0 0 0	90.52 ted in Ap 10.16 ulated in 155.32 ted in A 32.05 (Table \$ 0 on (negation of the context) 50.79	Apr 90.52 opendix 7.69 n Appendix 32.05 5a) 0 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05 0 es) (Tab	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15 32.05 0 ole 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Ta 120.55 ee Table 32.05 0 -72.41	Oct 90.52 11.62 ble 5 129.34 5 32.05 0 -72.41	Nov 90.52 13.56 140.43 32.05 0 -72.41	Dec 90.52 14.46 150.85 32.05 0 -72.41	leating	(67) (68) (69) (70) (71)

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

Orientation: Access Factor Table 6d	or	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast _{0.9x} 0.77	x	1.81	х	22.97	x	0.3	x	0.7	=	6.05	(75)
Northeast 0.9x 0.77	X	1.81	х	41.38	x	0.3	x	0.7	=	10.9	(75)
Northeast 0.9x 0.77	x	1.81	x	67.96	x	0.3	x	0.7] =	17.9	(75)
Northeast 0.9x 0.77	x	1.81	x	91.35	x	0.3	x	0.7	=	24.06	(75)
Northeast 0.9x 0.77	X	1.81	x	97.38	x	0.3	x	0.7] =	25.65	(75)
Northeast 0.9x 0.77	x	1.81	х	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x} 0.77	X	1.81	x	72.63	x	0.3	x	0.7	=	19.13	(75)
Northeast _{0.9x} 0.77	x	1.81	x	50.42	x	0.3	x	0.7	=	13.28	(75)
Northeast _{0.9x} 0.77	x	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast _{0.9x} 0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast 0.9x 0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x 0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x 0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x 0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x 0.77	X	1.05	X	106.25	X	0.3	X	0.7] =	16.24	(77)
Southeast 0.9x 0.77	X	1.05	x	119.01	x	0.3	x	0.7		18.19	(77)
Southeast 0.9x 0.77	X	1.05	х	118.15] x	0.3	x	0.7	=	18.05	(77)
Southeast 0.9x 0.77	X	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast 0.9x 0.77	X	1.05	x	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast 0.9x 0.77	X	1.05	x	92.85	×	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x 0.77	X	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x 0.77	X	1.05	X	44.07	X	0.3	X	0.7	=	6.73	(77)
Southeast 0.9x 0.77	X	1.05	X	31.49	X	0.3	X	0.7	=	4.81	(77)
Southwest _{0.9x} 0.77	X	5.57	x	36.79]	0.3	X	0.7	=	29.83	(79)
Southwest _{0.9x} 0.77	X	5.57	x	62.67]	0.3	x	0.7	=	50.8	(79)
Southwest _{0.9x} 0.77	X	5.57	x	85.75]	0.3	X	0.7	=	69.51	(79)
Southwest _{0.9x} 0.77	X	5.57	x	106.25]	0.3	X	0.7	=	86.13	(79)
Southwest _{0.9x} 0.77	X	5.57	X	119.01]	0.3	x	0.7	=	96.47	(79)
Southwest _{0.9x} 0.77	X	5.57	x	118.15]	0.3	X	0.7	=	95.77	(79)
Southwest _{0.9x} 0.77	X	5.57	x	113.91]	0.3	x	0.7	=	92.34	(79)
Southwest _{0.9x} 0.77	X	5.57	x	104.39]	0.3	X	0.7	=	84.62	(79)
Southwest _{0.9x} 0.77	X	5.57	x	92.85]	0.3	x	0.7	=	75.27	(79)
Southwest _{0.9x} 0.77	X	5.57	x	69.27]	0.3	X	0.7	=	56.15	(79)
Southwest _{0.9x} 0.77	X	5.57	x	44.07]	0.3	X	0.7	=	35.72	(79)
Southwest _{0.9x} 0.77	X	5.57	x	31.49]	0.3	x	0.7	=	25.52	(79)
Northwest 0.9x 0.77	X	6.09	x	11.28	x	0.3	x	0.7	=	10	(81)
Northwest 0.9x 0.77	X	6.09	x	22.97	x	0.3	x	0.7] =	20.35	(81)
Northwest _{0.9x} 0.77	x	6.09	X	41.38	×	0.3	x	0.7	=	36.67	(81)

	Northwest on V														
Northwest _{0.9x}	0.77	X	6.0)9	X	6	7.96	X		0.3	x	0.7	=	60.23	(81)
Northwest _{0.9x}	0.77	X	6.0)9	X	9	1.35	X		0.3	x	0.7	=	80.96	(81)
Northwest 0.9x	0.77	X	6.0)9	X	9	7.38	X		0.3	x	0.7	=	86.31	(81)
Northwest _{0.9x}	0.77	X	6.0)9	x	(91.1	X		0.3	x	0.7	=	80.74	(81)
Northwest 0.9x	0.77	X	6.0)9	x	7	2.63	X		0.3	x	0.7	=	64.37	(81)
Northwest 0.9x	0.77	X	6.0)9	X	5	0.42	X		0.3	x	0.7	=	44.69	(81)
Northwest 0.9x	0.77	X	6.0)9	x	2	8.07	X		0.3	x	0.7	=	24.88	(81)
Northwest _{0.9x}	0.77	X	6.0)9	x	,	14.2	X		0.3	x	0.7	=	12.58	(81)
Northwest _{0.9x}	0.77	X	6.0)9	x	é	9.21	X		0.3	x	0.7	=	8.17	(81)
Solar gains in y	vatts, ca	alculated	for eac	h month	_			(83)m	ı = Sı	ım(74)m .	(82)m		•	-	
(83)m= 48.42	86.78	130.19	180.49	219.68		25.79	214.48	184	.07	147.42	99	58.78	40.93		(83)
Total gains – ir	iternal a	nd solar	(84)m =	= (73)m	+ (8	83)m	, watts						ı	7	
(84)m= 326.73	363.38	396.62	430.64	453.52	4	43.71	421.92	396	.45	368.05	336.09	314.79	310.9		(84)
7. Mean interr	nal temp	erature	(heating	season)										
Temperature	during h	eating p	eriods ir	n the livi	ng	area f	from Tal	ole 9,	Th1	I (°C)				21	(85)
Utilisation fact	or for g	ains for I	living are	ea, h1,m	ı (s	ee Ta	ble 9a)								
Jan	Feb	Mar	Apr	May		Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec		
(86)m= 0.97	0.95	0.93	0.87	0.77		0.62	0.48	0.5	53	0.73	0.89	0.95	0.97		(86)
Mean internal	temper	ature in	living are	ea T1 (fo	ollo	w ste	ps 3 to 7	in T	able	9c)				_	
(87)m= 19.21	19.42	19.77	20.22	20.61		20.86	20.95	20.9		20.75	20.26	19.66	19.16		(87)
Temperature	during h	eating p	eriods ir	rest of	dw	ellina	from Ta	able 9) Th	2 (°C)				-	
(88)m= 20.53	20.53	20.53	20.54	20.54	-	0.54	20.54	20.	_	20.54	20.54	20.54	20.54		(88)
Litilization foot	or for a	oina for	root of d	walling	h2	m (ac	o Toblo	00)					l		
Utilisation fact	0.95	0.92	0.86	0.75	_	m (Se 0.59	0.44	9a) 0.4	ıa T	0.7	0.88	0.95	0.97	1	(89)
` '				l								0.00	0.07	_	(00)
Mean internal			i	i	Ť			·	_			1		7	(00)
(90)m= 17.73	18.03	18.53	19.17	19.7	2	0.03	20.12	20.	11	19.9	19.24	18.38	17.66		(90)
										I	LA = LIVII	ng area ÷ (4	+) =	0.6	(91)
Mean internal	temper	ature (fo	r the wh	ole dwe	llin	g) = fl	_A × T1	+ (1	– fL	A) × T2		_		=	
(92)m= 18.61	18.86	19.27	19.8	20.24	2	0.52	20.62	20.0	61	20.41	19.85	19.14	18.56		(92)
Apply adjustm			i		_			-	_		•			7	
(93)m= 18.61	18.86	19.27	19.8	20.24	2	0.52	20.62	20.0	61	20.41	19.85	19.14	18.56		(93)
8. Space heat											. 	(- -)			
Set Ti to the n the utilisation					ned	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m=((76)m an	d re-cal	culate	
Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec	1	
Utilisation fact			<u> </u>	Iviay	<u> </u>	ouii _	- Oui		<u> </u>	ООР		1101		_	
(94)m= 0.95	0.94	0.9	0.84	0.74	(0.59	0.45	0.4	19	0.7	0.86	0.93	0.96		(94)
Useful gains,	hmGm ,	W = (94)	4)m x (8	4)m						!			<u> </u>	_	
(95)m= 311.48	340.02	358.41	362.01	333.81	20	60.64	188.57	193	.94	256.16	290.52	294.18	298.11		(95)
Monthly avera	ige exte	rnal tem	perature	from T	abl	e 8								_	
(96)m= 4.3	4.9	6.5	8.9	11.7	·	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	for mea	an intern	al tempe	erature,	Lm	, W =	=[(39)m	x [(93	3)m-	- (96)m]			-	
(97)m= 724.05	704.92	643.66	544.12	425.79	29	92.46	198.4	207	.19	312.67	460.84	602.38	720.89		(97)

Space heating requirem	nent fo	r each m	nonth, k\	Wh/mon	th = 0.02	24 x [(97])m – (95)m] x (4 ⁻	1)m			
(98)m= 306.95 245.21 2	212.23	131.12	68.43	0	0	0	0	126.72	221.9	314.55		
	-	-		-	-	Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1627.12	(98)
Space heating requirem	nent in	kWh/m²	/year								30.09	(99)
9a. Energy requirements	– Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:			, .							Г		7,
Fraction of space heat f		_		mentary	-		(004)			ļ	0	(201)
Fraction of space heat f		•	` ,			(202) = 1 - (204)	` '	(000)]		 	1	(202)
Fraction of total heating		-				(204) = (204)	02) x [1 –	(203)] =		 	1	(204)
Efficiency of main space		•			0.4					ļ	100	(206)
Efficiency of secondary				g systen	า, % 						0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirem	1ent (C	131.12	68.43	0	0	0	0	126.72	221.9	314.55		
$(211)m = \{[(98)m \times (204)]\}$										000		(211)
· · · · · · · · · · · · · · · · · · ·	212.23	131.12	68.43	0	0	0	0	126.72	221.9	314.55		(211)
						Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	<u></u>	1627.12	(211)
Space heating fuel (sec	ondar	y), kWh/	month									
$= \{[(98)m \times (201)]\} \times 100$	÷ (20											
(215)m= 0 0	0	0	0	0	0	0 Tota	0	0 ar) =Sum(2	0	0		7(045)
Metar beating	/					Tota	i (KWII/yea	ar) =Surri(2	13) _{15,1012}	[0	(215)
Water heating Output from water heater	r (calcı	ulated at	oove)									
	140.6	125.17	122.02	108.12	102.97	114.19	114.36	129.83	138.39	148.91		
Efficiency of water heate	r										349.41	(216)
(217)m= 349.41 349.41 3	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41		(217)
Fuel for water heating, k\ $(219)m = (64)m \times 100 \div$												
` '	40.24	35.82	34.92	30.94	29.47	32.68	32.73	37.16	39.61	42.62		
						Tota	I = Sum(2	19a) ₁₁₂ =			438.43	(219)
Annual totals								k\	Wh/yeaı		kWh/year	<u>-</u>
Space heating fuel used,	, main	system	1								1627.12	
Water heating fuel used											438.43	
Electricity for pumps, fan	s and	electric l	keep-ho	t								
mechanical ventilation -	balan	ced, ext	ract or p	ositive i	nput fron	n outside	e			148.45		(230a)
Total electricity for the ab	oove, k	:Wh/yea	r			sum	of (230a).	(230g) =			148.45	(231)
Electricity for lighting										j	248.46	(232)
Total delivered energy fo	or all us	ses (211)(221)	+ (231)	+ (232).	(237b)	=			[[2462.46	(338)
12a. CO2 emissions – I		``	, , ,	` ′	, ,	` ′				L		
		Jan 110ati		23.10-111010								

Energy

kWh/year

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519	=	844.47	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	227.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1072.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	77.05	(267)
Electricity for lighting	(232) x	0.519	=	128.95	(268)
Total CO2, kg/year	sum	of (265)(271) =		1278.02	(272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =		23.63	(273)
EI rating (section 14)				83	(274)

			User D	Details: _						
Assessor Name: Software Name:	Stroma FSAP			Strom Softwa Address	are Ve	rsion:		Versic	on: 1.0.5.41	
Address :	1 Bed Var - MF,		i i	Address	i Bea	var - MF				
1. Overall dwelling dime	nsions:									
			Are	a(m²)		Av. He	ight(m)	-	Volume(m ³	_
Ground floor			5	54.08	(1a) x	2	2.5	(2a) =	135.2	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)-	+(1e)+(1r	n) <u></u>	54.08	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	135.2	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m³ per hou	r
Number of chimneys	0	0] + [0] = [0	X ·	40 =	0	(6a)
Number of open flues	0	0] + [0] = [0	x :	20 =	0	(6b)
Number of intermittent far	ns					0	x	10 =	0	(7a)
Number of passive vents					Ē	0	x '	10 =	0	(7b)
Number of flueless gas fir	res				F	0	X e	40 =	0	(7c)
					L					
								Air ch	nanges per ho	our
Infiltration due to chimney						0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in the		tended, procee	d to (17),	otherwise (continue tr	rom (9) to ((16)		0	(9)
Additional infiltration	.e d						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or tim	ber frame or	0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openin		orresponding to	the great	ter wall are	a (after					
If suspended wooden f	• / .	sealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else ente	r 0		,					0	(13)
Percentage of windows	and doors draug	ht stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	_			0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value, If based on air permeabili	•		•	•	•	etre of e	envelope	area	2	(17)
Air permeability value applies	,					is being us	sed		0.1	(18)
Number of sides sheltere	d				-				2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified for	- 1 	1		Ι	0				1	
		lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind specification (22)m= 5.1 5	eed from Table 7 4.9 4.4 4.	3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	4.4 4.	3 3.8	ა.ఠ	3./	4	4.3	4.5	4.7	I	
Wind Factor (22a)m = $(22a)$ m =	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		

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effect		_	rate for t	he appli	cable ca	ise	-	-	-	-	-		7(220)
If exhaust air h			endix N (2	3h) = (23a	a) x Fmv (e	equation (1	N5)) othe	rwise (23h) = (23a)			0.5	(23a)
If balanced with) - (20 0)			0.5	(23b) (23c)
a) If balance		•	-	_					2h\m + (23h) v [1 – (23c)	75.65 ± 1001	(230)
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22]	(24a)
b) If balance	<u> </u>	ļ			heat red	coverv (N	и ЛV) (24b	<u> </u>	2b)m + (1 23b)		I	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole h if (22b)n				•	•				5 x (23h)	l	1	
(24c)m = 0	0.07	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural	ventilatio	n or wh	ole hous	e nositiv	ve input	ventilatio						J	, ,
if (22b)n									0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				_	
(25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25)
3. Heat losse	s and he	eat loss	paramete	er:								_	_
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²·l		X k /K
Doo <mark>rs</mark>					3.57	X	1	=	3.57				(26)
Windows Type	1				1.81	X	1/[1/(1)+	0.04] =	1.74				(27)
Windows Type	2				6.09	x	1/[1/(1)+	0.04] =	5.86				(27)
Windows Type	3				1.05	X	1/[1/(1)+	0.04] =	1.01				(27)
Windows Type	e 4				5.57	X	1/[1/(1)+	0.04] =	5.36				(27)
Walls	62.	5	18.09	9	44.41	1 X	0.18	=	7.99		14	621.7	(29)
Total area of e	lements	, m²			62.5								(31)
Party wall					19.77	7 X	0	=	0		20	395.4	(32)
Party floor					54.08	3					40	2163.2	(32a)
Party ceiling					54.08	3				Ī	30	1622.	(32b)
Internal wall **					63.3						9	569.7	(32c)
* for windows and ** include the area						lated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				25.53	(33)
Heat capacity	Cm = S((Axk)						((28).	.(30) + (32	2) + (32a)	(32e) =	5372.44	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =			99.34	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	K						9.02	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	31)			(00)	(00)				 .
Total fabric he	at ioss							(33) +	(36) =			34.55	(37)

Ventilation hea	at loss ca	alculated	l monthly	,				(38)m	= 0.33 × (25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 10.27	10.17	10.08	9.6	9.51	9.03	9.03	8.94	9.22	9.51	9.7	9.89		(38)
Heat transfer of	coefficier	nt. W/K				<u>I</u>	!	(39)m	= (37) + (37)	<u>. </u>	<u> </u>		
(39)m= 44.81	44.72	44.63	44.15	44.06	43.58	43.58	43.49	43.77	44.06	44.25	44.44		
						ļ	!	,	Average =	Sum(39) ₁	12 /12=	44.13	(39)
Heat loss para	meter (F	HLP), W/	m²K			·	1	(40)m	= (39)m ÷	(4)			
(40)m= 0.83	0.83	0.83	0.82	0.81	0.81	0.81	0.8	0.81	0.81	0.82	0.82		_
Number of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	0.82	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ener	rgy requi	rement:								kWh/ye	ear:	
Assumed occu	ıpancv. I	N								1	.81		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.01		(/
if TFA £ 13.9 Annual averag	,	otor upoc	vo in litro	o por de	\/d o	orogo –	(25 v NI)	. 26					(40)
Redu <mark>ce the annua</mark>									se target o		7.2		(43)
not more that 125	litres per p	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 84.92	81.83	78.74	75.65	72.56	69.48	69.48	72.56	75.65	78.74	81.83	<mark>8</mark> 4.92		_
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		926.35	(44)
(45)m= 125.93	110.14	113.65	99.08	95.07	82.04	76.02	87.24	88.28	102.88	112.3	121.95		
			. ,						Γotal = Su	m(45) ₁₁₂ =	=	1214.59	(45)
If instantaneous w								` '					
(46)m= 18.89 Water storage	16.52	17.05	14.86	14.26	12.31	11.4	13.09	13.24	15.43	16.85	18.29		(46)
Storage volum		includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel	20	01		(47)
If community h	` ,		•			•							, ,
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		oclared l	nce fact	or ie kna	wn (k\\/k	v/dav/).					<u></u>		(40)
Temperature fa				טווא פו וכ	wii (Kvvi	i/uay).					.54		(48)
Energy lost fro				oor			(48) x (49)				8694		(49)
b) If manufact		-	-		or is not		(40) X (49)	-			0		(50)
Hot water stora			•								0		(51)
If community h	_		on 4.3										
Volume factor			2h							-	0		(52)
Temperature fa							(47) (54)	(50) (50)		0		(53)
Energy lost fro Enter (50) or (-	, KVVN/ye	ear			(47) x (51)	x (52) x (53) =		0		(54) (55)
Water storage	, ,	,	or each	month			((56)m = (55) × (41):	m	0.	.87		(33)
	24.34				26.00					26.00	26.05		(56)
(56)m= 26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(30)

If cylinder contains dedica	ted solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 26.95 24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
Primary circuit loss (annual) fro	om Table	 e 3							0		(58)
Primary circuit loss of	,			(59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified by facto	from Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0 0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calculate	d for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 0 0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat required f	or water h	eating ca	alculated	d for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 152.88 134.4	3 140.6	125.17	122.02	108.12	102.97	114.19	114.36	129.83	138.39	148.91		(62)
Solar DHW input calculate	ed using App	endix G o	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additional lines	if FGHRS	and/or \	WHRS	applies	, see Ap	pendix (3)					
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS 0 0	0	0	0	0	0	0	0	0	0	0	•	(63) (G2)
Output from water he	eater											
(64)m= 152.88 134.4	3 140.6	125.17	122.02	108.12	102.97	114.19	114.36	129.83	138.39	148.91		
	_ .					Outp	out from wa	ater heate	r (annual)₁	12	1531.92	(64)
Heat gains from wat	er heating	, kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)n	n] + 0.8 x	c [(46)m	+ (57)m	+ (59)m]	
(65)m= 41.87 36.62		32.95	31.61	27.28	25.28	29.01	29.35	34.21	37.34	40.55		(65)
in <mark>clude</mark> (57)m in c	alculation	of (65)m	only if c	ylinder is	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
include (57)m in c				ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gains (s	ee Table 8	and 5a		ylinder is	s in the d	dwelling	or hot w	ater is fr	om com	<mark>mu</mark> nity h	eating	
	ee Table s	and 5a		ylinder is	s in the o	dwelling		ater is fr	om com	munity h	leating	
5. Internal gains (s Metabolic gains (Tab	ee Table s le 5), Wat Mar	and 5a):				Sep				leating	(66)
5. Internal gains (s Metabolic gains (Tak Jan Fel (66)m= 90.52 90.52	le 5), Was Mar 90.52	and 5a tts Apr 90.52	May 90.52	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	Oct	Nov	Dec	eating	(66)
5. Internal gains (s Metabolic gains (Tat Jan Fel	le 5), Was Mar 90.52	and 5a tts Apr 90.52	May 90.52	Jun 90.52	Jul 90.52	Aug 90.52	Sep 90.52	Oct	Nov	Dec	eating	(66) (67)
5. Internal gains (s Metabolic gains (Tab Jan Fel (66)m= 90.52 90.52 Lighting gains (calcumum) 12.5	Mar 90.52 lated in A	90.52 ppendix 7.69	90.52 L, equat	90.52 ion L9 or	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	90.52 Table 5	Oct 90.52	Nov 90.52	Dec 90.52	eating	
5. Internal gains (s Metabolic gains (Tab Jan Fel (66)m= 90.52 90.52 Lighting gains (calculate)	Mar 90.52 lated in A 10.16	90.52 ppendix 7.69	90.52 L, equat	90.52 ion L9 or	Jul 90.52 r L9a), a 5.25	Aug 90.52 Iso see	90.52 Table 5	Oct 90.52	Nov 90.52	Dec 90.52	eating	
5. Internal gains (s Metabolic gains (Tak Jan Fel (66)m= 90.52 90.52 Lighting gains (calcumos) (67)m= 14.07 12.5 Appliances gains (calcumos)	Mar 90.52 lated in A 10.16 lculated ir	Apr 90.52 ppendix 7.69 Appendix 146.54	May 90.52 L, equat 5.75 dix L, eq	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1 118.06	Aug 90.52 Iso see 6.82 3a), also	90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34	Nov 90.52 13.56	Dec 90.52	eating	(67)
5. Internal gains (s Metabolic gains (Take Jan Fellow) 90.52 90.52 Lighting gains (calculation) 12.5 Appliances gains (calculation) 12.5 Appliances gains (calculation) 157.81 159.4	Mar 90.52 lated in A 10.16 lculated ir 5 155.32	Apr 90.52 ppendix 7.69 Appendix 146.54	May 90.52 L, equat 5.75 dix L, eq	Jun 90.52 ion L9 of 4.86 uation L	Jul 90.52 r L9a), a 5.25 13 or L1 118.06	Aug 90.52 Iso see 6.82 3a), also	90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34	Nov 90.52 13.56	Dec 90.52	eating	(67)
5. Internal gains (s Metabolic gains (Tak Jan Fel (66)m= 90.52 90.52 Lighting gains (calcul (67)m= 14.07 12.5 Appliances gains (calcul (68)m= 157.81 159.4 Cooking gains (calcul	Mar 90.52 lated in A 10.16 lculated ir 5 155.32 lated in A 32.05	Apr 90.52 ppendix 7.69 Append 146.54 ppendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34 5	Nov 90.52 13.56	Dec 90.52 14.46	eating	(67) (68)
5. Internal gains (s Metabolic gains (Take Jan Fellow) 90.52 90.52 Lighting gains (calculation) 12.5 Appliances gains (calculation) 157.81 159.4 Cooking gains (calculation) 157.81 159.4 Cooking gains (calculation) 157.81 159.4	Mar 90.52 lated in A 10.16 lculated ir 5 155.32 lated in A 32.05	Apr 90.52 ppendix 7.69 Append 146.54 ppendix 32.05	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a)	Aug 90.52 Iso see 6.82 3a), also 116.42	Sep 90.52 Table 5 9.15 see Tal 120.55	Oct 90.52 11.62 ble 5 129.34 5	Nov 90.52 13.56	Dec 90.52 14.46	eating	(67) (68)
5. Internal gains (s Metabolic gains (Tak Jan Fel (66)m= 90.52 90.52 Lighting gains (calculation) (67)m= 14.07 12.5 Appliances gains (calculation) (68)m= 157.81 159.4 Cooking gains (calculation) Cooking gains (calculation) Pumps and fans gain	Mar 90.52 lated in A 10.16 lculated ir 5 155.32 lated in A 32.05 as (Table s	90.52 ppendix 7.69 146.54 ppendix 32.05 5a) 0	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	eating	(67) (68) (69)
Metabolic gains (Take Jan Feb. 190.52 90.52 90.52 Lighting gains (calculof) 14.07 12.5 Appliances gains (calculof) 157.81 159.4 Cooking gains (calculof) 32.05 32.05 Pumps and fans gain (70)m= 0 0	Mar 90.52 lated in A 10.16 lculated ir 5 155.32 lated in A 32.05 as (Table s	90.52 ppendix 7.69 146.54 ppendix 32.05 5a) 0	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 or 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85	eating	(67) (68) (69)
Metabolic gains (Take Jan Fell (66)m= 90.52 90.52 Lighting gains (calculation) (calcul	Mar 90.52 lated in A 10.16 lculated ir A 32.05 ns (Table s 0 cion (nega	Apr 90.52 ppendix 7.69 n Append 146.54 ppendix 32.05 5a) 0	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85 0	eating	(67) (68) (69) (70)
5. Internal gains (s Metabolic gains (Tak Jan Fel (66)m= 90.52 90.52 Lighting gains (calculated) (67)m= 14.07 12.5 Appliances gains (calculated) (68)m= 157.81 159.4 Cooking gains (calculated) (69)m= 32.05 32.05 Pumps and fans gain (70)m= 0 0 Losses e.g. evapora (71)m= -72.41 -72.4	Mar 90.52 lated in A 10.16 lculated in A 32.05 las (Table s) 0 cion (nega	Apr 90.52 ppendix 7.69 n Append 146.54 ppendix 32.05 5a) 0	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15 32.05	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05	Nov 90.52 13.56 140.43	Dec 90.52 14.46 150.85 0	eating	(67) (68) (69) (70)
Metabolic gains (Take Jan Fell (66)m= 90.52 90.52 Lighting gains (calculation (67)m= 14.07 12.5 Appliances gains (calculation (68)m= 157.81 159.4 Cooking gains (calculation (69)m= 32.05 32.05 Pumps and fans gain (70)m= 0 0 Losses e.g. evapora (71)m= -72.41 -72.4 Water heating gains	Mar 90.52 lated in A 10.16 lculated in A 32.05 lated in A 32.05 lated in A 32.05 lated in A 32.05 lated in Call 155.32 lated in A 32.05 lated in Call 155.32 lated in A 32.05 lated in Call 155.32 lated in A 32.05 lated in Call 155.32 lated in A 32.05 lated in Call 155.32 lated in Call 155.32 lated in A 32.05 lated in A 32.05 lated in A 32.05 lated in Call 155.32 lated in A 32.05 late	ppendix 7.69 146.54 ppendix 32.05 5a) 0 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15 32.05 0 ole 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05 0	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05	Oct 90.52 11.62 ble 5 129.34 5 32.05 0 -72.41	Nov 90.52 13.56 140.43 32.05 0	Dec 90.52 14.46 150.85 0 -72.41 54.5	eating	(67) (68) (69) (70) (71)
5. Internal gains (s Metabolic gains (Tak Jan Fel (66)m= 90.52 90.52 Lighting gains (calculated) (67)m= 14.07 12.5 Appliances gains (calculated) (68)m= 157.81 159.4 Cooking gains (calculated) (69)m= 32.05 32.06 Pumps and fans gain (70)m= 0 0 Losses e.g. evapora (71)m= -72.41 -72.4 Water heating gains (72)m= 56.28 54.46	Mar 90.52 lated in A 10.16 Culated in A 32.05 Sign (Table 5) 0 Cable 5) 50.79 =	ppendix 7.69 146.54 ppendix 32.05 5a) 0 tive valu	May 90.52 L, equat 5.75 dix L, eq 135.45 L, equat 32.05	Jun 90.52 ion L9 of 4.86 uation L 125.02 tion L15 32.05 0 ole 5) -72.41	Jul 90.52 r L9a), a 5.25 13 or L1 118.06 or L15a) 32.05	Aug 90.52 Iso see 6.82 3a), also 116.42), also se 32.05 0	Sep 90.52 Table 5 9.15 see Tal 120.55 ee Table 32.05 0	Oct 90.52 11.62 ble 5 129.34 5 32.05 0 -72.41	Nov 90.52 13.56 140.43 32.05 0	Dec 90.52 14.46 150.85 0 -72.41 54.5	eating	(67) (68) (69) (70) (71)

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

Orientation: Access Factor Table 6d	or	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast _{0.9x} 0.77	x	1.81	х	22.97	x	0.3	x	0.7	=	6.05	(75)
Northeast 0.9x 0.77	X	1.81	х	41.38	x	0.3	x	0.7	=	10.9	(75)
Northeast 0.9x 0.77	x	1.81	x	67.96	x	0.3	x	0.7] =	17.9	(75)
Northeast 0.9x 0.77	x	1.81	x	91.35	x	0.3	x	0.7	=	24.06	(75)
Northeast 0.9x 0.77	X	1.81	x	97.38	x	0.3	x	0.7] =	25.65	(75)
Northeast 0.9x 0.77	x	1.81	х	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x} 0.77	X	1.81	x	72.63	x	0.3	x	0.7	=	19.13	(75)
Northeast _{0.9x} 0.77	x	1.81	x	50.42	x	0.3	x	0.7	=	13.28	(75)
Northeast _{0.9x} 0.77	x	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast _{0.9x} 0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast 0.9x 0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x 0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x 0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x 0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x 0.77	X	1.05	X	106.25	X	0.3	X	0.7] =	16.24	(77)
Southeast 0.9x 0.77	X	1.05	x	119.01	x	0.3	x	0.7		18.19	(77)
Southeast 0.9x 0.77	X	1.05	х	118.15] x	0.3	x	0.7	=	18.05	(77)
Southeast 0.9x 0.77	X	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast 0.9x 0.77	X	1.05	x	104.39	x	0.3	x	0.7	=	15.95	(77)
Southeast 0.9x 0.77	X	1.05	x	92.85	×	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x 0.77	x	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x 0.77	X	1.05	X	44.07	X	0.3	X	0.7	=	6.73	(77)
Southeast 0.9x 0.77	X	1.05	X	31.49	X	0.3	X	0.7	=	4.81	(77)
Southwest _{0.9x} 0.77	X	5.57	x	36.79]	0.3	X	0.7	=	29.83	(79)
Southwest _{0.9x} 0.77	X	5.57	x	62.67]	0.3	x	0.7	=	50.8	(79)
Southwest _{0.9x} 0.77	X	5.57	x	85.75]	0.3	X	0.7	=	69.51	(79)
Southwest _{0.9x} 0.77	X	5.57	x	106.25]	0.3	X	0.7	=	86.13	(79)
Southwest _{0.9x} 0.77	X	5.57	x	119.01]	0.3	x	0.7	=	96.47	(79)
Southwest _{0.9x} 0.77	X	5.57	x	118.15]	0.3	X	0.7	=	95.77	(79)
Southwest _{0.9x} 0.77	X	5.57	x	113.91]	0.3	x	0.7	=	92.34	(79)
Southwest _{0.9x} 0.77	X	5.57	x	104.39]	0.3	X	0.7	=	84.62	(79)
Southwest _{0.9x} 0.77	X	5.57	x	92.85]	0.3	X	0.7	=	75.27	(79)
Southwest _{0.9x} 0.77	X	5.57	x	69.27]	0.3	X	0.7	=	56.15	(79)
Southwest _{0.9x} 0.77	X	5.57	x	44.07]	0.3	X	0.7	=	35.72	(79)
Southwest _{0.9x} 0.77	X	5.57	x	31.49]	0.3	x	0.7	=	25.52	(79)
Northwest 0.9x 0.77	X	6.09	x	11.28	x	0.3	x	0.7	=	10	(81)
Northwest 0.9x 0.77	X	6.09	x	22.97	x	0.3	x	0.7] =	20.35	(81)
Northwest _{0.9x} 0.77	x	6.09	X	41.38	×	0.3	X	0.7	=	36.67	(81)

_															
Northwest 0.9x	0.77	×	6.0	9	X	6	7.96	X		0.3	X	0.7	=	60.23	(81)
Northwest 0.9x	0.77	X	6.0	9	X	9	1.35	X		0.3	Х	0.7	=	80.96	(81)
Northwest 0.9x	0.77	Х	6.0	9	X	9	7.38	X		0.3	x	0.7	=	86.31	(81)
Northwest 0.9x	0.77	X	6.0	9	x	9	91.1	x		0.3	x	0.7	_	80.74	(81)
Northwest 0.9x	0.77	X	6.0	9	x	7	2.63	x		0.3	x [0.7	=	64.37	(81)
Northwest 0.9x	0.77	X	6.0	9	x	5	0.42	x		0.3	x	0.7	_	44.69	(81)
Northwest 0.9x	0.77	Х	6.0	9	x	2	8.07	X		0.3	x	0.7	=	24.88	(81)
Northwest 0.9x	0.77	X	6.0	9	x	1	14.2	X		0.3	x	0.7	=	12.58	(81)
Northwest 0.9x	0.77	X	6.0	9	x	9	9.21	X		0.3	x	0.7	=	8.17	(81)
Solar gains in	watts, ca	alculated	for eac	h month				(83)m	n = Su	um(74)m .	(82)m			_	
(83)m= 48.42	86.78	130.19	180.49	219.68	22	25.79	214.48	184	.07	147.42	99	58.78	40.93		(83)
Total gains – ir	nternal a	nd solar	(84)m =	= (73)m ·	+ (8	33)m	, watts								
(84)m= 326.73	363.38	396.62	430.64	453.52	44	43.71	421.92	396	.45	368.05	336.09	314.79	310.9		(84)
7. Mean inter	nal temp	erature	(heating	season)										
Temperature			`		<i>'</i>	area f	rom Tab	ole 9.	. Th′	1 (°C)				21	(85)
Utilisation fac	_	•			-			,	,	(-)					``
Jan	Feb	Mar	Apr	May	Ė	Jun	Jul	Δι	ug	Sep	Oct	Nov	Dec		
(86)m= 0.96	0.94	0.91	0.84	0.72		0.57	0.44	0.4		0.69	0.87	0.94	0.96		(86)
									\rightarrow	I	0.07	0.01	1 0.00		
Mean internal			_	•							00.07	100	40.00	7	(07)
(87)m= 19.38	19.59	19.93	20.35	20.7	2	20.9	20.97	20.	96	20.81	20.37	19.8	19.33		(87)
Temperature	during h	eating p	eriods ir	rest of	dw	elling	from Ta	able 9	9, Tr	n2 (°C)				_	
(88)m= 20.59	20.59	20.59	20.59	20.59		20.6	20.6	20.	.6	20.6	20.59	20.59	20.59		(88)
Utilisation fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)							
(89)m= 0.96	0.94	0.9	0.83	0.71	_	0.54	0.4	0.4	14	0.66	0.86	0.94	0.96	7	(89)
Mean internal	temner	ature in	the rest	of dwelli	ina	T2 (fd	ollow ste	ns 3	to 7	' in Tabl	e 9c)	•	•		
(90)m= 18.03	18.34	18.82	19.43	19.89		0.15	20.23	20.:		20.05	19.47	18.66	17.96	٦	(90)
(00)	.0.0.	10.02							<u> l</u>			ng area ÷ (4		0.6	(91)
													,	0.0	(0.)
Mean internal			1		1			T `						7	
(92)m= 18.83	19.08	19.48	19.98	20.37	Ц_	20.6	20.67	20.		20.51	20.01	19.34	18.78		(92)
Apply adjustm					_			·			•		•	_	
(93)m= 18.83	19.08	19.48	19.98	20.37	2	20.6	20.67	20.	66	20.51	20.01	19.34	18.78		(93)
8. Space hear															
Set Ti to the r					ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=	(76)m an	d re-ca	lculate	
the utilisation					Г	la	l. d	Ι		Can	Oat	Nov		٦	
Jan Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	0.92	0.88	0.81	0.7	,	0.54	0.41	0.4	15	0.65	0.84	0.92	0.95	٦	(94)
` '			<u> </u>			J.54	0.41	0.4	+5	0.00	0.04	0.92	0.95		(34)
Useful gains, (95)m= 308.05	334.93	350.55	349.28	315.58	2/	40.35	171.21	176	82	240.49	281.73	289.67	295.2	٦	(95)
Monthly avera			l .		<u> </u>		111.21	L ''	.02	∠¬∪.+3	201.73	203.07	290.2	_	(00)
(96)m= 4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16.	<u>⊿</u> T	14.1	10.6	7.1	4.2	٦	(96)
Heat loss rate			<u> </u>		<u> </u>							1 ''	I 7.2	_	(50)
(97)m= 651.28	634.29	579.35	489.12	382.01	_	61.46	177.34	185	- -	280.38	414.5	541.64	647.76	.T	(97)
(07)111- 001.20	007.Z0	0,0.00	700.12	002.01	L	J 1.70	111.04	L 100		200.00	717.0	1 541.04	1 547.76		(01)

Space heating require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4 ⁻	1)m			
(98)m= 255.36 201.17	170.23	100.69	49.42	0	0	0	0	98.78	181.42	262.31		
						Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1319.38	(98)
Space heating require	ement in	kWh/m²	/year								24.4	(99)
9a. Energy requiremen	ts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:			, .							г		–
Fraction of space hea				mentary	•		(004)			ļ	0	(201)
Fraction of space hea		•	` ,			(202) = 1 -	,	(000)]		ļ	1	(202)
Fraction of total heating	_	-				(204) = (20	02) x [1 –	(203)] =		Į	1	(204)
Efficiency of main spa					0.4					Į	100	(206)
Efficiency of secondar				g systen	·	1				<u> </u>	0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating require	170.23	100.69	49.42	0	0	0	0	98.78	181.42	262.31		
(211) m = { $[(98)$ m x $(20-$							ŭ	00.70	1011.12	202.01		(211)
255.36 201.17	170.23	100.69	49.42	0	0	0	0	98.78	181.42	262.31		(211)
						Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1319.38	(211)
Space heating fuel (se	econdar	y), kWh/	month									_
$= \{[(98)m \times (201)]\} \times 10^{-1}$	00 ÷ (20	8)										
(215)m= 0 0	0	0	0	0	0	0	0	0	0	0		-
						Tota	I (KWh/yea	ar) =Sum(2	215) _{15,1012}		0	(215)
Water heating Output from water heat	er (calc	ulated al	oove)									
152.88 134.48	140.6	125.17	122.02	108.12	102.97	114.19	114.36	129.83	138.39	148.91		
Efficiency of water hea	ter			•	•	•			•		349.41	(216)
(217)m= 349.41 349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41		(217)
Fuel for water heating,												
$(219)m = (64)m \times 100$ (219)m = 43.75 38.49	÷ (217) 40.24	m 35.82	34.92	30.94	29.47	32.68	32.73	37.16	39.61	42.62		
` '				ļ		Tota	I = Sum(2	19a) ₁₁₂ =			438.43	(219)
Annual totals								k\	Wh/year		kWh/yea	_
Space heating fuel use	d, main	system	1								1319.38	
Water heating fuel used	d										438.43	
Electricity for pumps, fa	ans and	electric	keep-ho	t								
mechanical ventilation	ı - balan	ced, ext	ract or p	ositive i	nput fror	n outside	Э			148.45		(230a
Total electricity for the	above, k	(Wh/yea	r			sum	of (230a).	(230g) =			148.45	(231)
Electricity for lighting										Ī	248.46	(232)
Total delivered energy	for all us	ses (211)(221)	+ (231)	+ (232).	(237b)	=			Ī	2154.72	(338)
12a. CO2 emissions -	المطانيناط	ual baati		ام داد داد	ıdina mi	oro CHD				_		_

Energy

kWh/year

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519	=	684.76	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	227.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			912.3	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	77.05	(267)
Electricity for lighting	(232) x	0.519	=	128.95	(268)
Total CO2, kg/year	sum o	of (265)(271) =		1118.3	(272)
Dwelling CO2 Emission Rate	(272)	÷ (4) =		20.68	(273)
El rating (section 14)				85	(274)

				User D	etails:						
Assessor Name: Software Name:	Stroma F	SAP 201			Strom Softwa	are Vei	rsion:		Versio	on: 1.0.5.41	
	0.0-1.5	5 1		roperty.	Address	2 Bed -	·EF				
Address: 1. Overall dwelling dime	2 Bed - E	F, London	, IBC								
1. Overall dwelling diffic	FIISIUIIS.			Δros	a(m²)		Av. He	iaht(m)		Volume(m³	١.
Ground floor						(1a) x		2.5	(2a) =	167.63) (3:
Γotal floor area TFA = (1	3)+(1b)+(1c	١ــ(١٨)ــ(١٥	ر1ء مايد (1ء	,		(4)](3/	107.00	``
•	a)+(1b)+(10))+(10)+(10	<i>i)</i> + (11	')	57.05) · (2-) · (2-l	1) . (2-) .	(0-1)		_
Owelling volume						(3a)+(3b))+(3c)+(3d	1)+(3e)+	.(3n) =	167.63	(5)
2. Ventilation rate:	main	6.	econdaı	**/	other		total			m³ per hou	-
	heatin		neating	у	outer	- <u>-</u>	lolai			per nou	' —
Number of chimneys	0	+	0	_ +	0] = [0	X 4	40 =	0	(6
Number of open flues	0	+	0] + [0] = [0	x 2	20 =	0	(61
Number of intermittent fa	ans					Γ	0	x '	10 =	0	(7
Number of passive vents	3					Ī	0	x -	10 =	0	(71
Number of flueless gas f	ires					F	0	X 4	40 =	0	(70
						L					`
									Air ch	nanges <mark>per</mark> ho	ur
nfilt <mark>ration</mark> due to chi <mark>mne</mark>	ys, flues and	d fans = (6	a)+(6b)+(7	7a)+(7b)+(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has I			ed, procee	d to (17),	otherwise o	ontinue fr	om (9) to ((16)			_
Number of storeys in t Additional infiltration	he dwelling ((ns)						r(0)	47.04	0	(9)
Structural infiltration: () 25 for steel	or timber	frame or	0.35 fo	r masoni	v constr	ruction	[(9)	-1]x0.1 =	0	(1)
if both types of wall are p						•	uction			0	('
deducting areas of open	• .								,		_
If suspended wooden		•	led) or 0	.1 (seale	ed), else	enter 0				0	(1:
If no draught lobby, er	•		rinned							0	= (1: - (1:
Percentage of window Window infiltration	's and doors	uraugni si	прреа		0.25 - [0.2	x (14) ÷ 1	001 =			0	(1:
Infiltration rate					(8) + (10)	. ,	•	+ (15) =		0	= \(\)
Air permeability value,	, q50, expres	sed in cub	oic metre	s per ho					area	2	= \(\)
f based on air permeabi				•		•		·		0.1) (1)
Air permeability value appli	es if a pressuris	ation test ha	s been dor	ne or a de	gree air pe	rmeability	is being us	sed	!		
Number of sides shelter	ed				(20) 4	0.075 /4	10)1			2	(1
Shelter factor	tina abalta: 1	ooto-			(20) = 1 -	`	19)] =			0.85	(2)
nfiltration rate incorpora	•		J		(21) = (18	x (20) =				0.08	(2
nfiltration rate modified		- 	i	11	۸۰۰۰	San	Oct	Nov	Doo]	
Jan Feb	Mar Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	<u> </u>		20	20	27		4.2	1 5	17	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	0.92	1	1.08	1.12	1.18]	

0.11	ation rat	te (allowi	ing for sh	nelter an	d wind s	speed) = 0.08	(21a) x	(22a)m 0.08	I 0.00	0.1	0.1		
Calculate effec	i -				1		0.08	0.08	0.09	0.1	0.1		
If mechanica		_										0.5	(2:
If exhaust air he	eat pump	using App	endix N, (2	23b) = (23a	a) × Fmv (e	equation (l	N5)) , othe	rwise (23b) = (23a)			0.5	(2:
If balanced with	n heat reco	overy: effic	ciency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				75.65	(2:
a) If balance	d mech	anical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2)	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (I	MV) (24b	m = (22)	2b)m + (23b)			
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h if (22b)n			ntilation of then (24)	•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n			nole hous)m = (22t	•	•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losse	s and he	eat loss	paramet	er:							_	_	-
ELEMENT	Gros area	ss	Openin m	igs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-ł		A X k kJ/K
Doo <mark>rs</mark>					3.57	X	1	=	3.57				(2
Vin <mark>dows</mark> Type) 1				1.81	x	1/[1/(1)+	0.04] =	1.74				(2
Windows Type	2				2.1	x	1/[1/(1)+	0.04] =	2.02				(2
Vindows Type	3				1.05	X	1/[1/(1)+	0.04] =	1.01				(2
Vindows Type) 4				7.35	X	1/[1/(1)+	0.04] =	7.07				(2
loor					24.59) x	0.13	=	3.1967		75	184	4.25 (2
Valls	58.8	31	15.88	8	42.93	3 x	0.18	<u> </u>	7.73		14	601	.02 (2
Total area of e	lements	, m²			83.4								(3
Party wall					50.53	3 x	0		0		20	101	0.6 (3
Party floor					42.46	5					40	169	98.4 (3
Party ceiling					67.05	<u> </u>					30	201	1.5 (3
nternal wall **					87.34	4					9	786.	0599 (3
for windows and it include the area					alue calcui		g formula 1	/[(1/U-valu	ıe)+0.04] a	ı as given ir	n paragraph		,
abric heat los	ss, W/K	= S (A x	(U)				(26)(30) + (32) =				26.33	(3
leat capacity	Cm = S	(A x k)						((28).	(30) + (32	2) + (32a)	(32e) =	7951.83	(3
hormal macc	parame	eter (TMI	P = Cm -	÷ TFA) ir	n kJ/m²K			= (34)	÷ (4) =			118.6	(3
Heimai mass													
For design assess an be used inste				construct	ion are no	t known pi	ecisely the	e indicative	e values of	TMP in T	able 1f		
or design assess	ad of a de	tailed calc	culation.			•	ecisely the	e indicative	e values of	TMP in T	able 1f	15.91	(3

Total fabric heat loss					(33) +	(36) =		Γ	42.24	(37)
Ventilation heat loss calculated	d monthly						25)m x (5)	L)	72.27	(/
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 12.73 12.61 12.49	11.91 11.79	11.2	11.2	11.08	11.44	11.79	12.02	12.26		(38)
Heat transfer coefficient, W/K	•				(39)m	= (37) + (37)	38)m			
(39)m= 54.97 54.85 54.73	54.15 54.03	53.44	53.44	53.32	53.68	54.03	54.26	54.5		
Heat loss parameter (HLP), W	/m²K	•	•	•		Average = = (39)m ÷	Sum(39) ₁	12 /12=	54.12	(39)
(40)m= 0.82 0.82 0.82	0.81 0.81	0.8	0.8	0.8	0.8	0.81	0.81	0.81		
	ļ ļ	ļ	!		,	Average =	Sum(40) ₁	12 /12=	0.81	(40)
Number of days in month (Tab	 	ı	1				ı			_
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31 28 31	30 31	30	31	31	30	31	30	31		(41)
4. Water heating energy requ	irement:							kWh/ye	ear:	
Assumed occupancy, N								.17		(42)
if TFA > 13.9, $N = 1 + 1.76 \times 13.9$, $N = 1 + 1.76 \times 13.9$, $N = 1$	([1 - exp(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.	.9)			
Annual average hot water usage	ge in litres per da	y Vd,av	erage =	(25 x N)	+ 36		85	5.8		(43)
Reduce the annual average hot water			-	to achieve	a water us	se target o				
not more that 125 litres per person pe			_		_					
Jan Feb Mar Hot water usage in litres per day for ea	Apr May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
(44)m= 94.37 90.94 87.51	84.08 80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37		
(44)111= 34.37 30.34 07.31	04.00 00.03	11.22	11.22	00.03			m(44) ₁₁₂ =		1029.54	(44)
Energy content of hot water used - cal	culated monthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600					. 02010 1	 \`
(45)m= 139.96 122.41 126.31	110.12 105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		
If instantaneous water heating at pain	t of upo (no hot water	r otorogol	ontor O in	havas (16		Total = Su	m(45) ₁₁₂ =	=	1349.89	(45)
If instantaneous water heating at point						47.45	40.70			(46)
(46)m= 20.99 18.36 18.95 Water storage loss:	16.52 15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
Storage volume (litres) includir	ng any solar or W	/WHRS	storage	within sa	ame ves	sel	20	01		(47)
If community heating and no ta	ank in dwelling, e	nter 110	litres in	(47)						
Otherwise if no stored hot water	er (this includes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage loss: a) If manufacturer's declared I	lace factor is kno	wo /k\\/k	a/dayı):					-, 1		(40)
Temperature factor from Table		wii (Kvvi	i/uay).					.54		(48)
Energy lost from water storage				(48) x (49)	_			8694		(49) (50)
b) If manufacturer's declared	•	or is not	known:	(40) X (40)	_			0		(30)
Hot water storage loss factor fi	•	h/litre/da	ay)					0		(51)
If community heating see secti	on 4.3									/=-·
Volume factor from Table 2a Temperature factor from Table	2h						-	0		(52) (53)
Energy lost from water storage				(47) x (51)	v (52) v (53) –		0		, ,
Enter (50) or (54) in (55)	, rvvii/yeal			(1 1) X (31)	√ ∧ (J∠) X (JJ) =	-	0 .87		(54) (55)
								.07		(55)

Water	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	1	(56)
If cylind	er contains	dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
Prima	ry circuit	loss (ar	nual) fro	om Table	e 3					-		0	Ì	(58)
	ry circuit	`	,			59)m = ((58) ÷ 36	55 × (41)	m				•	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)		_	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Comb	i loss cal	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41)	m					_	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat requ	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	166.91	146.75	153.26	136.2	132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49		(62)
Solar D	HW input of	alculated	using App	endix G o	r Appendix	H (negati	ve quantity	') (enter '0	if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	3)	_	_	_	_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Outpu	t from wa	ater hea	ter										_	
(64)m=	166.91	146.75	153.26	136.2	132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49		
								Outp	out from wa	ater heate	r (annual) ₁	12	1667.22	(64)
Heat g	g <mark>ain</mark> s froi	n water	heating,	, kWh/m	onth 0.2	<mark>5 ´</mark> [0.85	× (45)m	+ (61)m	+ 0.8 >	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	46.54	40.7	42	36.62	35.13	30.32	28.09	32.24	32.62	38.02	41.5	45.07		(65)
inclu	ude (57)ı	m in calc	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ate <mark>r is fr</mark>	om com	munity h	neating	
5. In	ternal ga	ins (see	Table 5	5 and 5a):									
Metab	olic gain	s (Table	5), Wat	its										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62	108.62		(66)
Lightir	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Γable 5		-			
(67)m=	16.97	15.07	12.26	9.28	6.94	5.86	6.33	8.22	11.04	14.02	16.36	17.44		(67)
Applia	nces gai	ns (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5		•	•	
(68)m=	190.32	192.29	187.31	176.72	163.35	150.78	142.38	140.4	145.38	155.98	169.35	181.92		(68)
Cookii	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)	, also se	e Table	5	•	!	•	
(69)m=		33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86	33.86		(69)
Pumps	s and far	ns gains	(Table 5	. 5а)									1	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(70)
Losse	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)							ı	
(71)m=	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9	-86.9		(71)
Water	heating	gains (T	able 5)		!			<u> </u>			!		ı	
(72)m=		60.57	56.45	50.85	47.22	42.11	37.76	43.33	45.31	51.1	57.64	60.57]	(72)
Total	internal	gains =	! :		ı	(66)	m + (67)m	+ (68)m +	- (69)m +	(70)m + (7	1)m + (72))m	I	
											• '		_	
(73)m=	325.42	323.51	311.61	292.44	273.09	254.33	242.05	247.55	257.31	276.68	298.93	315.52		(73)

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

	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	X	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast _{0.9x}	0.77	X	1.81	х	22.97	X	0.3	X	0.7	=	6.05	(75)
Northeast 0.9x	0.77	X	1.81	x	41.38	X	0.3	x	0.7	=	10.9	(75)
Northeast _{0.9x}	0.77	X	1.81	х	67.96	x	0.3	x	0.7	=	17.9	(75)
Northeast _{0.9x}	0.77	X	1.81	x	91.35	X	0.3	x	0.7	=	24.06	(75)
Northeast 0.9x	0.77	X	1.81	x	97.38	x	0.3	x	0.7	=	25.65	(75)
Northeast _{0.9x}	0.77	X	1.81	x	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x}	0.77	X	1.81	x	72.63	x	0.3	x	0.7	=	19.13	(75)
Northeast _{0.9x}	0.77	X	1.81	x	50.42	x	0.3	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	X	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast 0.9x	0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast _{0.9x}	0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x	0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x	0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x	0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x	0.77	X	1.05	X	106.25	X	0.3	X	0.7	=	16.24	(77)
Southeast 0.9x	0.77	X	1.05	х	119.01	х	0.3	x	0.7	_	18.19	(77)
Southeast 0.9x	0.77	X	1.05	х	118.15	×	0.3	x	0.7	=	18.05	(77)
Southeast _{0.9x}	0.7 <mark>7</mark>	X	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast 0.9x	0.77	X	1.05	x	104.39	Х	0.3	x	0.7	=	15.95	(77)
Southeast _{0.9x}	0.77	X	1.05	x	92.85	X	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x	0.77	X	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x	0.77	x	1.05	х	44.07	x	0.3	x	0.7	=	6.73	(77)
Southeast 0.9x	0.77	X	1.05	X	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x}	0.77	X	7.35	X	36.79		0.3	X	0.7	=	39.36	(79)
Southwest _{0.9x}	0.77	X	7.35	x	62.67		0.3	x	0.7	=	67.04	(79)
Southwest _{0.9x}	0.77	X	7.35	X	85.75		0.3	x	0.7	=	91.72	(79)
Southwest _{0.9x}	0.77	X	7.35	x	106.25		0.3	X	0.7	=	113.65	(79)
Southwest _{0.9x}	0.77	X	7.35	x	119.01		0.3	x	0.7	=	127.3	(79)
Southwest _{0.9x}	0.77	X	7.35	x	118.15		0.3	X	0.7	=	126.38	(79)
Southwest _{0.9x}	0.77	X	7.35	X	113.91		0.3	X	0.7	=	121.84	(79)
Southwest _{0.9x}	0.77	X	7.35	X	104.39		0.3	x	0.7	=	111.66	(79)
Southwest _{0.9x}	0.77	X	7.35	X	92.85		0.3	X	0.7	=	99.32	(79)
Southwest _{0.9x}	0.77	X	7.35	X	69.27		0.3	X	0.7	=	74.09	(79)
Southwest _{0.9x}	0.77	X	7.35	x	44.07		0.3	x	0.7	=	47.14	(79)
Southwest _{0.9x}	0.77	X	7.35	x	31.49		0.3	x	0.7	=	33.68	(79)
Northwest 0.9x	0.77	X	2.1	x	11.28	x	0.3	x	0.7	=	3.45	(81)
Northwest 0.9x	0.77	x	2.1	x	22.97	x	0.3	x	0.7] =	7.02	(81)
Northwest 0.9x	0.77	X	2.1	X	41.38	X	0.3	X	0.7	=	12.65	(81)

_															
Northwest _{0.9x}	0.77	Х	2.	1	X	6	7.96	X		0.3	x	0.7	=	20.77	(81)
Northwest _{0.9x}	0.77	X	2.	1	X	9	1.35	X		0.3	x	0.7	=	27.92	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	7.38	X		0.3	x	0.7	=	29.76	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	91.1	X		0.3	x	0.7	=	27.84	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	7	2.63	X		0.3	x [0.7	=	22.2	(81)
Northwest 0.9x	0.77	X	2.	1	X	5	0.42	X		0.3	x	0.7	=	15.41	(81)
Northwest 0.9x	0.77	X	2.	1	x	2	8.07	x		0.3	x [0.7	=	8.58	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	,	14.2	x		0.3	x [0.7	=	4.34	(81)
Northwest 0.9x	0.77	X	2.	1	x	9	9.21	x		0.3	x	0.7	=	2.82	(81)
Solar gains in y	watts, ca	alculated	for eac	h month				(83)m	n = Su	ım(74)m .	(82)m			_	
(83)m= 51.4	89.68	128.37	168.56	197.46	19	99.85	191.09	168	.94	142.2	100.65	61.95	43.74		(83)
Total gains – ir	nternal a	nd solar	(84)m =	= (73)m ·	+ (8	33)m	, watts							_	
(84)m= 376.82	413.2	439.98	461	470.55	45	54.17	433.14	416	.48	399.51	377.33	360.89	359.25		(84)
7. Mean interr	nal temp	erature	(heating	season)										
Temperature	during h	eating p	eriods ir	n the livi	ng :	area f	from Tab	ole 9,	, Th′	I (°C)				21	(85)
Utilisation fact	tor for g	ains for I	living are	ea, h1,m	(Se	ee Ta	ble 9a)								
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.98	0.97	0.95	0.9	0.81	(0.67	0.52	0.5	55	0.76	0.91	0.97	0.98		(86)
Mean internal	temper	ature in	living ar	ea T1 (fo	ollo.	w ste	ns 3 to 7	7 in T	able	9c)			•		
(87)m= 19.53	19.71	19.99	20.36	20.68		0.89	20.97	20.		20.82	20.42	19.91	19.49	1	(87)
Temperature	during b	ooting n	oriodo ir	root of	ما الم	ماانمم	from To	blo () Th	2 (%C)				J	
(88)m= 20.59	20.59	20.59	20.6	20.6		20.6	20.6	20.	_	20.6	20.6	20.6	20.59	1	(88)
` '								<u> </u>	<u>. </u>	20.0	20.0	20.0		J	()
Utilisation fact			i		_			–	-4	0.70	0.0		0.00	1	(00)
(89)m= 0.98	0.96	0.94	0.89	0.8	<u> </u>	0.64	0.48	0.5	I	0.73	0.9	0.96	0.98		(89)
Mean internal			i	1				i 				,		7	
(90)m= 18.24	18.5	18.91	19.43	19.88	2	0.15	20.23	20.	23	20.07	19.53	18.8	18.19		(90)
										f	LA = Livir	ng area ÷ (4) =	0.54	(91)
Mean internal	temper	ature (fo	r the wh	ole dwe	lling	g) = fl	_A × T1	+ (1	– fL	A) × T2					
(92)m= 18.93	19.15	19.49	19.93	20.31	2	0.55	20.63	20.	62	20.47	20	19.4	18.89		(92)
Apply adjustm	ent to t	ne mean	interna	temper	atu	re fro	m Table	4e,	whe	re appro	priate			_	
(93)m= 18.93	19.15	19.49	19.93	20.31	2	0.55	20.63	20.	62	20.47	20	19.4	18.89		(93)
8. Space heat															
Set Ti to the n					ned	at ste	ep 11 of	Tabl	le 9b	, so tha	t Ti,m=(76)m an	d re-cal	culate	
the utilisation Jan	Feb	Mar		I	Г	Jun	Jul	Ι		Sep	Oct	Nov	Dec	1	
Utilisation fact			Apr	May		Jun	Jui	A	ug	Sep	Oct	INOV	Dec	J	
(94)m= 0.97	0.95	0.93	0.88	0.78		0.63	0.48	0.5	51	0.72	0.89	0.95	0.97	1	(94)
Useful gains,			<u> </u>							•		1		_	, ,
(95)m= 364.15	393.6	408.08	404.07	368.76	28	37.38	207.11	214	.22	289.19	334.84	342.99	348.81	1	(95)
Monthly avera	age exte	rnal tem	perature	from T	able	e 8								_	
(96)m= 4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	for mea	an intern	al tempe	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	- (96)m]			_	
(97)m= 804.39	781.41	710.89	597.13	464.98	3′	18.01	215.24	22	25	341.88	507.97	667.26	800.44		(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m		
(98)m= 327.54 260.61 225.29 139.01 71.59 0 0 0 128.8 233.47 336.01		_
Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ =	1722.33	(98)
Space heating requirement in kWh/m²/year	25.69	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		7(004)
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) $(202) = 1 - (201) =$ $(202) = (202) \times (4 - (202)) =$	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	100	(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 heating requirement (calculated above) 327.54 260.61 225.29 139.01 71.59 0 0 0 128.8 233.47 336.01		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)		(211)
327.54 260.61 225.29 139.01 71.59 0 0 0 128.8 233.47 336.01		(= : : /
Total (kWh/year) =Sum(211) _{15,1012} =	1722.33	(211)
Space heating fuel (secondary), kWh/month		
$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Total (kWh/year) =Sum(215) _{15,1012} =		(215)
Water heating	0	(213)
Output from water heater (calculated above)		
166.91 146.75 153.26 136.2 132.62 117.26 111.44 123.91 124.2 141.29 150.9 162.49		_
Efficiency of water heater	349.41	(216)
(217)m= 349.41 349.41 349.41 349.41 349.41 349.41 349.41 349.41 349.41 349.41 349.41 349.41 349.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m		
(219)m= 47.77 42 43.86 38.98 37.95 33.56 31.89 35.46 35.54 40.44 43.19 46.5		
Total = Sum(219a) ₁₁₂ =	477.15	(219)
Annual totals kWh/year	kWh/year	7
Space heating fuel used, main system 1	1722.33	_
Water heating fuel used	477.15	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside 184.05		(230a
Total electricity for the above, kWh/year sum of (230a)(230g) =	184.05	(231)
Electricity for lighting	299.64	(232)
	2602.40	(338)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	2683.18	(330)

Energy

kWh/year

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519	=	893.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	247.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1141.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	95.52	(267)
Electricity for lighting	(232) x	0.519	=	155.51	(268)
Total CO2, kg/year	sum	of (265)(271) =		1392.57	(272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =		20.77	(273)
EI rating (section 14)				83	(274)

				User D	etails: _						
Assessor Name: Software Name:	Stroma FS	AP 2012			Strom Softwa	are Ve	rsion:		Versio	n: 1.0.5.41	
Address :	2 Bed - MF,	London,		торену	Address	. z beu ·	- IVII				
1. Overall dwelling dime	ensions:										
				Are	a(m²)	1	Av. He	ight(m)	,	Volume(m ³	<u>^</u>
Ground floor				6	37.05	(1a) x		2.5	(2a) =	167.63	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+((1d)+(1e))+(1r	1) 6	37.05	(4)					
Dwelling volume						(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	167.63	(5)
2. Ventilation rate:											
	main heating	se h	condar eating	У	other		total			m³ per hou	ır
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	ıns						0	x '	10 =	0	(7a)
Number of passive vents	;					Ē	0	x -	10 =	0	(7b)
Number of flueless gas fi	ires					F	0	X 4	40 =	0	(7c)
									Air ch	nanges per ho	our
Infiltration due to chimne							0		÷ (5) =	0	(8)
If a pressurisation test has b Number of storeys in t			d, procee	d to (17),	otherwise (continue fr	rom (9) to	(16)			7 (0)
Additional infiltration	ne aweiling (na	P)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0	.25 for steel or	timber f	rame or	0.35 fo	r masoni	ry consti	ruction	,	•	0	(11)
if both types of wall are p			oonding to	the great	ter wall are	a (after					
deducting areas of openii If suspended wooden t	• ,. ,		ed) or 0	1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, en		•	<i>5</i> a , 6. 6.	ir (ocaic	, oloo	ornor o				0	(13)
Percentage of windows	•		ripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,				•	•	•	etre of e	envelope	area	2	(17)
If based on air permeabil	•									0.1	(18)
Air permeability value applie Number of sides sheltere		on test nas	been dor	ie or a de	gree air pe	rmeability	is being u	sea		2	(19)
Shelter factor	,				(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorporat	ting shelter fac	tor			(21) = (18) x (20) =				0.08	(21)
Infiltration rate modified f	or monthly win	d speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table	e 7								_	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2\m <i>≟ 4</i>										
	1.23 1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
				L						I	

•	ation rat	e (allowi	ing for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effe		•	rate for t	he appli	cable ca	se						0.5	(23
If exhaust air h			endix N (2	3h) = (23a	a) x Fmv (e	equation (N5)) othe	rwise (23h) = (23a)			0.5	==
If balanced with) - (20 0)			0.5	(23)
a) If balance		-	-	_					2h\m + ('	23h) ~ [1 _ (23c)	75.65 · 1001	(23
(24a)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22	+ 100j	(24
b) If balance		<u> </u>	ļ		Į	ļ	Į	Į	<u>. </u>				`
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h	OUSE EX	tract ver	ntilation o	or positiv	/e input	ventilatio	n from o	L outside					
,			then (24	•					.5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural	ventilatio	on or wh	ole hous	e positi	ve input	ventilati	on from I	loft				l	
if (22b)r	n = 1, th	en (24d)	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(25
3. Heat losse	s and he	eat loss	paramete	er:							_	_	
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	e 2 e 3		Openin m		Net Ar A ,r 3.57 1.81 2.1 1.05 7.35	x x x x	U-valu W/m2 1 1/[1/(1)+ 1/[1/(1)+ 1/[1/(1)+	= 0.04] = 0.04] =	A X U (W/k) 3.57 1.74 2.02 1.01 7.07	<) 	k-value kJ/m²-l		X k J/K (26 (27 (27 (27
Nalls	58.8	21	15.88		42.93	=	0.18		7.73	╡ ┌	14	601.0	
Fotal area of e	L		10.00	<u>-</u>	58.8	=	0.10		7.75		17		(31
Party wall					50.53	3 x	0		0	\neg	20	1010	.6 (32
Party floor					67.05	5					40	268	
Party ceiling					67.05	<u></u>				[30	2011	=
nternal wall **	•				87.34	=					9	╡	599 (32
for windows and	l roof wind				alue calcui		g formula 1	/[(1/U-valu	ıe)+0.04] a	L s given in			02
abric heat los				,			(26)(30)) + (32) =				23.13	(33
Heat capacity		,	,					((28)	(30) + (32	2) + (32a).	(32e) =	7091.18	(34
hermal mass		,	⊃ = Cm ÷	- TFA) ir	n kJ/m²K	,			÷ (4) =	. ,	• •	105.76	(35
	•	•		,			ecisely the		values of	TMP in T	able 1f		
ŭ		tailed calc											
can be used inste Thermal bridg	ad of a de		ulation.	using Ar	pendix l	K						8.29	(36
an be used inste	ead of a de es : S (L	x Y) cal	ulation. culated ı	• .	•	K						8.29	(36

Ventila	tion hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	12.73	12.61	12.49	11.91	11.79	11.2	11.2	11.08	11.44	11.79	12.02	12.26		(38)
Heat tr	ansfer c	coefficier	nt, W/K			-	-	-	(39)m	= (37) + (3	38)m	-		
(39)m=	44.15	44.04	43.92	43.33	43.21	42.63	42.63	42.51	42.86	43.21	43.45	43.68		
Heat lo	ss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	43.3	(39)
(40)m=	0.66	0.66	0.66	0.65	0.64	0.64	0.64	0.63	0.64	0.64	0.65	0.65		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	0.65	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
•	-		-			-	-	-			-	-		
4. Wa	ter heat	ing ener	rgy requi	rement:								kWh/ye	ear:	
A a a	مما ممد		NI.										1	(40)
if TF.			N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		.17		(42)
Annual	averag	e hot wa	ater usag									5.8		(43)
			hot water person per			_	-	to achieve	a water us	se target o	f———			
not more			,							0 /				
Hot water	Jan er usage in	Feb	Mar day for ea	Apr	May	Jun	Jul	Aug (43)	Sep	Oct	Nov	Dec		
	94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37		
(44)m=	94.37	90.94	67.51	64.06	60.05	11.22	11.22	60.05			m(44) ₁₁₂ =		1029.54	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	Tm / 3600					1029.34	(44)
(45)m=	139.96	122.41	126.31	110 <mark>.12</mark>	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		_
If instant	aneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	=	1349.89	(45)
(46)m=	20.99	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
	storage	loss:									<u> </u>			
Storage	e volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel	20	01		(47)
	-	-	ind no ta		_			. ,						
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage anufact		eclared l	oss facto	or is kno	wn (kW/h	n/day).					.54		(48)
,			m Table) 10 KHO	**** (1.000)	"aay).					3694		(49)
•			storage		ear			(48) x (49)) <u>=</u>			0		(50)
			eclared o			or is not		(10)11(10)				0		(00)
			factor fr		e 2 (kW	h/litre/da	ıy)					0		(51)
	-	_	ee secti	on 4.3									İ	
		from Tal	ble 2a m Table	2h							-	0		(52)
					oor			(A7) v (EA)	v (EO) v (52) —		0		(53)
• • • • • • • • • • • • • • • • • • • •		m water [54] in (5	storage 55)	, KVVII/Y6	zai			(47) x (51)	7 X (OZ) X (JJ) =		0 .87		(54) (55)
	` '	. , .	culated f	or each	month			((56)m = (55) × (41):	m				(30)
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(56)
(55)	_3.55	5-	L			L	L_0.00	L_0.00			I			(50)

If cylinder cor	tains dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) IS Tro	m Append	ix H	
(57)m= 26.	95 24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
Primary cir	cuit loss (ar	nnual) fro	m Table		•	•	•	•	•		0		(58)
•	cuit loss cal	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified	d by factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat	required for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 166	.91 146.75	153.26	136.2	132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49		(62)
Solar DHW in	put calculated	using App	endix G oı	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	on to wate	er heating)		
(add additi	onal lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS (0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output fror	n water hea	ter											
(64)m= 166	.91 146.75	153.26	136.2	132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49		_
							Outp	out from wa	ater heate	r (annual)₁	12	1667.22	(64)
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ^[0.85	× (45)m	+ (61)n	1] + 0.8 >	([(46)m	+ (57)m	+ (59)m]	
(65)m= 46.	54 40.7	42	36.62	35.13	30.32	28.09	32.24	32.62	38.02	41.5	45.07		(65)
include (57)m in cal	culation (of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	<mark>mu</mark> nity h	eating	
	57)m in calo al gains (see				ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Interna		e Table 5	and 5a		ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Interna	al gains (see	e Table 5	and 5a		ylinder is Jun	s in the o	dwelling Aug	or hot w	ater is fr	om com	munity h	eating	
5. Interna	al gains (see gains (Table an Feb	Table 5	and 5a):								eating	(66)
5. Interna Metabolic (Ja (66)m= 108	al gains (see gains (Table an Feb	Table 5 5), Wat Mar 108.62	and 5a ts Apr 108.62	May 108.62	Jun 108.62	Jul 108.62	Aug 108.62	Sep 108.62	Oct	Nov	Dec	eating	(66)
5. Interna Metabolic (Ja (66)m= 108	gains (Table an Feb .62 108.62 ins (calcula	Table 5 5), Wat Mar 108.62	and 5a ts Apr 108.62	May 108.62	Jun 108.62	Jul 108.62	Aug 108.62	Sep 108.62	Oct	Nov	Dec	eating	(66)
Metabolic (Ge6)m= 108 Lighting ga (67)m= 16.	gains (Table an Feb .62 108.62 ins (calcula	Mar 108.62 ted in Ap	Apr 108.62 opendix 9.28	May 108.62 L, equat 6.94	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5 11.04	Oct 108.62	Nov 108.62	Dec 108.62	eating	. ,
Metabolic (Ge6)m= 108 Lighting ga (67)m= 16.	gains (Table gains (Table an Feb .62 108.62 ins (calcula 97 15.07	Mar 108.62 ted in Ap	Apr 108.62 opendix 9.28	May 108.62 L, equat 6.94	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5 11.04	Oct 108.62	Nov 108.62	Dec 108.62	eating	. ,
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190	gains (Table gains (Table an Feb .62 108.62 ins (calcula 97 15.07	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Appendix 176.72	May 108.62 L, equat 6.94 dix L, eq	Jun 108.62 ion L9 o 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta 145.38	Oct 108.62 14.02 ble 5 155.98	Nov 108.62	Dec 108.62	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190	gains (Table an Feb .62 108.62 iins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Appendix 176.72	May 108.62 L, equat 6.94 dix L, eq	Jun 108.62 ion L9 o 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta 145.38	Oct 108.62 14.02 ble 5 155.98	Nov 108.62	Dec 108.62	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33.	gains (Table an Feb .62 108.62 iins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a)	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 2 see Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33.	gains (Table an Feb .62 108.62 ins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula 86 33.86 d fans gains	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a)	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 5 see Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (gains (Table an Feb .62 108.62 ins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula 86 33.86 d fans gains	Mar 108.62 ted in Ap 12.26 culated in Ap ated in A 33.86 (Table 8	and 5a ts Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula .32 192.29 .6 33.86 .6 33.86 .7 0 .7 evaporation	Mar 108.62 ted in Ap 12.26 culated in Ap ated in A 33.86 (Table 8	and 5a ts Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86	gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula .32 192.29 .6 33.86 .6 33.86 .7 0 .7 evaporation	ted in Ap 12.26 culated in 187.31 ated in A 33.86 (Table 5 0 on (negar	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 0	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69) (70)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86	gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .7 gains (calcula gains) .8 gains (calcula gains)	ted in Ap 12.26 culated in 187.31 ated in A 33.86 (Table 5 0 on (negar	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 0	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69) (70)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86 Water heat (72)m= 62.	gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .7 gains (calcula gains) .8 gains (calcula gains)	108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 0 on (negative) -86.9 Table 5) 56.45	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86 5a) 0 tive valu	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 0 es) (Tab	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86 0 ole 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86 0	Oct 108.62 14.02 ble 5 155.98 5 33.86 0 -86.9	Nov 108.62 16.36 169.35 33.86 0	Dec 108.62 17.44 181.92 33.86 0	eating	(67) (68) (69) (70) (71)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86 Water heat (72)m= 62.	gains (Table an Feb 108.62 108.62 108.62 108.62 15.07 15.07 16.07	108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 0 on (negative) -86.9 Table 5) 56.45	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86 5a) 0 tive valu	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 0 es) (Tab	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86 0 ole 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86 0	Oct 108.62 14.02 ble 5 155.98 5 33.86 0 -86.9	Nov 108.62 16.36 169.35 33.86 0	Dec 108.62 17.44 181.92 33.86 0	eating	(67) (68) (69) (70) (71)

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

	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	X	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast _{0.9x}	0.77	X	1.81	х	22.97	X	0.3	x	0.7	=	6.05	(75)
Northeast 0.9x	0.77	X	1.81	x	41.38	X	0.3	x	0.7	=	10.9	(75)
Northeast _{0.9x}	0.77	X	1.81	х	67.96	х	0.3	x	0.7	=	17.9	(75)
Northeast _{0.9x}	0.77	X	1.81	x	91.35	X	0.3	x	0.7	=	24.06	(75)
Northeast 0.9x	0.77	X	1.81	x	97.38	x	0.3	x	0.7	=	25.65	(75)
Northeast _{0.9x}	0.77	X	1.81	x	91.1	x	0.3	x	0.7	=	24	(75)
Northeast _{0.9x}	0.77	X	1.81	x	72.63	x	0.3	x	0.7	=	19.13	(75)
Northeast _{0.9x}	0.77	X	1.81	x	50.42	x	0.3	x	0.7	=	13.28	(75)
Northeast 0.9x	0.77	X	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast 0.9x	0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast _{0.9x}	0.77	X	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x	0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x	0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x	0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x	0.77	X	1.05	X	106.25	X	0.3	X	0.7	=	16.24	(77)
Southeast 0.9x	0.77	X	1.05	х	119.01	х	0.3	x	0.7	-	18.19	(77)
Southeast 0.9x	0.77	X	1.05	х	118.15	×	0.3	x	0.7	=	18.05	(77)
Southeast _{0.9x}	0.7 <mark>7</mark>	X	1.05	x	113.91	x	0.3	x	0.7	=	17.41	(77)
Southeast 0.9x	0.77	X	1.05	x	104.39	Х	0.3	x	0.7	=	15.95	(77)
Southeast _{0.9x}	0.77	X	1.05	x	92.85	X	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x	0.77	X	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x	0.77	x	1.05	х	44.07	x	0.3	x	0.7	=	6.73	(77)
Southeast 0.9x	0.77	X	1.05	X	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x}	0.77	X	7.35	X	36.79		0.3	X	0.7	=	39.36	(79)
Southwest _{0.9x}	0.77	X	7.35	x	62.67		0.3	x	0.7	=	67.04	(79)
Southwest _{0.9x}	0.77	X	7.35	X	85.75		0.3	x	0.7	=	91.72	(79)
Southwest _{0.9x}	0.77	X	7.35	X	106.25		0.3	X	0.7	=	113.65	(79)
Southwest _{0.9x}	0.77	X	7.35	x	119.01		0.3	x	0.7	=	127.3	(79)
Southwest _{0.9x}	0.77	X	7.35	x	118.15		0.3	X	0.7	=	126.38	(79)
Southwest _{0.9x}	0.77	X	7.35	X	113.91		0.3	X	0.7	=	121.84	(79)
Southwest _{0.9x}	0.77	X	7.35	X	104.39		0.3	x	0.7	=	111.66	(79)
Southwest _{0.9x}	0.77	X	7.35	X	92.85		0.3	X	0.7	=	99.32	(79)
Southwest _{0.9x}	0.77	X	7.35	X	69.27		0.3	X	0.7	=	74.09	(79)
Southwest _{0.9x}	0.77	X	7.35	x	44.07		0.3	x	0.7	=	47.14	(79)
Southwest _{0.9x}	0.77	X	7.35	x	31.49		0.3	x	0.7	=	33.68	(79)
Northwest 0.9x	0.77	X	2.1	x	11.28	x	0.3	x	0.7	=	3.45	(81)
Northwest 0.9x	0.77	x	2.1	x	22.97	x	0.3	x	0.7] =	7.02	(81)
Northwest 0.9x	0.77	X	2.1	X	41.38	X	0.3	X	0.7	=	12.65	(81)

Northw	/est _{0.9x}	0.77	Х	2.	1	x	67	7.96	X		0.3	x [0.7	=	20.77	(81)
Northw	/est _{0.9x}	0.77	Х	2.	1	x	9	1.35	X		0.3	x [0.7	=	27.92	(81)
Northw	/est _{0.9x}	0.77	Х	2.	1	x	97	7.38	X		0.3	x	0.7	=	29.76	(81)
Northw	/est _{0.9x}	0.77	х	2.	1	x	9	1.1	X		0.3	x	0.7	=	27.84	(81)
Northw	est _{0.9x}	0.77	х	2.	1	x	72	2.63	x		0.3	x	0.7	=	22.2	(81)
Northw	est _{0.9x}	0.77	x	2.	1	x	50	0.42	x		0.3	_ x [0.7		15.41	(81)
Northw	/est <u>0.9</u> x	0.77	x	2.	1	x T	28	3.07	x		0.3	= x =	0.7	-	8.58	(81)
Northw	/est _{0.9x}	0.77	x	2.	1	x \lceil	1	4.2	x		0.3	_ x [0.7	=	4.34	(81)
Northw	/est _{0.9x}	0.77	х	2.	1	x	9	.21	x		0.3	_ x [0.7	=	2.82	(81)
	_															
Solar	gains in	watts, c	alculated	d for eac	h month				(83)m	ı = Su	ım(74)m .	(82)m				
(83)m=	$\overline{}$	89.68	128.37	168.56	197.46	T T	9.85	191.09	168.	.94	142.2	100.65	61.95	43.74		(83)
Total (gains – ir	nternal a	and sola	r (84)m =	= (73)m	+ (83	3)m ,	watts					1			
(84)m=	376.82	413.2	439.98	461	470.55	454	4.17	433.14	416.	.48	399.51	377.33	360.89	359.25		(84)
7 Ma	ean inter	nal temr	perature	(heating	season)				-			!	!		
	perature	•		`		<i>'</i>	roa fi	rom Tak	مام ۵	Th1	I (°C\				21	(85)
		_	٠.			•			JIE 3,		i (C)				21	(00)
Utilis	ation fac		1	T .	1	Ė.			Ι		Can	0 = 1	Nov	Daa		
(00)	Jan	Feb	Mar	Apr	May		un 57	Jul		ug	Sep	Oct	Nov	Dec 0.97		(86)
(86)m=	0.96	0.95	0.92	0.85	0.73	0.	.57	0.42	0.4	ю	0.67	0.86	0.95	0.97		(80)
Mear	internal	temper	ature in	living ar	ea T1 (fo	ollow	v step	os 3 to 7	in T	able	9c)					
(87)m=	19.85	20.02	20.28	20.59	20.82	20	.95	20.99	20.9	99	20.91	20.62	20.19	19.81		(87)
Tem	oerature	during h	neating p	eriods i	n rest of	dwe	elling	from Ta	able 9), Th	2 (°C)					
(88)m=	20.67	20.67	20.67	20.68	20.68	20	.68	20.68	20.6	68	20.68	20.68	20.68	20.67		(88)
Utilis	ation fac	tor for a	ains for	rest of d	welling	h2 n	n (se	e Table	9a)							
(89)m=	0.96	0.94	0.91	0.84	0.72		54	0.4	0.4	3	0.65	0.85	0.94	0.97		(89)
\		1.1		11	. (. .		<u>-</u>				· · · · · · · · ·	- 0 -)	<u> </u>	l		
	internal	<u>.</u>	1	1	1	<u> </u>	`		i 	$\overline{}$	1		100	40.75		(00)
(90)m=	18.81	19.06	19.43	19.87	20.19	20	.35	20.39	20.3	39	20.3	19.92	19.3 ng area ÷ (4	18.75		(90)
											,	LA = LIVII	ig alea - (+) =	0.54	(91)
Mear	n internal	l temper	ature (fo	or the wh	ole dwe	lling) = fL	A × T1	+ (1	– fL/	A) × T2			_	<u>.</u>	
(92)m=	19.36	19.57	19.88	20.25	20.53	20	.67	20.71	20.7	71	20.63	20.29	19.78	19.32		(92)
Apply	y adjustn	nent to t	he mear	n interna	l temper	atur	e fror	m Table	4e, 1	whe	re appro	priate	_			
(93)m=	19.36	19.57	19.88	20.25	20.53	20	.67	20.71	20.7	71	20.63	20.29	19.78	19.32		(93)
8. Sp	ace hea	ting req	uiremen	t												
	i to the r			•		ned a	at ste	p 11 of	Tabl	e 9b	, so tha	t Ti,m=(76)m an	d re-cald	culate	
the u	tilisation				i							_	1	I _	İ	
	Jan	Feb	Mar	Apr	May	J	lun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
	ation fac			1	T	_							1	l	Ī	(0.4)
(94)m=		0.93	0.9	0.83	0.71	0.	54	0.4	0.4	3	0.64	0.84	0.93	0.96		(94)
	ul gains,		- `	, ` `			1				1		T		I	(05)
(95)m=		385.05	394.39	380.95	334.08		7.02	172.59	179.	.49	256.17	317.34	335.08	344.25		(95)
	hly avera		1	ri e		г –		40.5	, -	, 1	,,, I	4.5 =	1 - ;		Ī	(00)
(96)m=		4.9	6.5	8.9	11.7	<u> </u>	4.6	16.6	16.		14.1	10.6	7.1	4.2		(96)
Heat	loss rate	tor me	T T		1	T	, W = _{8.95}	[(39)m 175.21	- `	' T	- (96)m 279.76		550.76	1	1	
(97)m =	665.13	646.15	587.74	491.96	381.49	_ ^-			183			418.83		660.45		(97)

Space heating requirement to	or each r	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m						
(98)m= 228.01 175.46 143.85	79.92	35.27	0	0	0	0	75.51	155.29	235.25		_			
					Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1128.57	(98)			
Space heating requirement i	n kWh/m	²/year							[16.83	(99)			
9a. Energy requirements – In	dividual h	eating s	ystems i	ncluding	micro-C	CHP)								
Space heating:		, ,							г		¬			
Fraction of space heat from			ementary	system		(004)			Į	0	(201)			
•	raction of space heat from main system(s) $ (202) = 1 - (201) = $ raction of total heating from main system 1 $ (204) = (202) \times [1 - (203)] = $													
-	•				(204) = (2	02) x [1 –	(203)] =		Į	1	(204)			
Efficiency of main space hea				٥,					Į	100	(206)			
Efficiency of secondary/supp	_	·	g systen		•	ı		ı		0	(208)			
Jan Feb Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear			
Space heating requirement (228.01 175.46 143.85	<u> </u>	35.27) 0	0	0	0	75.51	155.29	235.25					
$(211)m = \{[(98)m \times (204)] \} x$		Į						100.20	200.20		(211)			
228.01 175.46 143.85		35.27	0	0	0	0	75.51	155.29	235.25		(211)			
					Tota	l (kWh/yea	ar) =Sum(2	1 211) _{15,1012}	=	1128.57	(211)			
Space heating fuel (seconda	ıry), kWh	/month									_			
$= \{[(98)m \times (201)]\} \times 100 \div (201)$	(80													
(215)m= 0 0 0	0	0	0	0	0	0	0	0	0		-			
					lota	ıı (KVVN/yea	ar) =Sum(2	215) _{15,1012}	-	0	(215)			
Water heating Output from water heater (cal	culated a	hove)												
166.91 146.75 153.26		132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49					
Efficiency of water heater	·•	•	•	•	•	•		•		349.41	(216)			
(217)m= 349.41 349.41 349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41	349.41		(217)			
Fuel for water heating, kWh/n														
(219) m = (64) m x $100 \div (217)$ (219)m = 47.77 42 43.86	7)m 38.98	37.95	33.56	31.89	35.46	35.54	40.44	43.19	46.5					
	ļ				Tota	l = Sum(2	19a) ₁₁₂ =			477.15	(219)			
Annual totals							k'	Wh/year		kWh/yea				
Space heating fuel used, mai	n system	1								1128.57				
Water heating fuel used									ſ	477.15				
Electricity for pumps, fans and	d electric	keep-ho	t						_		_			
mechanical ventilation - bala	nced, ex	tract or p	ositive i	nput fror	n outside	Э			184.05		(230a			
Total electricity for the above,	kWh/yea	ar			sum	of (230a).	(230g) =			184.05	(231)			
Electricity for lighting														
Total delivered energy for all	otal delivered energy for all uses (211)(221) + (231) + (232)(237b) =													
									L		_			

Energy

kWh/year

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519	=	585.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	247.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			833.37	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	95.52	(267)
Electricity for lighting	(232) x	0.519	=	155.51	(268)
Total CO2, kg/year	sum o	of (265)(271) =		1084.41	(272)
Dwelling CO2 Emission Rate	(272)	÷ (4) =		16.17	(273)
El rating (section 14)				87	(274)

		User D	Details:						
Assessor Name: Software Name:	Stroma FSAP 2012	le on out i	Strom Softwa	are Ve	rsion:		Versio	on: 1.0.5.41	
Address :	2 Bed - TF, London, TBC	торепу	Address	Z Bea ·	- I F				
1. Overall dwelling dime	ensions:								
0 10			a(m²)			ight(m)	٦	Volume(m	<u> </u>
Ground floor			67.05	(1a) x	2	2.5	(2a) =	167.63	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1i	ገ)	67.05	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	167.63	(5)
2. Ventilation rate:									
	main secondar heating heating	у	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0] = [0	X	40 =	0	(6a)
Number of open flues	0 + 0	7 + [0] = [0	X	20 =	0	(6b)
Number of intermittent fa	ins			-	0	X	10 =	0	(7a)
Number of passive vents	;				0	x	10 =	0	(7b)
Number of flueless gas fi	ires			-	0	X	40 =	0	(7c)
				L			Air ch	nanges per ho	
	ys, flues and fans = (6a)+(6b)+(7			antinus fi	0		\div (5) =	0	(8)
Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	a to (17),	otnerwise (continue ir	rom (9) to ((16)		0	(9)
Additional infiltration	(no)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame of	0.35 fo	r masoni	y consti	ruction			0	(11)
	resent, use the value corresponding to	the great	ter wall are	a (after					
deducting areas of openii If suspended wooden f	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	,	`	,,					0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	100] =			0	(15)
Infiltration rate					12) + (13)			0	(16)
•	q50, expressed in cubic metre	•	•	•	etre of e	envelope	area	2	(17)
·	lity value, then $(18) = [(17) \div 20] + (18)$ es if a pressurisation test has been do				is boing u	sod		0.1	(18)
Number of sides sheltere		ie oi a de	gree an pe	пеаышу	is being u	seu		2	(19)
Shelter factor			(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorporat	ting shelter factor		(21) = (18	x (20) =				0.08	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m <i>∸</i> 4								
	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18]	
, ,	1 1 1 2 2					<u> </u>		J	

djusted infiltra	ation rate	(allowi	ng for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.11	0.11	0.1	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.1	0.1		
Calculate effect If mechanica		-	rate for t	пе арріі	саріе са	ise					Г	0.5	(2
If exhaust air he			endix N. (2	3b) = (23a	a) × Fmv (eguation (N5)) . othe	rwise (23b) = (23a)		L		(2
If balanced with									, (===,		F	0.5	=
									26\m . (22h) [_ 	75.65	(2
a) If balance	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	23D) X [$\frac{1 - (230)}{0.22}$	- 100]	(2
, L	l l				<u> </u>			l	ļ	l	0.22		(2
b) If balance					1	, , ,	, 	i `	 				(0
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h if (22b)n	ouse ext า < 0.5 ×			•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural	ventilatio	n or wh	ole hous	e positi	ve input	ventilati	on from	oft		Į.			
,	n = 1, the			•					0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change r	ate - er	nter (24a) or (24l	b) or (24	c) or (24	ld) in bo	x (25)	-	-			
25)m= 0.23	0.23	0.23	0.22	0.21	0.2	0.2	0.2	0.21	0.21	0.22	0.22		(2
3. Heat losse		. I										_	
LEMENT	Gros:	s	Openin	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	<)	k-value kJ/m²·K		X k J/K
oors					3.57		1	= 1	3.57	7			(2
Vin <mark>dows</mark> Type	1				1.81		1/[1/(1)+		1.74	Ħ			(2
Vindows Type							1/[1/(1)+			Ħ			·
					2.1				2.02	닉			(2
Vindows Type					1.05		1/[1/(1)+		1.01	ᆗ			(2
Vindows Type	: 4				7.35	X	1/[1/(1)+	0.04] =	7.07	╛.			<u>(2</u>
Valls	58.81	1	15.8	8	42.93	3 X	0.18	=	7.73		14	601.0	2 (2
Roof	67.05	5	0		67.0	5 X	0.11	=	7.38		9	603.4	5 (3
otal area of e	lements,	m²			125.8	6							(3
arty wall					50.53	3 X	0	=	0		20	1010.	6 (3
arty floor					67.05	5					40	2682	(3
nternal wall **					87.34					[9	786.05	=
for windows and	roof windo	ws. use e	effective wi	ndow U-v			g formula 1	/[(1/U-valu	ue)+0.041 a	l ns aiven in			00 (0
* include the area							,		,	J	. 3 4		
abric heat los	s, W/K =	S (A x	U)				(26)(30) + (32) =			Γ	30.51	(3
eat capacity	Cm = S(Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	5683.13	(3
hermal mass	paramet	er (TMF	= Cm ÷	- TFA) ir	n kJ/m²K			= (34)	÷ (4) =		Ť	84.76	<u> </u>
or design assess an be used instea				construct	tion are no	t known p	recisely the	e indicative	e values of	TMP in T	able 1f		
				ısina Ar	nendix	K					Г	10.00	(:
hermal bridge	, o . o	1 <i>)</i> 001	odiated t	aonig / w	pondix :						J	18.08	
details of therma	•	,		• •	•						L	10.00	

Ventilation	on hea	nt loss ca	alculated	l monthly	У				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	12.73	12.61	12.49	11.91	11.79	11.2	11.2	11.08	11.44	11.79	12.02	12.26		(38)
Heat trar	nsfer c	oefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m=	61.32	61.2	61.08	60.5	60.38	59.79	59.79	59.67	60.03	60.38	60.61	60.85		
Heat loss	s para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	60.47	(39)
(40)m=	0.91	0.91	0.91	0.9	0.9	0.89	0.89	0.89	0.9	0.9	0.9	0.91		
Number	of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁ .	12 /12=	0.9	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wate	er heat	ing ener	rgy requi	rement:								kWh/ye	ear:	
Assume	d occu	nancy I	N								2	17		(42)
if TFA	> 13.9			[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		17		(42)
Annual a												5.8		(43)
Reduce the not more th							-	to achieve	a water us	se target o	†			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water i									Sep	Oct	NOV	Dec		
(44)m=	94.37	90.94	87.51	84.08	80.65	77.22	77.22	80.65	84.08	87.51	90.94	94.37		
	-										m(44) ₁₁₂ =		1029.54	(44)
Energy cor	ntent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	Tm / 3600	kWh/mor	th (see Ta	bles 1b, 1	c, 1d)		
(45)m= 1	139.96	122.41	126.31	110 <mark>.12</mark>	105.66	91.18	84.49	96.96	98.11	114.34	124.81	135.54		_
If instantar	neous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		Γotal = Su	m(45) ₁₁₂ =	= [1349.89	(45)
(46)m=	20.99	18.36	18.95	16.52	15.85	13.68	12.67	14.54	14.72	17.15	18.72	20.33		(46)
Water st	orage	loss:	<u> </u>				<u> </u>	<u> </u>			<u> </u>	<u> </u>		
Storage		` ,					•		ame ves	sel	20	01		(47)
If communication of the statement of the	-	_			-			, ,	ers) ente	er '0' in (47)			
Water st				. (-					,	,	,			
a) If mai	nufact	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):				0.	54		(48)
Tempera	ature fa	actor fro	m Table	2b							0.8	694		(49)
Energy lo			_	-		!+		(48) x (49)	=			0		(50)
b) If marHot wate				-								0		(51)
If commu					,		,,					<u> </u>		(= -)
Volume f												0		(52)
Tempera												0		(53)
Energy lo			-	, kWh/ye	ear			(47) x (51)	x (52) x (53) =	-	0		(54)
Enter (5	, ,		•	or oach	manth			//EG\~~ /	EE) (44):	~	0.	87		(55)
Water st						00.00		((56)m = (00.00	00.0-		(50)
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(56)

If cylinder cor	tains dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) IS Tro	m Append	ix H	
(57)m= 26.	95 24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95		(57)
Primary cir	cuit loss (ar	nnual) fro	m Table		•	•	•	•	•		0		(58)
•	cuit loss cal	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified	d by factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat	required for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 166	.91 146.75	153.26	136.2	132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49		(62)
Solar DHW in	put calculated	using App	endix G oı	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	on to wate	er heating)		
(add additi	onal lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS (0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output fror	n water hea	ter											
(64)m= 166	.91 146.75	153.26	136.2	132.62	117.26	111.44	123.91	124.2	141.29	150.9	162.49		_
							Outp	out from wa	ater heate	r (annual)₁	12	1667.22	(64)
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ^[0.85	× (45)m	+ (61)n	1] + 0.8 >	([(46)m	+ (57)m	+ (59)m]	
(65)m= 46.	54 40.7	42	36.62	35.13	30.32	28.09	32.24	32.62	38.02	41.5	45.07		(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating													
include (57)m in cal	culation (of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	<mark>mu</mark> nity h	eating	
	57)m in calo al gains (see				ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Interna		e Table 5	and 5a		ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Interna	al gains (see	e Table 5	and 5a		ylinder is Jun	s in the o	dwelling Aug	or hot w	ater is fr	om com	munity h	eating	
5. Interna	al gains (see gains (Table an Feb	Table 5	and 5a):								eating	(66)
5. Interna Metabolic (Ja (66)m= 108	al gains (see gains (Table an Feb	Table 5 5), Wat Mar 108.62	and 5a ts Apr 108.62	May 108.62	Jun 108.62	Jul 108.62	Aug 108.62	Sep 108.62	Oct	Nov	Dec	eating	(66)
5. Interna Metabolic (Ja (66)m= 108	gains (Table an Feb .62 108.62 ins (calcula	Table 5 5), Wat Mar 108.62	and 5a ts Apr 108.62	May 108.62	Jun 108.62	Jul 108.62	Aug 108.62	Sep 108.62	Oct	Nov	Dec	eating	(66)
Metabolic (Ge6)m= 108 Lighting ga (67)m= 16.	gains (Table an Feb .62 108.62 ins (calcula	Mar 108.62 ted in Ap	Apr 108.62 opendix 9.28	May 108.62 L, equat 6.94	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5 11.04	Oct 108.62	Nov 108.62	Dec 108.62	eating	. ,
Metabolic (Ge6)m= 108 Lighting ga (67)m= 16.	gains (Table gains (Table an Feb .62 108.62 ins (calcula 97 15.07	Mar 108.62 ted in Ap	Apr 108.62 opendix 9.28	May 108.62 L, equat 6.94	Jun 108.62 ion L9 o	Jul 108.62 r L9a), a 6.33	Aug 108.62 Iso see	Sep 108.62 Table 5 11.04	Oct 108.62	Nov 108.62	Dec 108.62	eating	. ,
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190	gains (Table gains (Table an Feb .62 108.62 ins (calcula 97 15.07	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Appendix 176.72	May 108.62 L, equat 6.94 dix L, eq	Jun 108.62 ion L9 o 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta 145.38	Oct 108.62 14.02 ble 5 155.98	Nov 108.62	Dec 108.62	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190	gains (Table an Feb .62 108.62 iins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula	Mar 108.62 ted in Ap 12.26 culated in	Apr 108.62 ppendix 9.28 Appendix 176.72	May 108.62 L, equat 6.94 dix L, eq	Jun 108.62 ion L9 o 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38	Aug 108.62 Iso see 8.22 3a), also	Sep 108.62 Table 5 11.04 see Ta 145.38	Oct 108.62 14.02 ble 5 155.98	Nov 108.62	Dec 108.62	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33.	gains (Table an Feb .62 108.62 iins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a)	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 5 see Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33.	gains (Table an Feb .62 108.62 ins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula 86 33.86 d fans gains	Mar 108.62 ted in Ap 12.26 culated in 187.31 ated in A	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat	Jun 108.62 ion L9 of 5.86 uation L 150.78	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a)	Aug 108.62 Iso see 8.22 3a), also 140.4	Sep 108.62 Table 5 11.04 5 see Ta 145.38 ee Table	Oct 108.62 14.02 ble 5 155.98	Nov 108.62 16.36	Dec 108.62 17.44 181.92	eating	(67)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (gains (Table an Feb .62 108.62 ins (calcula 97 15.07 gains (calcula .32 192.29 ains (calcula 86 33.86 d fans gains	Mar 108.62 ted in Ap 12.26 culated in Ap ated in A 33.86 (Table 8	and 5a ts Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69)
Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula .32 192.29 .6 33.86 .6 33.86 .7 0 .7 evaporation	Mar 108.62 ted in Ap 12.26 culated in Ap ated in A 33.86 (Table 8	and 5a ts Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a)	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86	gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula .32 192.29 .6 33.86 .6 33.86 .7 0 .7 evaporation	ted in Ap 12.26 culated in 187.31 ated in A 33.86 (Table 5 0 on (negar	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 0	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69) (70)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86	gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .7 gains (calcula gains) .8 gains (calcula gains)	ted in Ap 12.26 culated in 187.31 ated in A 33.86 (Table 5	Apr 108.62 ppendix 9.28 Append 176.72 ppendix 33.86 5a) 0	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86	Oct 108.62 14.02 ble 5 155.98 5 33.86	Nov 108.62 16.36 169.35	Dec 108.62 17.44 181.92 33.86	eating	(67) (68) (69) (70)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86 Water heat (72)m= 62.	gains (Table an Feb .62 108.62 .62 108.62 .63 15.07 .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .6 gains (calcula gains) .7 gains (calcula gains) .8 gains (calcula gains)	108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 0 on (negative) -86.9 Table 5) 56.45	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86 5a) 0 tive valu	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 0 es) (Tab	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86 0 ole 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86 0	Oct 108.62 14.02 ble 5 155.98 5 33.86 0 -86.9	Nov 108.62 16.36 169.35 33.86 0	Dec 108.62 17.44 181.92 33.86 0	eating	(67) (68) (69) (70) (71)
5. Internal Metabolic ((66)m= 108 Lighting ga (67)m= 16. Appliances (68)m= 190 Cooking ga (69)m= 33. Pumps and (70)m= (Losses e.g (71)m= -86 Water heat (72)m= 62.	gains (Table an Feb 108.62 108.62 108.62 108.62 15.07 15.07 16.07	108.62 ted in Ap 12.26 tulated in 187.31 ated in A 33.86 (Table 5 0 on (negative) -86.9 Table 5) 56.45	Apr 108.62 opendix 9.28 n Append 176.72 opendix 33.86 5a) 0 tive valu	May 108.62 L, equat 6.94 dix L, eq 163.35 L, equat 33.86 0 es) (Tab	Jun 108.62 ion L9 of 5.86 uation L 150.78 tion L15 33.86 0 ole 5) -86.9	Jul 108.62 r L9a), a 6.33 13 or L1 142.38 or L15a) 33.86	Aug 108.62 Iso see 8.22 3a), also 140.4), also se 33.86	Sep 108.62 Table 5 11.04 see Ta 145.38 ee Table 33.86 0	Oct 108.62 14.02 ble 5 155.98 5 33.86 0 -86.9	Nov 108.62 16.36 169.35 33.86 0	Dec 108.62 17.44 181.92 33.86 0	eating	(67) (68) (69) (70) (71)

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

Orientation: Access F Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	1.81	x	11.28	x	0.3	x	0.7	=	2.97	(75)
Northeast 0.9x 0.77	x	1.81	x	22.97	x	0.3	x	0.7	=	6.05	(75)
Northeast 0.9x 0.77	x	1.81	x	41.38	x	0.3	x	0.7	j =	10.9	(75)
Northeast 0.9x 0.77	x	1.81	x	67.96	x	0.3	x	0.7	j =	17.9	(75)
Northeast 0.9x 0.77	x	1.81	x	91.35	x	0.3	x	0.7	j =	24.06	(75)
Northeast 0.9x 0.77	×	1.81	x	97.38	x	0.3	x	0.7] =	25.65	(75)
Northeast 0.9x 0.77	x	1.81	x	91.1	x	0.3	x	0.7] =	24	(75)
Northeast 0.9x 0.77	x	1.81	x	72.63	x	0.3	x	0.7] =	19.13	(75)
Northeast 0.9x 0.77	x	1.81	x	50.42	x	0.3	x	0.7] =	13.28	(75)
Northeast 0.9x 0.77	х	1.81	x	28.07	x	0.3	x	0.7	=	7.39	(75)
Northeast 0.9x 0.77	X	1.81	x	14.2	x	0.3	x	0.7	=	3.74	(75)
Northeast 0.9x 0.77	х	1.81	x	9.21	x	0.3	x	0.7	=	2.43	(75)
Southeast 0.9x 0.77	X	1.05	x	36.79	x	0.3	x	0.7	=	5.62	(77)
Southeast 0.9x 0.77	X	1.05	x	62.67	x	0.3	x	0.7	=	9.58	(77)
Southeast 0.9x 0.77	X	1.05	x	85.75	x	0.3	x	0.7	=	13.1	(77)
Southeast 0.9x 0.77	X	1.05	X	106.25	X	0.3	X	0.7] =	16.24	(77)
Southeast 0.9x 0.77	x	1.05	х	119.01	x	0.3	x	0.7	-	18.19	(77)
Southeast 0.9x 0.77	x	1.05	х	118.15] x	0.3	x	0.7] =	18.05	(77)
Southeast 0.9x 0.77	X	1.05	x	113.91] x	0.3	x	0.7] =	17.41	(77)
Southeast 0.9x 0.77	x	1.05	x	104.39	x	0.3	x	0.7] =	15.95	(77)
Southeast 0.9x 0.77	X	1.05	x	92.85	X	0.3	x	0.7	=	14.19	(77)
Southeast 0.9x 0.77	X	1.05	х	69.27	x	0.3	x	0.7	=	10.58	(77)
Southeast 0.9x 0.77	X	1.05	x	44.07	x	0.3	x	0.7	=	6.73	(77)
Southeast 0.9x 0.77	X	1.05	x	31.49	x	0.3	x	0.7	=	4.81	(77)
Southwest _{0.9x} 0.77	X	7.35	X	36.79]	0.3	X	0.7	=	39.36	(79)
Southwest _{0.9x} 0.77	X	7.35	x	62.67]	0.3	x	0.7	=	67.04	(79)
Southwest _{0.9x} 0.77	X	7.35	X	85.75]	0.3	X	0.7	=	91.72	(79)
Southwest _{0.9x} 0.77	X	7.35	x	106.25]	0.3	x	0.7	=	113.65	(79)
Southwest _{0.9x} 0.77	х	7.35	x	119.01]	0.3	x	0.7] =	127.3	(79)
Southwest _{0.9x} 0.77	х	7.35	x	118.15]	0.3	x	0.7	=	126.38	(79)
Southwest _{0.9x} 0.77	х	7.35	x	113.91]	0.3	x	0.7	=	121.84	(79)
Southwest _{0.9x} 0.77	X	7.35	X	104.39]	0.3	X	0.7] =	111.66	(79)
Southwest _{0.9x} 0.77	X	7.35	X	92.85]	0.3	X	0.7	=	99.32	(79)
Southwest _{0.9x} 0.77	X	7.35	X	69.27]	0.3	X	0.7	=	74.09	(79)
Southwest _{0.9x} 0.77	х	7.35	x	44.07]	0.3	x	0.7	=	47.14	(79)
Southwest _{0.9x} 0.77	X	7.35	x	31.49]	0.3	x	0.7] =	33.68	(79)
Northwest 0.9x 0.77	X	2.1	x	11.28	x	0.3	x	0.7	<u> </u>	3.45	(81)
Northwest 0.9x 0.77	X	2.1	x	22.97	x	0.3	x	0.7] =	7.02	(81)
Northwest _{0.9x} 0.77	X	2.1	X	41.38	x	0.3	X	0.7	=	12.65	(81)

Northwest _{0.9x}	0.77	×	2.	1	X	6	7.96	X		0.3	x	0.7	=	20.77	(81)
Northwest _{0.9x}	0.77	x	2.	1	X	9	1.35	X		0.3	x	0.7	=	27.92	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	7.38	X		0.3	x	0.7	=	29.76	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	91.1	X		0.3	x	0.7	=	27.84	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	7	2.63	X		0.3	x	0.7	=	22.2	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	5	0.42	X		0.3	х	0.7	=	15.41	(81)
Northwest 0.9x	0.77	X	2.	1	x	2	8.07	x		0.3	x [0.7	=	8.58	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	1	14.2	X		0.3	x [0.7	=	4.34	(81)
Northwest _{0.9x}	0.77	X	2.	1	x	9	9.21	x		0.3	x	0.7	=	2.82	(81)
Solar gains in y	vatts, ca	alculated	for eac	h month		_		(83)m	ı = Sı	um(74)m .	(82)m	_	-	_	
(83)m= 51.4	89.68	128.37	168.56	197.46	19	99.85	191.09	168	.94	142.2	100.65	61.95	43.74		(83)
Total gains – ir	iternal a	ınd solar	(84)m =	= (73)m ·	+ (8	33)m	, watts					_		_	
(84)m= 376.82	413.2	439.98	461	470.55	45	54.17	433.14	416	.48	399.51	377.33	360.89	359.25		(84)
7. Mean interr	nal temp	erature	(heating	season)										
Temperature	during h	eating p	eriods ir	n the livi	ng a	area f	rom Tab	ole 9,	, Th	1 (°C)				21	(85)
Utilisation fact	or for g	ains for I	living are	ea, h1,m	(se	ee Ta	ble 9a)								
Jan	Feb	Mar	Apr	May	Ī,	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.96	0.94	0.92	0.87	0.79	Q).67	0.54	0.5	57	0.75	0.88	0.94	0.96		(86)
Mean internal	temper	ature in	living ar	ea T1 (fo	ollo	w ste	ns 3 to 7	7 in T	able	9c)			•		
(87)m= 18.86	19.08	19.45	19.93	20.39		0.74	20.9	20.		20.62	20.05	19.37	18.81	7	(87)
` ' -									7					_	
Temperature (88)m= 20.54	20.54	20.54	20.55	20.55		eiiing 0.55	20.55	20.		20.55	20.55	20.55	20.55	1	(88)
` '								<u> </u>	00	20.00	20.00	20.00	20.00		(00)
Utilisation fact					_	<u> </u>		É		0.00				7	(00)
(89)m= 0.95	0.94	0.91	0.86	0.78).64	0.49	0.5	53	0.72	0.87	0.94	0.96		(89)
Mean internal	temper	ature in	the rest	of dwell	ng	T2 (fd	ollow ste	eps 3	to 7	in Tabl	e 9c)			_	
(90)m= 17.26	17.57	18.1	18.8	19.44	1	9.91	20.1	20.	80	19.77	18.97	18.01	17.19		(90)
										f	LA = Livii	ng area ÷ (4) =	0.54	(91)
Mean internal	temper	ature (fo	r the wh	ole dwe	lling	g) = fl	_A × T1	+ (1	– fL	A) × T2					
(92)m= 18.12	18.38	18.82	19.41	19.95	2	0.36	20.53	20.	51	20.23	19.55	18.74	18.06]	(92)
Apply adjustm	ent to t	ne mean	interna	temper	atu	re fro	m Table	4e,	whe	re appro	priate			_	
(93)m= 18.12	18.38	18.82	19.41	19.95	2	0.36	20.53	20.	51	20.23	19.55	18.74	18.06		(93)
8. Space heat	ing requ	uirement													
Set Ti to the n					ed	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m=	(76)m an	d re-cal	culate	
the utilisation				I	Г	1	Lat	Ι		0	0-4	l Na		7	
Jan Utilisation fact	Feb	Mar	Apr	May	<u></u>	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(94)m= 0.94	0.92	0.89	0.84	0.75	7	0.63	0.49	0.5	52	0.7	0.85	0.92	0.94	1	(94)
Useful gains,				<u> </u>	`		01.10	0.0		•	0.00	1 0.02	1 0.0 .	_	, ,
(95)m= 352.45	379.14	390.98	385.88	354.5	28	34.33	212.72	218	.06	280.62	319.8	330.21	338.3	7	(95)
Monthly avera		rnal tem	perature	l	<u> </u>			<u> </u>				1	<u> </u>	_	•
(96)m= 4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2]	(96)
Heat loss rate	for mea	an intern	al tempe	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	- (96)m]			_	
(97)m= 847.26	824.95	752.73	635.7	498.15		14.23	234.75	244	_ _ т	367.67	540.24	705.4	843.32]	(97)
														-	

Space heating requirements 8)m= 368.14 299.59	269.14	179.87	106.88	0	0	0	0	164.01	270.13	375.73		
, <u> </u>				<u> </u>	<u> </u>	Tota	l per year	(kWh/year) = Sum(98	8) _{15,912} =	2033.49	(98
Space heating requi	ement ir	n kWh/m ²	²/year								30.33	(99
a. Energy requireme	nts – Inc	lividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space heating:												_
Fraction of space heat from secondary/supplementary system								0	(20			
Fraction of space heat from main system(s) (202) = 1 - (201) =								1	(20			
raction of total heat	•	-				(204) = (2	02) × [1 –	(203)] =			1	(20
Efficiency of main sp		•			0.4						100	(20
Efficiency of seconda	, ,,		1	g systen		ı	ı		<u> </u>		0	(20
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	ear
Space heating requires 368.14 299.59	269.14	179.87	d above,) 0	0	0	0	164.01	270.13	375.73	7	
$11)$ m = {[(98)m x (2)	1						Ŭ	101.01	270.10	070.70	_	(21
368.14 299.59	269.14	179.87	106.88	0	0	0	0	164.01	270.13	375.73	1	(2)
	-				<u>!</u>	Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012} :	=	2033.49	(21
						\						
Space heating fuel (seconda	y), kWh	/month									
			month									
Space heating fuel (: {[(98)m x (201)] } x (15)m= 0 0			month	0	0	0	0	0	0	0		_
{[(98)m x (201)] } x 15)m= 0 0	100 ÷ (20	08)		0	9	-		-	0 215) _{15,1012}		0	(21
{[(98)m x (201)] } x 15)m= 0 0 Vater heating	100 ÷ (20	08)	0	0	0	-		-			0	(21
{[(98)m x (201)] } x 15)m= 0 0	0 ÷ (20	08)	0	117.26	0	-		-			0	(21
{[(98)m x (201)] } x 15)m= 0 0 2 ater heating utput from water heating 166.91 146.75	100 ÷ (20 0 ater (calc 153.26	08) 0 culated a	0 bove)			Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,1012}		349.41	(21
[[(98)m x (201)] } x [15)m= 0 0 ater heating utput from water heating 166.91 146.75 ficiency of water heating	100 ÷ (20 0 ater (calc 153.26	08) 0 culated a	0 bove)			Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,1012}			(21
[[(98)m x (201)] } x (15)m= 0 0 [ater heating utput from water heating 166.91 146.75] [ficiency of water heating 17)m= 349.41 349.41] [uel for water heating 198.41]	100 ÷ (20 0 ater (calcounts) 153.26 ater 349.41 , kWh/m	08) 0 culated a 136.2 349.41	0 bove) 132.62	117.26	111.44	Total	124.2	141.29	150.9	162.49		_
([(98)m x (201)] } x (15)m= 0 0 (ater heating) utput from water heating (166.91 146.75) (ficiency of water heating) (19)m = (64)m x 10	100 ÷ (20 0 ater (calcounts) 153.26 ater 349.41 , kWh/m	08) 0 culated a 136.2 349.41	0 bove) 132.62	117.26	111.44	Total	124.2	141.29	150.9	162.49		(21
[[(98)m x (201)] } x [15)m= 0 0 [ater heating [utput from water heating [166.91	100 ÷ (20 ater (calconduction) 153.26 ater 349.41 349.41 349.41	349.41 onth	0 bove) 132.62	117.26 349.41	349.41	Total 123.91 349.41 35.46	124.2 349.41	141.29 349.41 40.44	150.9 349.41	162.49		(21
([(98)m x (201)] } x (15)m= 0 0 (ater heating) utput from water heating) (166.91 146.75) (ficiency of water heating) (17)m= 349.41 349.41) uel for water heating) (19)m = (64)m x 10	100 ÷ (20 ater (calconduction) 153.26 ater 349.41 349.41 349.41	349.41 onth	0 bove) 132.62	117.26 349.41	349.41	Total 123.91 349.41 35.46	124.2 349.41 35.54	141.29 349.41 40.44 19a) ₁₁₂ =	150.9 349.41	162.49 349.41 46.5	349.41	(2°
([(98)m x (201)] } x (ater heating utput from water heating) utput from water heating 166.91 146.75 (ficiency of water heating) 17)m= 349.41 349.41 uel for water heating 19)m = (64)m x 10 19)m= 47.77 42	100 ÷ (20 0 ater (calconduction) 153.26 ater 349.41 0 ÷ (217 43.86	349.41 onth)m 38.98	0 bove) 132.62 349.41	117.26 349.41	349.41	Total 123.91 349.41 35.46	124.2 349.41 35.54	141.29 349.41 40.44 19a) ₁₁₂ =	150.9 349.41 43.19	162.49 349.41 46.5	349.41 477.15	(2°
[[(98)m x (201)] } x [[(98)m x (201)] } x [[(98)m x (201)]] } x [[(98)m x (201)]] } x [[(98)m x (201)] } x [[(98)m x (201)]] } x [[(98)m x (201)]] } x [[(98)m x (201)] } x [[(98)m x (201	100 ÷ (20 ater (cald 153.26 ater 349.41 , kWh/m 0 ÷ (217 43.86	349.41 onth)m 38.98	0 bove) 132.62 349.41	117.26 349.41	349.41	Total 123.91 349.41 35.46	124.2 349.41 35.54	141.29 349.41 40.44 19a) ₁₁₂ =	150.9 349.41 43.19	162.49 349.41 46.5	349.41 477.15 kWh/yea	(2°
ater heating utput from water heating utput from water heating 166.91 146.75 ficiency of water heating 19)m = (64)m x 10 19)m = 47.77 42 nnual totals bace heating fuel use ater heating fuel use	100 ÷ (20 ater (calconduction) 153.26 ater 349.41 349.41 349.41 43.86 ed, main and additional additional and additional additional and additional additional additional and additional addi	349.41 onth)m 38.98	0 bove) 132.62 349.41	349.41 33.56	349.41	Total 123.91 349.41 35.46	124.2 349.41 35.54	141.29 349.41 40.44 19a) ₁₁₂ =	150.9 349.41 43.19	162.49 349.41 46.5	349.41 477.15 kWh/yea 2033.49	(2'
ater heating utput from water heating utput from water heating 166.91 146.75 ficiency of water heating 19)m = 349.41 349.41 uel for water heating 19)m = (64)m x 10 19)m = 47.77 42 nnual totals bace heating fuel use ater heating fuel use ectricity for pumps,	100 ÷ (20 ater (calconduction) 153.26 ater 349.41 349.41 349.41 43.86 ed, main and and and and and and and and and an	349.41 onth)m 38.98	0 bove) 132.62 349.41 37.95	349.41 33.56	349.41 31.89	Total 123.91 349.41 35.46 Total	124.2 349.41 35.54 Il = Sum(2)	141.29 349.41 40.44 19a) ₁₁₂ =	150.9 349.41 43.19	162.49 349.41 46.5	349.41 477.15 kWh/yea 2033.49	(2°
ater heating utput from water heating utput from water heating 166.91 146.75 ficiency of water heating 19)m = 349.41 349.41 uel for water heating 19)m = (64)m x 10 19)m = 47.77 42 nnual totals bace heating fuel us ater heating fuel us ectricity for pumps, hechanical ventilation	100 ÷ (20 153.26 ater 349.41 349.41 349.41 43.86 ed, main ed fans and	349.41 onth)m 38.98 system electric	0 bove) 132.62 349.41 37.95	349.41 33.56	349.41 31.89	123.91 349.41 35.46 Tota	124.2 349.41 35.54 Il = Sum(2)	141.29 349.41 40.44 19a) ₁₁₂ = k 1	150.9 150.9 349.41 43.19	162.49 349.41 46.5	349.41 477.15 kWh/yea 2033.49	(2°
[[(98)m x (201)] } x [15)m= 0 0 [ater heating 166.91 146.75 166.91 349.41 349.41 349.41 19)m= 47.77 42 [Innual totals	100 ÷ (20 153.26 ater 349.41 349.41 349.41 43.86 ed, main ed fans and	349.41 onth)m 38.98 system electric	0 bove) 132.62 349.41 37.95	349.41 33.56	349.41 31.89	123.91 349.41 35.46 Tota	124.2 124.2 349.41 35.54 Il = Sum(2)	141.29 349.41 40.44 19a) ₁₁₂ = k 1	150.9 150.9 349.41 43.19	162.49 349.41 46.5	349.41 477.15 kWh/yea 2033.49 477.15	(21

Energy

kWh/year

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519	=	1055.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	247.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1303.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	95.52	(267)
Electricity for lighting	(232) x	0.519	=	155.51	(268)
Total CO2, kg/year	sum o	of (265)(271) =		1554.06	(272)
Dwelling CO2 Emission Rate	(272)	÷ (4) =		23.18	(273)
El rating (section 14)				81	(274)



Be Green



APPENDIX E - BRUKL REPORTS

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name Shell and Core

Howson Terrace

As designed

Date: Tue Aug 24 16:59:34 2021

Administrative information

Building Details

Address: Howson Terrace, Richmond HIII, Richmond, ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.8

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Matt Fitzpatrick
Telephone number:

Address: 2 Dronken House 43a High Street, Kings

Langley, WD4 8FG

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	10.3
Target CO ₂ emission rate (TER), kgCO ₂ /m².annum	10.3
Building CO ₂ emission rate (BER), kgCO ₂ /m².annum	9.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U a-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"Ground Floor - Ground Floor_W_10"
Floor	0.25	0.13	0.13	"Ground Floor - Ground Floor_S_3"
Roof	0.25	0.11	0.11	"Ground Floor - Ground Floor_R_5"
Windows***, roof windows, and rooflights	2.2	1	1	"Ground Floor - Ground Floor_G_12"
Personnel doors	2.2	1	1	"Ground Floor - Ground Floor_D_62"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
II limitima anno suoimbto descende II subsectiva	1// 21/\1			

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]

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

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	2

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

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

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency			
This system	4.35	-	-	-	-			
Standard value	2.5*	N/A	N/A	N/A	N/A			
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO								
* Standard shown is f	or all types >12 kW output,	, except absorption and gas	s engine heat pumps. For t	ypes <=12 kW outpu	ut, refer to EN 14825			

^{*} Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	-
Standard value	N/A	N/A

[&]quot;No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

Shell and core configuration

Zone	Assumed shell?
Ground Floor - Ground Floor	NO
Ground Floor - Lift Core	NO
Ground Floor - WC	NO
Ground Floor - Bin Store	NO
Ground Floor - Lobby	NO
Ground Floor - Stair Core	NO
First Floor - Stair Core	NO
First Floor - Lift Core	NO
Second Floor - Stair Core	NO
Second Floor - Lift Core	NO
Third Floor - Stair Core	NO
Third Floor - Lift Core	NO

General lighting and display lighting	Lumino	ous effic			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]	
Standard value	60	60	22		
Ground Floor - Ground Floor	-	417	-	502	
Ground Floor - Lift Core	-	341	-	16	
Ground Floor - WC	-	303	-	26	
Ground Floor - Bin Store	-	115	-	64	
Ground Floor - Lobby	-	269	-	33	
Ground Floor - Stair Core	-	254	-	41	
First Floor - Stair Core	-	440	-	145	
First Floor - Lift Core	-	336	-	17	
Second Floor - Stair Core	-	440	-	145	
Second Floor - Lift Core	-	336	-	17	

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Third Floor - Stair Core	-	440	-	145
Third Floor - Lift Core	-	336	-	17

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

There are no zones in the building where the solar gain check is applicable.

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	388.8	388.8
External area [m²]	790.9	790.9
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	2	3
Average conductance [W/K]	238.47	474.07
Average U-value [W/m²K]	0.3	0.6
Alpha value* [%]	32.36	21.1

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

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services

A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways

B1 Offices and Workshop businesses

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

100 **Residential spaces**

D1 Non-residential Institutions: Community/Day Centre

D1 Non-residential Institutions: Libraries, Museums, and Galleries

D1 Non-residential Institutions: Education

D1 Non-residential Institutions: Primary Health Care Building

D1 Non-residential Institutions: Crown and County Courts

D2 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger terminals Others: Emergency services

Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

		_	_	
		Actual		Notional
Heating		2.83		12.28
Cooling		0		0
Auxiliary		3.07		1.46
Lighting		11.62		6.58
Hot water		0		0
Equipment*		13.13		13.13
TOTAL**		17.52		20.31

^{*} Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	124.24	195.74
Primary energy* [kWh/m²]	53.78	60.8
Total emissions [kg/m²]	9.1	10.3

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

ŀ	HVAC Systems Performance										
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2		Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST	[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas						al Gas				
	Actual	39.5	84.7	2.8	0	3.1	3.88	0	4.35	0	
	Notional	107.4	88.3	12.3	0	1.5	2.43	0			

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type



Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U i-Тур	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	"Ground Floor - Ground Floor_W_10"
Floor	0.2	0.13	"Ground Floor - Ground Floor_S_3"
Roof	0.15	0.11	"Ground Floor - Ground Floor_R_5"
Windows, roof windows, and rooflights	1.5	1	"Ground Floor - Ground Floor_G_12"
Personnel doors	1.5	1	"Ground Floor - Ground Floor_D_62"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K))]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the r	ninimum L	J-value oc	curs.

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	2

