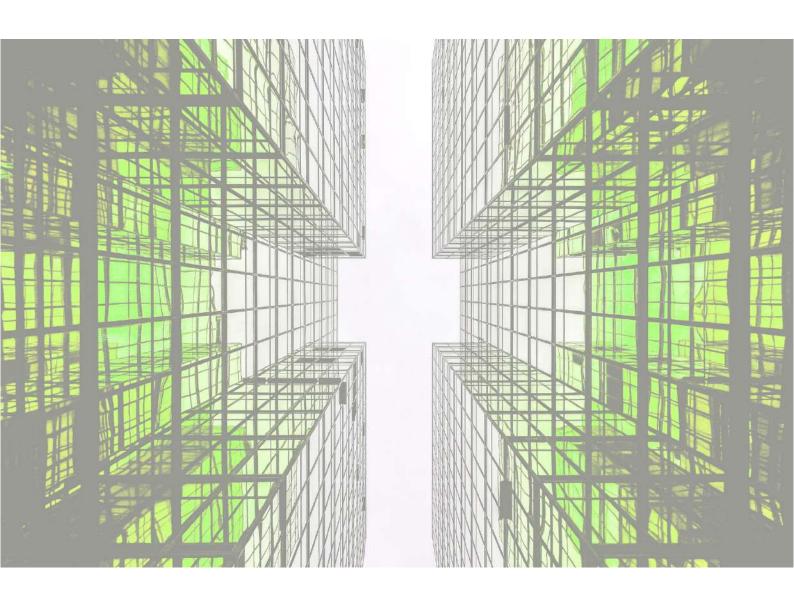
# Energy & Sustainability Statement

## Residential Development, Branch Hill House, Camden

Prepared for Almax Group

13th December 2019







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## **EXECUTIVE SUMMARY**

- 1. This Sustainability and Energy Statement has been prepared by Envision on behalf of Almax Group (The Applicant) and is submitted in support of a full planning application for the change of use of Branch Hill House from a care home (Use Class C2) to residential (Use Class C3) and associated external alterations, demolition of the 1960s extension and erection of replacement building, including basement, comprising residential accommodation (Use Class C3), ancillary plant, access and servicing and car parking.
- 2. The primary purpose of this document is to explain how the scheme can meet with London Borough of Camden energy and sustainability policies, along with those found within the London Plan, incorporating January 2019 updates.
- 3. Envision has undertaken a review of the relevant policies and worked with the design team to determine and agree the relevance and approach that should be taken to fulfil each policy.

## **Summary of Sustainability Strategy**

- 4. The scheme will deliver a series of sustainability measures which are compatible with the GLA and the London Borough of Camden's requirements for sustainable design and construction:
  - SuDs strategy to achieve a run-off rate of 2 l/s during all events up to and including the 1:100
     AEP event, including a 40% allowance for climate change
  - A comprehensive ecological strategy to deliver a net gain in biodiversity and the Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC);
  - Sustainable material selections with timber to be procured with Forest Stewardship Council accreditation:
  - Incorporation of climate adaptation measures, including permeable paving, landscaping and passive building design including MVHR;
  - Water conservation measures within the units to comply with 110 litres / bedspace per day and the provision of communal external rainwater harvesting tank for irrigation purposes;
  - New play space and public realm.



### **Summary of Energy Strategy**

- 5. This statement additionally illustrates how the scheme complies with the nationally recognised Energy Hierarchy and follows passive and efficiency improvements before the application of any Low or Zero Carbon (LZC) sources.
- 6. Envision has produced Part L1A compliant SAP calculations in order to determine the energy and  $CO_2$  emissions for the proposed development. These have been calculated using SAP 10 figures, with detailed calculations provided in Appendix II.
- 7. To minimise energy consumption by the development and to ensure compliance with relevant energy policies, the following design measures are recommended and will need to be incorporated into the detailed design;
  - Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
  - Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
  - High-efficiency ground-source heat pumps providing efficient space and water heating to each dwelling on site;
  - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
  - High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing;
  - Mechanical Ventilation Heat Recovery (MVHR), ensuring space heating loads are kept to a minimum;
  - Reduction in solar gain through the use of lower g-values.
- 8. The figures used as the basis for this assessment are discussed further in Section 5 of this report.
- 9. In line with the requirements of the October 2018 update to the 'GLA Guidance on preparing Energy Assessments', the predicted CO<sub>2</sub> emissions and energy demand presented in this report have been calculated using SAP 10 figures and presented in the 'Carbon Emission Reporting Spreadsheet', provided in Appendix II.



## **New-Build Residential - Carbon Savings Predicted**

- 10. As seen in the table below, in total the new-build portion of the development reduces CO<sub>2</sub> emissions by **25.39 tonnes.CO<sub>2</sub>.year**, equal to a **57.62**% saving beyond the Part L 2013 baseline (using SAP 10 emission factors), thereby complying with adopted and emerging London Borough of Camden and London Plan energy policies with regards to minimum CO<sub>2</sub> emission reductions for major residential developments.
- 11. In order to bring the residential carbon savings to 100%, the remaining residential carbon emissions are to be offset through a carbon offset payment. As detailed in the table below, the carbon offset payment, priced at £60 per tonne of CO<sub>2</sub> per year (over 30 years) to be paid via a S106 to LB Camden is £33,606.69

Table A.1 - Final New Build CO<sub>2</sub> reductions Chart

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development	44.06	14.10	
After energy demand reduction	39.49	14.10	
After heat network / CHP	n/a	n/a	
After renewable energy	18.67	14.10	
	Regulated domestic carbon dioxide savings		
	(Tonnes CO₂ per annum)	(%)	
Savings from energy demand reduction	4.56	10.36%	
Savings from heat network / CHP	n/a	n/a	
Savings from renewable energy	20.82	47.26%	
Cumulative on-site savings	25.39	57.62%	
Annual Savings from off-set payment	18.67		
Cumulative savings for off-set payment ( over 30 Years)	560.11		
Carbon offset Payment (£60 per tonne)	£ 33,606.69		



## **Change-of-Use Apartments - Carbon Savings Predicted**

12. As seen in the table below, in total the refurbished portion of the development reduces CO<sub>2</sub> emissions by **37.54 tonnes.CO<sub>2</sub>.year**, equal to a **82.08**% saving beyond the existing building baseline (using SAP 10 emission factors), and is therefore deemed to have 'maximised CO<sub>2</sub> reductions', as required by Policy CC1 of the Camden Local Plan.

Table A.2 – Final Refurbished CO<sub>2</sub> reductions Chart

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO: per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development	45.73	14.10	
After energy demand reduction	26.59	14.10	
After heat network / CHP	n/a	n/a	
After renewable energy	8.19	14.10	
	Regulated dor dioxide		
	(Tonnes CO2	(%)	
	per annum)		
Savings from energy demand reduction	per annum) 19.14	41.85%	
	• -	41.85% n/a	
reduction	19.14		



## 1 INTRODUCTION

1.1 Envision has been appointed by Almax Group (the Applicant) to produce a Sustainability and Energy Statement in support of a full planning application for the change of use of Branch Hill House from a care home (Use Class C2) to residential (Use Class C3) and associated external alterations, demolition of the 1960s extension and erection of replacement building, including basement, comprising residential accommodation (Use Class C3), ancillary plant, access and servicing and car parking.

## Scope

- 1.2 The primary purpose of this statement is to explain how best practice sustainable design and construction measures would be incorporated in the proposed development to ensure alignment with local planning policy.
- 1.3 Section 5 (Energy Statement) sets the parameters of detailed design, but remains at a strategic level. The calculations in this document are an indication of system size and carbon emissions based on guidance documents, approved software and practical experience. They are not design calculations but establish the viability and feasibility of various technologies for the proposed development.
- 1.4 This statement is structured as follows:
  - Section 2 provides a description of the site and the development proposals;
  - Section 3 provides a description of the main energy and sustainability policies relevant to the application;
  - Section 4 provides a summary of the sustainable design measures incorporated into the design;
  - Section 5 provides an energy assessment, structured against the requirements of the policies examined in Section 3;
  - Section 6 provides a concluding summary.



## 2 CONTEXT AND PROPOSALS

## **Site Location**

- 2.1 Branch Hill House is an unlisted building located in the London Borough of Camden in the Hampstead Conservation Area.
- 2.2 The current site arrangement comprises a 3-storey (+1 storey basement) masonry residential manor house constructed circa 1870s, with an abutting 2-storey concrete frame residential block constructed circa 1960s. The site has formerly been used as a residential facility for senior-citizens but is currently occupied by building guardians. The site is set back from the main Branch Hill road, with access via a driveway (Spedan Close).



Fig 2.1 – Site Location

## **The Proposed Development**

- 2.3 The general proposal is for the redevelopment of the site including the change of use of Branch Hill House from a care home (Use Class C2) to residential (Use Class C3) and associated external alterations, demolition of the 1960s extension and erection of replacement building, including basement, comprising residential accommodation (Use Class C3), ancillary plant, access and servicing and car parking.
- 2.4 The development will therefore create 34 new dwellings, with 29 new-build units in the 5 storey extension and 5 'change-of-use' apartments in the existing Branch Hill House.



## 3 SUSTAINABILITY & ENERGY POLICY CONTEXT

3.1 Many definitions of sustainable development exist, although the common objective for all is the integration of economic, social and environmental issues to ensure a better quality of life for people today, without compromising the needs of future generations. A key mechanism for delivering the principles of sustainable development lies within the UK planning system, which is implemented through national guidance and local planning policies. A review of all the relevant policy documents was undertaken in order to gain an understanding of the guiding policies for sustainability.

## **National Planning Policy Framework**

- 3.1 The revised National Planning Policy Framework (NPPF) was published on 24<sup>th</sup> July 2018 and updated in February 2019. It sets the framework for all planning policy in England and how these are expected to be applied. The NPPF establishes a presumption in favour of sustainable development, and the need to support economic growth through the planning system.
  - Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives: An economic role to help build a strong, responsive and competitive economy, by ensuring that sufficient land if the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;
  - A social role 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
  - An environmental role 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.
- 3.2 Planning plays a key role in helping shape places to achieve radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. The NPPF does not include detailed measures on sustainable design codes and standards to apply, although expects that when setting any local requirement for a building's sustainability, local planning authorities should do so in a way consistent with the national technical standards.



### **London Plan**

- 3.3 The London Plan (2016) sets out the Mayor's vision for London. In accord with the NPPF, it promotes economic development, and endorses the principles of sustainable development. It is the main vehicle for strategic decision-making on London's development, including development decisions. The Plan contains a number of policies directly related to a development's sustainable design and energy reduction, including:
  - Policy 5.1 Climate change mitigation;
  - Policy 5.2 Minimising carbon dioxide emissions;
  - Policy 5.3 Sustainable design and construction;
  - Policy 5.6 Decentralised energy in development proposals;
  - Policy 5.7 Renewable energy;
  - Policy 5.9 Overheating and cooling;
  - Policy 5.10 Urban greening;
  - Policy 5.11 Green roofs and development site environs;
  - Policy 5.15 Water use and supplies, and
  - Policy 7.2 An inclusive environment.
- 3.4 Of particular importance to the CO<sub>2</sub> and Energy reductions required for a development is *Policy* 5.2: Minimising carbon dioxide emissions.
- 3.5 Policy 5.2 requires that development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
  - Be lean: use less energy;
  - Be clean: supply energy efficiently;
  - Be green: use renewable energy.
- 3.6 The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations.



#### CO<sub>2</sub> Reduction Targets for Major Residential Development (New-Build)

- 3.7 London Plan policy 5.2B sets a 'zero carbon' target for major residential development. The 'Zero Carbon Homes' requires the residential element of the application achieves at least a **35 per cent reduction** in regulated carbon dioxide emissions (beyond Part L1A 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the London Borough of Camden to be ring fenced to secure delivery of carbon dioxide savings elsewhere.
- 3.8 Therefore, the CO₂ targets for the new-build residential portion of the development is a 35% reduction below Part L 2013.
- 3.9 The remaining regulated carbon emissions, to 100%, are offset via the 'carbon offset fund'. The carbon off-set price has been determined at £60 per tonne of carbon dioxide for a period of 30 years, i.e. £1,800 per tonne of remaining carbon emissions.

#### **Draft New London Plan**

3.10 The Mayor of London has consulted on a Draft New London Plan which was published for consultation in December 2017. The consultation period ended on Friday 2 March 2018. The Draft New London Plan showing Minor Suggested Changes, which includes clarifications, corrections and factual updates to the Consultation Draft Plan, was published on 13th August 2018. The Examination in Public commenced in January 2019 and ran to the end of May 2019. Whilst the current 2016 London Plan is still the adopted Development Plan, the Draft London Plan may be a material consideration in planning decisions. The significance given to it is a matter for the decision maker, but it gains more weight as it moves through the process to adoption.

# Greater London Authority guidance on preparing energy assessments as part of planning applications (October 2018)

- 3.11 In October 2018 the GLA published their new guidance on preparing energy assessments for all planning applications submitted within London. The new guidance encourages the use of SAP 10 carbon dioxide emissions factors, which reflect the decarbonisation of the grid since the last update of Building Regulations Part L in April 2014. Some of the other key considerations include:
  - 1. Domestic developments should achieve at least a 10% improvement on Building Regulations from energy efficiency (Be-Lean stage) alone;
  - 2. Non-domestic developments should achieve at least a 15% improvement on Building Regulations from energy efficiency (Be-Lean stage) alone;
  - 3. Site-wide heat networks should be embedded into development proposals from the beginning of the design process to avoid significant redesign at a later stage (e.g. by allowing sufficient space for an energy centre). Developments should commit to a single energy centre to supply the site wide heat network;



- 4. Demonstrate that connection to existing or planned district heating networks has been prioritised and provide evidence to support this;
- 5. Maximise on-site renewable energy generation, regardless of whether the 35% target has been met at the first 2 stages of the Energy Hierarchy (Be Lean, Be Clean) and; and
- 6. Carbon dioxide emissions reductions to be achieved as far as possible on-site. Cash in lieu contributions will only be considered acceptable in instances where it has been clearly demonstrated that no further savings can be achieved on-site.
- 3.12 The new guidance replaces the previous March 2016 version and should be used for any new applications, or where an application is at early enough stages to comply with the new guidance. The main change regarding the new carbon dioxide emission factors approach will apply from January 2019, and therefore these are stated in this report.

# London Plan Supplementary Planning Guidance: Sustainable Design and Construction

3.13 The Mayor of London Published its Sustainable Designed Construction SPG in April 2014. The SPG provides guidance on the implementation of London Plan policy 5.3 - Sustainable Design and Construction, as well as a range of policies, primarily in Chapters 5 and 7 of the London Plan which address matters relating to environmental sustainability. As an SPG, the document does not set new policy, but explains how policies in the London Plan should be carried through into action.

## **London Borough of Camden Planning Policy**

- 3.14 The most relevant policies which need to be considered when assessing the scheme's compliance to sustainability policy are those provided within local development documents.
- 3.15 The London Borough of Camden's adopted Local Plan (2016-2031) provides the planning framework for the Borough until 2031 and includes a suite of planning policies and strategic site allocations and supersedes the previous Core Strategy and Development Policies planning documents (adopted in 2010).

#### **Camden Local Plan (2016 – 2031)**

3.16 Policies relevant to the energy & sustainability of new development contained within the Camden Local Plan include:

#### 1. Policy CC1 – Climate Change Mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. We will:

(a) promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;



- (b) require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
- (c) ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
- (d) support and encourage sensitive energy efficiency improvements to existing buildings;
- (e) require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
- (f) expect all developments to optimise resource efficiency.

Key additional targets under Policy CC1 include the requirement for development to achieve a 20% reduction in CO<sub>2</sub> emissions through the use of on-site renewable energy generation (which can include sources of site related decentralised renewable energy)

#### 2. Policy CC2 (a) - Adapting to climate change

All development should adopt appropriate climate change adaptation measures such as:

- (a) the protection of existing green spaces and promoting new appropriate green infrastructure;
- (b) not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;
- (c) incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
- (d) measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

### 3. Policy CC2 (b) - Sustainable design & construction measures

All development should adopt appropriate climate change adaptation measures such as:

- (a) ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
- (b) encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;
- (c) encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment.

#### 4. Policy CC3 – Water & Flooding

We will require development to:



- (a) incorporate water efficiency measures;
- (b) avoid harm to the water environment and improve water quality;
- (c) consider the impact of development in areas at risk of flooding (including drainage);
- (d) incorporate flood resilient measures in areas prone to flooding;
- (e) utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and f. not locate vulnerable development in flood-prone areas

Key additional targets under Policy CC3 include the requirement for new residential development to meet a requirement of 110 litres per person per day water use. Refurbishment will be required to meet BREEAM water efficiency credits. Major developments and high or intense water use developments, such as hotels, hostels and student housing, should include a grey water and rainwater harvesting system. Where such a system is not feasible or practical, developers must demonstrate to the Council's satisfaction that this is the case.

#### 5. Policy CC4 – Air Quality

The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan

#### 6. Policy CC5 – Waste

This policy requires developments to include facilities for the storage and collection of waste and recycling.



#### Camden Planning Guidance – Energy Efficiency & Adaptation

- 3.17 The council prepared the Camden Planning Guidance (CPG) on Energy and resources to support the policies in the Camden Local Plan 2017. The guidance is consistent with the Local Plan and forms a Supplementary Planning Document (SPD) which is an additional "material consideration" in planning decisions.
- 3.18 The guidance provides information on key energy and resource issues within the borough and supports Local Plan Policies CC1 Climate change mitigation and CC2 Adapting to climate change with guidance provided on key areas including:
  - 1. Information requirements for renewable energy installations;
  - 2. Guidance on energy efficiency in existing buildings (i.e. flats in existing Branch Hill House);
- 3.19 This document is referred to within the sustainability statement and energy assessment.

## **Building Regulations Part L1b**

- 3.20 The existing building at Branch Hill House comprises of a care home (Use Class C2) with the proposals including the change of use of Branch Hill House to residential (Use Class C3).
- 3.21 The five no. new flats in the existing Branch Hill House are therefore considered to be assessed against Approved Document L1B: conservation of fuel and power in existing dwellings, 2010 edition (incorporating 2010, 2011, 2013, 2016 and 2018 amendments) (ADL1B).
- Clause 4.11 of ADL1B states; "Material changes of use covered by this document are where, after the change: a) the building is used as a dwelling where previously it was not, b) the building contains a flat, where previously it did not; or, c) the building, which contains at least one dwelling, contains a greater or lesser number of dwellings than it did previously.



## 4 SUSTAINABILITY STATEMENT

4.1 This section provides an account of the sustainability benefits of the proposed development, and how relevant policy will be addressed in the development proposals. The section is structured against the headline sustainability themes of the Mayor's SPG on Sustainable Design & Construction and applicable policies in the London Borough of Camden's Local Plan.

## **Sustainable Design Standards**

- 4.2 Policy CC2 of the Local Plan "encourages" the application of BREEAM Domestic Refurbishment where 5 or more dwellings are to be created via change of use. There are impracticalities with applying BREEAM Domestic Refurbishment on a minor portion of a development, as the design team and contractor would be enacting specific design & construction measures on the existing building only, adding unnecessary cost and complexity.
- 4.3 Instead, it is proposed the refurbished apartments will implement many of the design principles from BREEAM Domestic Refurbishment, as outlined in the ensuing sections, including but not limited to:
  - 1. 82.08% reduction in CO<sub>2</sub> emissions over the existing building baseline;
  - 2. Water efficient fittings to achieve a 110 litres/person/day target;
  - 3. Contractor to register with considerate constructors and monitor on-site utility consumption;
  - 4. SuDs strategy to achieve a run-off rate of 2 l/s during all events up to and including the 1:100 AEP event, including a 40% allowance for climate change
  - 5. A comprehensive ecological strategy to deliver a net gain in biodiversity and the Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC)
  - 6. Sustainable transport initiatives to include a 'car free scheme', save for disabled parking and the provision of extensive cycle parking.

#### Energy and CO<sub>2</sub> Reduction

- 4.4 An Energy Assessment has been prepared and is included in Section 5 which explains how the energy hierarchy identified above has been implemented.
- 4.5 The energy assessment has been undertaken using software recognised under the National Calculation Method (NCM) which have been applied by Envision to consider how the relevant targets can be met. Further details of the energy assessment are given in Section 5.
- 4.6 In total the new-build portion of the development reduces CO<sub>2</sub> emissions by 25.39 tonnes.CO<sub>2</sub>.year, equal to a **57.62**% saving beyond the Part L 2013 baseline (using SAP 10 emission factors), thereby complying with adopted and emerging London Borough of Camden and London



- Plan energy policies with regards to minimum CO<sub>2</sub> emission reductions for major residential developments.
- 4.7 In total the refurbished portion of the development reduces CO<sub>2</sub> emissions by 37.54 tonnes.CO<sub>2</sub>.year, equal to a **82.08%** saving beyond the existing building baseline (using SAP 10 emission factors), and is therefore deemed to have 'maximised CO<sub>2</sub> reductions', as required by Policy CC1 of the Camden Local Plan.
- 4.8 The CO₂ reduction strategy for the development will follow the London Plan's 'Energy Hierarchy

  − Be Lean, Be Clean and Be Green' and the reductions proposed for the development are
  attributed to design features which reduce the consumption of energy. These outlined further in
  the appended Energy Statement, but include;
  - 1. Optimised glazing;
  - 2. Thermally efficient building fabrics;
  - 3. Efficient lighting;
  - 4. Low air permeability;
  - 5. The use of Mechanical Ventilation Heat Recovery (MVHR); and
  - 6. Use of a shared ground loop array providing efficient space and water heating.

## **Ecology & Green Infrastructure**

- 4.9 Green spaces can contribute to the aesthetics and vitality of built-up urban areas. As Camden and the wider London area becomes more compact, dense and intensive in its built environment, the value of 'green' and 'amenity' space will increase. However, a balance must be struck between maximising the footprint of a site and providing an element of bio-diversity.
- 4.10 A Preliminary Ecological Appraisal (PEA) was undertaken in May 2018 by an experienced consultant ecologist, which determined that:
  - The woodland and notable tree specimens will need to be afforded suitable protection during the construction phase. All protective measures should accord with approved plans and BS 5837 (2012) Trees in Relation to Design, Demolition and Construction – Recommendations.
  - 2. Branch Hill House was assigned 'high' bat roost potential due to the close proximity to Hampstead Heath, presence of loft voids and external crevices. Three dedicated emergence/re-entry surveys were recommended in the PEA, and subsequently undertaken. No roosts were identified. Spedan Close was identified as a commuting corridor for low numbers of common pipistrelle bats. Foraging activity is focused around groups of trees and the woodland edge. Lighting will be controlled to ensure this behaviour continues.
  - 3. Trees on/bordering the site are likely to support breeding birds March-August inclusive. It is recommended that tree work avoids this period wherever practically possible. Where this is not possible, nest checks will be required immediately before work commences.



- 4. The grassland to the west of Branch Hill House has potential to attract transient reptiles if left unmanaged. Precautionary measures and habitat management recommendations are included in this report.
- 5. Japanese knotweed was identified in a localised position on the bank rear of Branch Hill House. This plant was subsequently remediated by a licensed contractor. It is recommended that contractors remain vigilant and any further Japanese knotweed is identified and treated appropriately.
- 4.11 In accordance with Local Plan Policy A3 and the NPPF Section 4.3.3, the following ecological enhancement measures are proposed for the scheme:
  - 1. Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC) to the north of the site;
  - 2. Introduction of native species, bird nest boxes and bat boxes will be provided to the woodland to improve on-site biodiversity;
  - 3. Development of a Residential Play strategy to include; play space, a woodland trail, a woodland glade and a Jekyll Gatden;
  - 4. Softworks strategy to remainder of site to include a range of native & non-native species.

### Flood Risk & SuDs

- 4.12 Policy CC3 of the Camden Local Plan requires developments to undertake a Flood Risk Assessment and to Incorporate sustainable drainage systems and avoid non-permeable hard standings with the aim of achieving greenfield runoff rates
- As detailed in the Level 2Flood Risk Assessment prepared by Ridge for the development, the site is located within Flood Zone 1. This is defined as having a low chance of tidal or fluvial flooding (less than 1:1000 year probability). As the site falls into this zone, it is defined as suitable for all development classes. In addition, the risk of flooding from additional sources has been identified as follows:
  - The risk of pluvial (surface water) flooding is considered to be very low;
  - The risk of sewer flooding to be moderate;
  - The risk of groundwater flooding is considered to be low;
- 4.14 The SuDs strategy prepared by Ridge confirms that in order to reduce the post-development surface water run-off rate to a maximum rate of 2 l/s during all events up to and including the 1:100 AEP event, including a 40% allowance for climate change, the following SuDs measures will be incorporated:
  - Reducing surface water run-off through the installation of permeable surfaces;
  - 2. Installation of a shallow below ground geocellular attenuation tank(s) within the site curtilage. The tank(s) will be appropriately sized to accommodate the attenuated volume of surface water generated by the Application Site during the 1:100yr event plus the predetermined allowance for climate change.



#### **Water Conservation**

4.15 The Mayor of London has published his Water Strategy – Securing London's Water Future (2011), which sets out how water efficiency will be implemented across London. This guides development towards reducing demand for water. Policy CC3 includes the requirement for new residential development to meet a requirement of 110 litres per person per day water use. As part of this, the council requires the consideration of grey water, and rainwater harvesting systems. In accordance with Policy CC3, the following section examines the water efficiency within the development to meet the relevant targets.

Table 4.1 – Water consumption specifications

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Strategy, Code	Fittings- based, Code level 3/4	Fittings- pased, Code evel 3/4	Fittings- based, Code level 3/4	Fittings-based,	Fittings-based,	Recycling- based, Code level 5/6
	10101014	0101014	10101014			1010.0.0
wc	4 (single flush)	4/2.6 (dual lush)	5/3 (dual flush)	6/4 (dual-flush toilet)	4/2.6 (dual flush)	6 (supplied by greywater)
Taps (excluding kitchen taps)	4	5	4	4	1.6	3
Bath	180	155	180	180	155	155
Shower	8	8	8	8	6	7
Kitchen sink taps	6	8	6	6	3	4
Washing machine	8.17 (not supplied)	3.17 (not supplied)	8.17 (not supplied)	6.14 (supplied)	6.14	8.17 (not supplied)
Dishwasher	1.25 (not supplied)	1.25 (not supplied)	1.25 (not supplied)	1.25 (not supplied)	0.67	1.25 (not supplied)
Water Recycling	0 (not supplied)	) (not supplied)	0 (not supplied)	0 (not supplied)	0 (not supplied)	26.52 (greywater supplying toilet)
Predicted per capita consumption (Code)	104.65	99.81	103.28	103.43	79.99	79.84

- 4.16 Table 4.1 illustrates the various fittings-based water consumption levels to achieve scenarios. In this case, Scenario 1 specification demonstrate consumption of less than 110 litres/person/day.
- 4.17 The development will include a dedicated external communal rainwater harvesting tank, for use by residents (if desired), but primarily for irrigation use by the groundsman tending to the wider landscaped areas. The size and location of this tank will be agreed at the detail-design stage.

#### **Pollution**



4.18 Any new development can potentially lead to detrimental environmental effects; as is the nature of construction. These potential effects have been considered during the planning stages of this proposal. The development is not of the scale that would require an Environmental Impact Assessment (EIA), however the measures as outlined in this section, and subsequently implemented, will ensure that any potential impacts can be appropriately controlled in order to demonstrate compliance with Local Plan Policy A4 (Noise) and CC4 (Air Quality).

#### **Noise**

4.19 Hepworth Acoustics have prepared a Noise Impact Assessment that has been included with this application. The assessment measured background noise levels on site, and determined that no specific noise mitigation measures are required for the development. In addition, as no external plant is proposed, there is no mitigation required for plant.

#### **Air Quality**

4.20 With regards to air quality, the entire Borough of Camden was designated as an Air Quality Management Area in 2002, declared for exceedance of PM10 and NO2. Since then Camden have produced a number of Air Quality Action plans along with annual reports to Defra. Policy CC4 of the Camden Local Plan requires that "Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution." The energy strategy at Branch Hill House is proposing no on-site fossil fuel combustion as all space and water heating will be provided by an electric-led ground-source heat pump, alongside electric cooking.

#### **External Lighting**

- 4.21 The development's lighting strategy will ensure that it does not have adverse effects at night-time. Although a detailed lighting scheme for the site that ensures it minimises light pollution has not yet been undertaken the following measure are expected to be incorporated:
  - External lighting will be designed in compliance with Table 1 and accompanying notes of ILE Guidance Note for reduction of obtrusive light.
  - 2. All non-safety/security lighting will be automatically switched off between 2300hrs and 0700hrs.

#### Waste

- 4.22 This section has considered all the requirements set out under Camden Local Plan Policy CC5 which requires development proposals to; "make sure that developments include facilities for the storage and collection of waste and recycling.
- 4.23 Residential waste storage space would take account of the requirement of BS5906:2005. This requires that suitable refuse and recycling space provision is allocated for the residential apartments in a centralised waste store. The necessary provision is as follows:



- 100 litres for first bed/1 bed;
- 70 litres for each bedroom after that.
- 4.24 In accordance with storage requirements in BS5906:2005, 50% of this quantity of waste arisings should be for recyclable waste and 75% of the quantity should be for general municipal waste. This over provision of storage capacity will ensure that sufficient space is always allocated to cater for waste volumes.
- 4.25 For each portion of the development adequate storage for refuse and recycling has been provided in accessible locations and sufficient space will be provided in each collection location/area for refuse vehicles to manoeuvre so that they can enter and exit in forward gear. The development layout has been checked to ensure refuse and delivery vehicles can access the development as required.

## **Sustainable Transport**

- 4.26 A Transport Assessment has been produced by RPS as part of the planning application, which demonstrates the measures to be incorporated into the development are in line with Local Plan policies T1 to T4 and Policy 6.13 of the London Plan. A summary of the measures is provided below.
- 4.27 The development site currently has a poor level of public transport with a PTAL rating of 1b, however the site is accessible by all modes of transport, with Hampstead Underground station and local bus services accessible within 650 metres of the site (8-minute walk). The site is therefore accessible to non-car modes of travel.
- 4.28 To encourage walking and cycling as sustainable modes of travel to/from the development, information will be provided to residents on the local facilities and amenities in the area including local pedestrian and cycle routes to and from the site.

#### **Cycle Parking**

- 4.29 The cycle parking for the two elements of the proposed scheme has been considered with regards to Camden Planning Guidance on Transport (March 2019) and the Emerging London Plan cycle parking minimum standards. The location of cycle parking has been considered for both shortand long-term use.
- 4.30 76 long-stay cycle parking spaces will be provided in accordance with the requirements of the Camden Planning Guidance (CPG) on Transport (March 2019). The provision represents a 20 percent increase on the minimum standards of the Draft New London Plan (July 2019). Furthermore, two short-stay cycle parking spaces for visitors will be provided close to the front entrance of the development, in accordance with the minimum standards of the Draft New London Plan (July 2019).

#### **Car Parking**

4.31 The development will be car-free with the exception of four disabled car parking spaces provided in the basement in accordance with the Draft New London Plan (July 2019). One disabled parking



- bay will be provided with an active Electric Vehicle Charging Point (ECVP), with the remaining three bays provided with passive provision in accordance with the Draft New London Plan (July 2019).
- 4.32 Deliveries and servicing, including refuse collection, and emergency vehicle access will be from Spedan Close, via Branch Hill
- 4.33 With regards to car sharing clubs, there are a number of clubs located in the vicinity of the site.

  The nearest car club is available on Lower Terrace circa 40 metres east of the site.

## **Sustainable Construction**

- 4.34 The construction phase of the development can have a significant effect on the quality of the site and its surroundings, including the local environment, neighbouring residents, surrounding employees and the general public. Sustainable construction involves the prudent use of existing and new resources, the efficient management of the construction process, and consideration of potential adverse environmental impacts on local sensitive receptors.
- 4.35 It is not considered that the construction phase will yield an adverse level of disturbance, particularly given the surrounding land uses, although various measures adopted by the contractor will ensure that any potential disturbance is minimised. The principal contractor will be required to deliver high standards of sustainable construction, which will be achieved through the following:
  - Registering the site against the Considerate Constructors Scheme;
  - Managing the construction site to reduce environmental effects, this will include adopting best practice measures to protect water and air quality, monitoring water and energy use from construction activities;

#### **Materials**

- 4.36 Maximising the sustainability of all the materials used in the build will be an important factor from the outset. The re-use of a number of major existing building elements will add to the material environmental performance of the scheme.
- 4.37 The development will be designed and constructed as to maximise the sustainability of materials. The client will ensure the following standards are met in the development:



- 1. At least 50% of timber and timber products are to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) scheme.
- 2. No construction or insulation materials are to be used which will release toxins into the internal and external environment, including those that deplete stratospheric ozone.



## **5** ENERGY STATEMENT

- 5.1 In pursuing compliance with the Energy Policy in the London Borough of Camden, Envision has followed guidance from the Borough's Local Plan, namely Policy CC1 Energy & Carbon Reduction which directs the user to seek guidance from the requirements of the London Plan for major development.
- 5.2 Policy CC1 refers to the requirements of the current London Plan 2016 and in particular Policy 5.2 which has a requirement that all new buildings should make the fullest contribution to minimising carbon dioxide (CO<sub>2</sub>) emissions in accordance with the following energy hierarchy:
  - 1. Step 1 Reducing Energy Requirements;
  - 2. Step 2 Supplying the energy that is required more efficiently;
  - 3. Step 3 Meeting remaining energy requirements through renewable and low carbon energy.

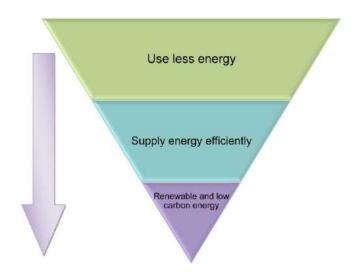


Fig 5.1 - 'Energy Hierarchy'

## <u>Methodology – New Build Residential</u>

- 5.3 London Plan policy 5.2B sets a 'zero carbon' target for major residential development. The 'Zero Carbon Homes' requires the residential element of the application to achieve at least a **35 per cent reduction** in regulated carbon dioxide emissions (beyond Part L1A 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the London Borough of Camden to be ring fenced to secure delivery of carbon dioxide savings elsewhere.
- In line with the requirements of the October 2018 update to the 'GLA Guidance on preparing Energy Assessments', the predicted CO<sub>2</sub> emissions and energy demand presented in this report have been calculated using **SAP 10 figures**. The GLA 'Carbon Emission Reporting Spreadsheet', to be provided with referable planning applications is set up for development proposing communal heating systems. As this development proposes a communal network connecting to individual



heating systems (not compatible with the GLA Carbon Emission Reporting Spreadsheet) the consumption figures have been manually converted with SAP 10 emission factors and provided in Appendix II.

- 5.5 Compliance with Part L1a of Building Regulations is provided via the SAP worksheets in Appendix Vi to VIII.
- 5.6 In accordance with NCM guidance, the appropriate methodology for calculating the energy performance of the new-build apartments is "The Government's Standard Assessment Procedure for Energy Rating of Dwellings". This procedure was undertaken using Stroma FSAP 2012 version 1.0.4.16 which is a Department of Communities and Local Government (DCLG) approved methodology and software for undertaking SAP assessments.
- 5.7 For the purposes of this assessment, the following apartment typologies were selected for analysis;

**Table 5.1 – Apartment Typologies** 

Apartment Type	Unit Reference
Ground Floor 2-Bed	Flat 3
Ground Floor – 3 or 4 Bed	Flat 8
Mid Floor 1-Bed	Flat 10
Mid Floor 2-Bed	Flat 23
Mid Floor 3 or 4 Bed	Flat 15
Top Floor 1-Bed	Flat 33
Top Floor 2-Bed	Flat 32
Top Floor 3 or 4 Bed	Flat 31
Gatehouse	-
Triplex	-

5.8 In order to provide a level of analysis reflecting the various orientations of the scheme, on each block, apartments were selected from each elevation.



## Methodology - Refurbished (Change of Use) Residential

- 5.9 As detailed in Section 3, the five no. new flats in the existing Branch Hill House are to be assessed against Approved Document L1B: conservation of fuel and power in existing dwellings, 2010 edition (incorporating 2010, 2011, 2013, 2016 and 2018 amendments).
- 5.10 Policy CC1 of the Camden Local Plan requires major residential refurbishment (>1,000m²) to meet the "greatest possible CO<sub>2</sub> reductions, alongside meeting Part L1B values for retained elements"
- 5.11 The applicant has followed best practice guidance in relation to major residential refurbishment, namely the 'GLA Guidance on Preparing Energy Assessments', alongside reference to the BRE Domestic Refurbishment ENE 01 methodology, which require:
  - 1. Where major refurbishments are being carried out an estimate of the CO<sub>2</sub> savings from the refurbishment of the building will be expected. To provide this, developers are required to estimate the CO<sub>2</sub> emission baseline performance of the un-refurbished condition of the existing building using Building Regulations approved compliance software.
  - Where estimates of the existing performance of building elements or services have been made developers are required to outline the source of these assumptions, such as a building condition survey, Energy Performance Certificate (EPC) conventions, industry benchmarks etc.
  - 3. The baseline for change of use applications should be estimated assuming the existing building is the same as the proposed end use.
  - 4. All other assumptions (heating, hot water, infiltration, thermal bridging etc.) should be based on the details set out in SAP appendix S or using actual values where available.
- 5.12 Once the existing building baseline DER has been established the BER/DER of the refurbished building should be determined following improvements at each stage of the energy hierarchy using Building Regulations compliance software.
- 5.13 At each stage of the energy hierarchy, CO<sub>2</sub> emissions will be calculated and reported using SAP 10 emission factors.
- 5.14 As this refurbished portion proposes individual heating systems (not compatible with the GLA Carbon Emission Reporting Spreadsheet) the consumption figures have been manually converted with SAP 10 emission factors and provided in Appendix II.

## <u>Establishing the Target Emission Rate (TER) – New Build Residential</u>

- The total emissions savings calculated in this report for the new-build flats are expressed against a Building Regulation 2013 Target Emission Rate. This is the Baseline against which the measures implemented must show an improvement.
- 5.16 The Target Emission Rates for the development have been established using DCLG approved methodology and software.



5.17 The calculated carbon emissions and total energy demand for the Target Emission Rate are illustrated below. The calculated figure demonstrates a Part L1A Building Regulations 2013 compliant model – arrived at using SAP 10 carbon factors.

Table 5.2 - Target CO<sub>2</sub> emissions for New-Build Portion

Unit	Total Floor Area for Unit Type (m²)	SAP 10 TER	Total Target CO <sub>2</sub> (kg.CO <sub>2</sub> .yr)	Target Regulated Energy (kWh.yr)
GF-2 Bed	232.1	14.24	3,304.72	18,896.94
GF-3/4 Bed	391	13.57	5,306.35	28,283.90
MF-1 Bed	568.9	15.41	8,765.32	38,536.10
MF-2 Bed	212.6	12.79	2,719.22	11,751.46
MF-3/4 Bed	942.1	10.70	10,081.90	51,252.78
TF-1 Bed	109.4	18.65	2,040.35	10,547.22
TF-2 Bed	210.5	13.72	2,887.22	15,272.90
TF-3/4 Bed	191	13.24	2,528.69	12,054.00
Gatehouse	167	17.37	2,901.49	12,907.45
Triplex	263.3	13.38	3,522.68	16,955.69
		Total =	44,057.93	216,458.44

The figure of **44,057.93 kg.CO<sub>2</sub>.yr** the targets that must be reached and improved upon by the proposals in this Energy Assessment in order to comply with Building Regulations Part L1a 2013. This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

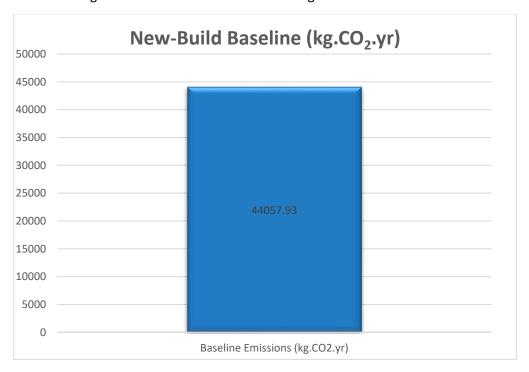


Fig 5.2 - Target CO<sub>2</sub> emissions for New-Build Portion



## Establishing the Target Emission Rate (TER) – Refurbished Residential

5.19 As detailed in various reports submitted with this planning application, the existing building dates from the 1870s. Therefore, existing fabric performance figures were taken from SAP Appendix S (Reduced Data SAP for existing dwellings), with the age band assumed to be A, which applies to buildings built between before 1900 and up to 1919. Details on building services were provided by the client, and where not identified were also taken from SAP Appendix S.

**Table 5.3 – Existing Building Inputs** 

Elements	Input	Comment
External Wall U-Value (W/m² K)	0.6	Taken from SAP Appendix S, assuming an unfilled cavity wall.
Ground Floor U-Value (W/m² K)	0.25	Calculated using guidance as provided in Table S9 of Appendix S from SAP for solid ground floors.  (Nominal insulation assumed)
Roof (Flat & Pitched) U- Value (W/m² K)	0.68	Calculated using guidance as provided in Table S11 of Appendix S from SAP for solid ground floors
External Windows U- Value (W/m² K)	3.1	Assumed as double-glazed prior to 2002.
Party Walls U-Value (W/m² K)	0	Assumed as fully-filled cavity with effective edge sealing an insulation in line with layers in abutting elements.
Air Permeability	15 m³/h.m²	Default value.
Heating & Hot Water	Gas-fired system boiler.	Confirmed from client, assumed as regular condensing boiler (post-1998). DHW storage sized as 210 litres in line with Appendix S Table S17 with a nominal 50mm factory insulated jacket.
Lighting	Assumed as non-LED	-
Ventilation	Assumed as basic extract fans	-



5.20 Based on the inputs laid out in Table 5.3, the baseline for the refurbished portion of the development was calculated as follows (using SAP 10 emission factors):

<b>Table 5.4 –</b>	Target CO:	emissions fo	or Refurbished	<b>Portion</b>
--------------------	------------	--------------	----------------	----------------

Unit	Total Floor Area for Unit Type (m²)	SAP 10 TER	Total Target CO <sub>2</sub> (kg.CO <sub>2</sub> .yr)	Target Regulated Energy (kWh.yr)
Flat 1	178	40.65	7,235.94	34,318.14
Flat 2	227.6	37.97	8,642.44	40,991.57
Flat 7	250.9	43.26	10,854.71	51,553.65
Flat 16	270	33.91	9,155.32	43,453.59
Flat 24	229	42.99	9,845.34	46,739.43
		Total =	45,733.75	217,056.38

The figure of **45,773.75 kg.CO<sub>2</sub>.yr** is the target that must be reached and improved upon by the proposals in this Energy Assessment in order to comply with Camden Policy CC1, which requires major residential refurbishment (>1,000m²) to meet the "greatest possible CO<sub>2</sub> reductions, alongside meeting Part L1B values for retained elements. This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

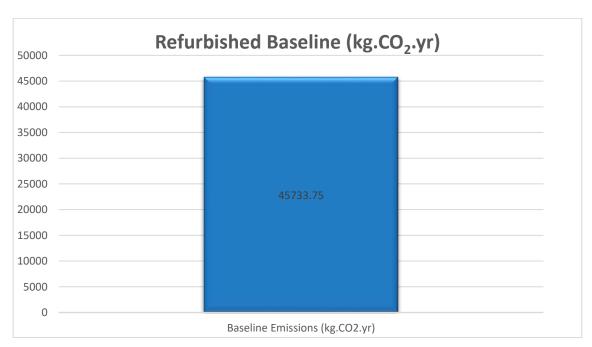


Fig 5.3 - Target CO<sub>2</sub> emissions for Refurbished Portion



## Applying the London Plan Energy Hierarchy: Stage 1 – Be Lean

The Greater London Authority seeks a 'fabric first' approach to reducing the carbon footprint of London's built environment. This is achieved through buildings using less energy by improving uvalues, air-tightness and lighting efficiency amongst others. This is the first step to consider in reducing a building's carbon emissions before the efficient delivery of power, heat or renewables are considered by a design-team.

## **Fabric Efficiency**

5.23 U-Values, are used to measure how effective elements of a buildings fabric are as insulators. That is, how effective they are at preventing heat from transmitting between the inside and the outside of a building. Very broadly, the better (i.e. lower) the U-value of a buildings fabric, the less energy is required to maintain comfortable conditions inside the building. The following U-Values are proposed for the development;

Table 5.5 - Proposed U-Values

Elements	New Building Elements: U-Values – W/m² K	Refurbished Building Elements: U-Values – W/m²K¹	Comment
External Wall	0.12	0.35	n/a
Wall to unheated corridor	0.15	0.35	
Ground Floor	0.11	0.25	n/a
Roof (Flat & Pitched)	0.13	0.16	n/a
External Windows	1.1 (G-Value 0.45)	1.8 (G-value 0.55)	Assumed as double- glazed
External Solid Doors	1.8	1.8	n/a
Party Walls	0	0	Assumed as fully-filled cavity with effective edge sealing

The main circulation areas and corridors are assumed to be unheated at this stage, and therefore walls adjoining each apartment to circulation zones are to be insulated.

#### **Air Permeability**

5.25 The designed Air Permeability Rate (APR) has been set at 3 m<sup>3</sup>/h.m<sup>2</sup> @ 50Pa for the new-build portion of the development.

<sup>&</sup>lt;sup>1</sup> The U-Values proposed in the refurbished portion will apply to new and upgraded elements.



5.26 The designed Air Permeability Rate (APR) has been retained at an assumed 15 m³/h.m² @ 50Pa for the refurbished portion of the development. During detail-design, opportunities will be explored to improve this figure.

#### Lighting

5.27 The SAP calculation software used for assessing the development does not allow for the specification of lighting elements. However, it is assumed that the light fittings will be specified as LED, low-energy with local manual switching and if appropriate, occupancy sensing.

## **Ventilation Strategy: New-Build Portion**

- The ventilation strategy has been designed to meet with occupant and client requirements across the varied activity zones in the development, whilst maintaining the energy efficiency needed to lower carbon emissions. A balanced whole-house mechanical ventilation system with heat recovery is proposed for every new-build dwelling as follows;
  - 1. 1-Bed Flats: Nuaire MRXBOX95AB-WM1 (or similar);
  - 2. 2-Bed Flats: Nuaire MRXBOX95-WM2 (or similar);
  - 3. 3 & 4-Bed Flats: Nuaire MRXBOX95-WH1

### **Ventilation Strategy: Refurbished Portion**

5.29 In order to reduce the impact of the ventilation strategy on the internal aesthetics of the existing building, basic extract fans have been assumed for all WCs and kitchen hoods.

#### **Space & Water Heating**

- 5.30 In line with the 'GLA guidance on preparing Energy Assessments', the heating system for each dwelling (new build & refurbished) assumed at 'Be-Lean' stage is an individual gas-fired heating system, with the efficiency in line with the notional building boiler efficiency (91%).
- 5.31 Each dwelling will be provided with domestic hot water storage as follows:
  - 1. 1-Bed Flats: 150 litre cylinder with 0.99 kwh/day heat loss
  - 2. 2-Bed Flats: 250 litre cylinder with 1.49 kwh/day heat loss
  - 3. 3 & 4-Bed Flats: 305 litre cylinder with 1.63 kwh/day heat loss
- 5.32 The SAP assessment assumes the pipework will be fully insulated and the water heating will be timed separately.



## New-Build Residential - Be Lean Stage CO₂ Reductions

5.33 The following tables and graphs represent the Be-Lean improvements for the new-build apartments over the Target Emission Rate (TER) baseline emissions;

Table 5.6 - New-Build Be-Lean Emissions

Unit	Total Floor Area for Unit Type (m²)	SAP 10 DER	Total CO <sub>2</sub> (kg.CO <sub>2</sub> .yr)	Regulated Energy (kWh.yr)
GF-2 Bed	232.1	13.54	3,142.20	17,884.12
GF-3/4 Bed	391	12.98	5,073.65	26,897.52
MF-1 Bed	568.9	13.24	7,533.55	32,903.40
MF-2 Bed	212.6	11.30	2,401.40	10,316.06
MF-3/4 Bed	942.1	8.52	8,024.65	40,391.88
TF-1 Bed	109.4	18.19	1,989.72	10,248.86
TF-2 Bed	210.5	13.07	2,752.14	14,496.46
TF-3/4 Bed	191	12.88	2,459.66	11,676.21
Gatehouse	167	17.28	2,885.19	12,778.03
Triplex	263.3	12.28	3,232.16	15,453.74
		Total =	39,494.31	193,046.28
		Difference over Baseline	4563.62	23412.16
		% Difference	10.36%	10.82%

5.34 As detailed above, the measures as taken at 'Be-Lean' stage would result in a **10.36**% reduction in new-build regulated CO<sub>2</sub> emissions over the Part L 2013 Target Emission Rate, calculated using SAP 10 emission factors.

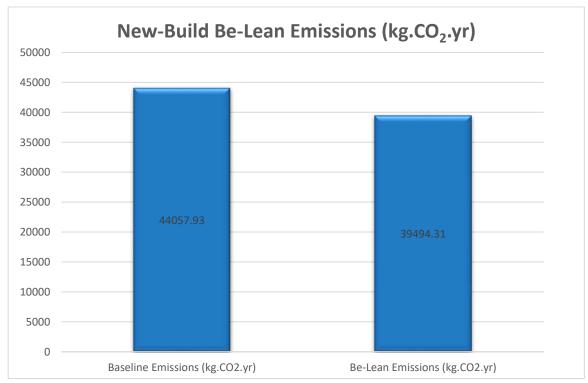


Fig 5.4 - New Build Be-Lean Stage Reductions



## Refurbished Residential - Be Lean Stage CO<sub>2</sub> Reductions

5.35 The following tables and graphs represent the Be-Lean improvements for the refurbished apartments over the existing building baseline:

Table 5.7 - Refurbished Be-Lean Emissions

Unit	Total Floor Area for Unit Type (m²)	SAP 10 DER	Total CO <sub>2</sub> (kg.CO <sub>2</sub> .yr)	Regulated Energy (kWh.yr)
Flat 1	178	34.26	6,099.16	28,954.96
Flat 2	227.6	31.40	7,146.64	33,930.39
Flat 7	250.9	36.54	9,168.12	43,572.63
Flat 16	270	28.43	7,676.91	36,467.10
Flat 24	229	31.20	7,144.35	33,931.13
		Total =	37,235.18	176,856.21
		Difference over Baseline	8498.56	40200.17
		% Difference	18.58%	18.52%

As detailed above, the measures as taken at 'Be-Lean' stage would result in a 18.58% reduction in refurbished element's regulated  $CO_2$  emissions over the existing building baseline DER, calculated using SAP 10 emission factors.

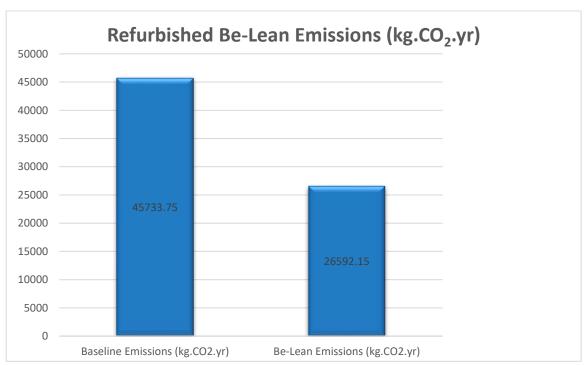


Fig 5.5 - Refurbished Be-Lean Stage Reductions



## **Cooling & Overheating**

- 5.37 Policy 5.9 of the London Plan (2016) seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.
- 5.38 Applicants should apply the cooling hierarchy as detailed in Policy 5.9 with the development at Branch Hill House to incorporate the following measures;

Table 5.8 – Cooling Methods

Table 5.8 – Cooling Methods				
Cooling Method	Measures Employed			
Minimising internal heat generation through energy efficient design	<ul> <li>Where present, lateral pipework will run through all residential corridors to ensure internal heat gains are minimised. Corridors will be ventilated to prevent heat build up in summer operation.</li> <li>The g-value of all installed glazing will be as low as feasible possible (currently assumed as 0.45 in new build apartments) in order to reduce internal solar gain.</li> <li>Mechanical service risers to be ventilated at low level and at roof level to ensure risers do not create nuisance heat load in summer operation.</li> </ul>			
Reducing the amount of heat entering the building in summer	<ul> <li>The building form for all new-build apartments is on a beneficial east-west axis, reducing the risk of overheating from low lying morning and evening sun. To the direct south of the new-build portion are a large number of large trees which will offer a significant level of shading.</li> <li>Internal blinds will be provided to all bedrooms to reduce evening sun, although it is acknowledged very few bedrooms have a western orientation which are most at risk from evening overheating.</li> </ul>			
Use of thermal mass and high ceilings to manage the heat within the building	<ul> <li>All floor-to-ceiling heights are maintained at a minimum 2500mm, with the majority at 2700mm.</li> <li>This relative increase in exposed surface will help to lower indoor air temperatures.</li> </ul>			
Passive ventilation	<ul> <li>The majority of dwellings (which comprise the majority of floor area in the development) have been designed with, a shallow floor plate, openable windows and a number allow for cross-ventilation.</li> </ul>			
Mechanical ventilation	<ul> <li>The refurbished apartments will utilise natural ventilation via openable windows and extract fans to all WCs and kitchen hoods.</li> <li>An MVHR system is proposed for each new-build apartment. These will facilitate a sufficient amount of air changes per hour to ensure there is no stagnant air and will help in lowering the overall indoor air temperature.</li> </ul>			



### **CIBSE TM59 Assessment**

- 5.39 The latest criteria for the assessment of overheating risk have been specified by the Chartered Institute of Building Services Engineers (CIBSE) in CIBSE TM59: Design methodology for the assessment of overheating risk in homes (2017). CIBSE TM59 is based on CIBSE TM52 and CIBSE Guide A guidance documents, and provides a standardised approach to predicting overheating risk for both naturally and mechanically ventilated residential buildings.
- 5.40 The new CIBSE TM59 guidance requires that the following two criteria must be met in order to demonstrate compliance:
  - 1. For living rooms, kitchens and bedrooms: the number of hours during which the operative temperature exceeds the comfort threshold temperature is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance);
  - 2. For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (CIBSE Guide A Fixed temperature threshold).

(Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32.85 hours, so 33 or more hours above 26 °C will be recorded as a fail).

## **Modelling Methodology**

5.41 The performance of the units has been assessed under CIBSE TM59 adaptive comfort model for a primarily natural ventilated scenario through the EnergyPlus engine using DesignBuilder v.6.1.0.006.

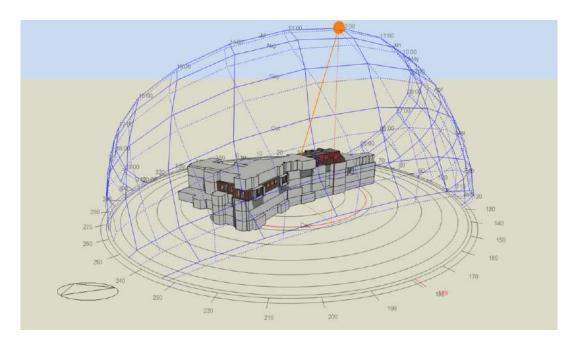


Fig 5.6 – Image of overheating model



- For the purposes of the assessment, a number of the worst-case apartments in the development were chosen for analysis:
  - 1. Flat 25: 2-Bed Apartment on south west corner (mid floor apartment);
  - 2. Flat 26 & 27: 1-Bed apartments with single aspect living areas/bedrooms on south elevation (mid floor apartment);
  - 3. Flat 34: 1-Bed apartment with single aspect living areas/bedrooms on south elevation (top floor flat)

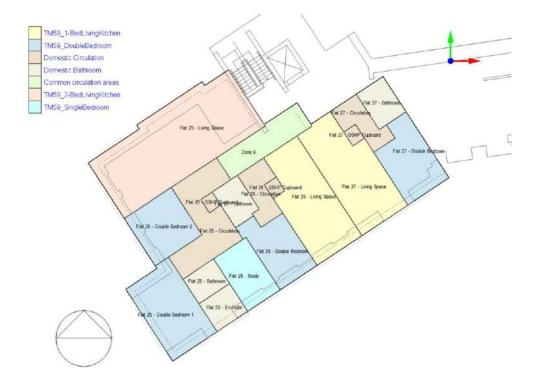


Fig 5.7 – Image of mid floor apartments

## **Site External Weather Conditions**

- 5.43 The effects of external conditions are vital in an overheating assessment as, in particular, they influence:
  - Solar heat gains (a function of incident direct & diffuse solar radiation and solar altitude);
  - 2. Calculated natural ventilation rates (a function of external temperature, wind directions and speeds).
- 5.44 CIBSE Design Summer Year weather data for London Heathrow (representative of urban areas outside the Central Activity Zone) has been used for the 2020s, high emissions, 50% percentile scenario as required by CIBSE TM59 guidance and as the most relevant to the location of the proposed development site.



## **DesignBuilder EnergyPlus Model Inputs**

All fabric and M&E inputs to the EnergyPlus model are in line with the measures outlined in this report. Design Inputs specific to the TM59 analysis have been detailed below;

**Table 5.9 – DesignBuilder Inputs** 

Input	Parameters	Comment
Building Fabric & Construction	As per inputs detailed in 'Be-Lean' section	-
Window & Balcony Doors	Glazing g-value to be specified at 0.45 as per 'Be-Lean' section.	-

External Shading	<ul> <li>-All balcony windows benefit from overhang of balcony above;</li> <li>- All windows benefit from 200mm reveal of surrounding wall.</li> <li>- External trees are present on southern elevation</li> </ul>	Trees have been modelled with 20% transparency, i.e. 80% of sunlight is let through.
Internal Shading	High-reflectance internal blinds have been assumed and to be included in the design, operating in accordance with TM59 schedules. The slats are assumed to close fully to block beam solar in high summer months and this will be reported in a Home User Guide.	TM59 methodology prescribes that internal blinds can be included for the analysis only if specifically included in the design, provided in the base build and explained within the associated home user guide. In addition, blinds should not be used if they clash with the opening of windows.  The architect will need to include for these in design.
Natural Ventilation	Windows to have effective free area of between 50%-70% depending on window typology  All windows to operate in accordance with TM59 schedules	
Mechanical Ventilation	MVHR assumed for all dwellings, to achieve minimum 0.7-1 ach/hr dependant on apartment type and zone.	Assumptions on the dwelling ventilation are based on a MVHR system achieving minimum Part F requirements.



### **Internal Gains**

The following internal gains assumptions (Table 5.9) have been made in the DesignBuilder EnergyPlus model, in line with the CIBSE TM59 guidance and calculations of the Energetik heat gains;

Table 5.10 – Internal Gains Assumptions

Table 5.10 – Internal Gains Assumption		Familian and transfer
Unit/Room Type	Occupancy	Equipment Load
1 Bed Apartment: Living/Kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2 Bed Apartment: Living/Kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3+ Bed Apartment: Living/Kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
Double Bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gain in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single Bedroom	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
All Rooms – Lighting	n/a	Lighting assumed 2 W/m² from 6pm to 11pm
Internal DHW	n/a	A standing loss of 20 W for the hot water cylinder has been assumed in each dwelling.



### **TM59 Results - Dwellings**

5.47 The table below summarises the results given by running dynamic thermal simulations for the buildings under the current design summer year (1989) for the 2020s high emission, 50% percentile scenario, as required by CIBSE TM59.

Table 5.8 - EnergyPlus TM59 Output

Naturally ventilated				
Criteria for predominantly natura	ally ventilated homes			
Block	Zone	Criterion A (%)	Criterion B (hr)	Pass/Fail
Level3SWApartments	Flat25XLivingSpace	0.49	N/A	Pass
Level3SWApartments	Flat25XStudy	0.00	23.67	Pass
Level3SWApartments	Flat26XDoubleBedroom	0.00	30.33	Pass
Level3SWApartments	Flat26XLivingSpace	0.09	N/A	Pass
Level3SWApartments	Flat27XDoubleBedroom	0.00	13.50	Pass
Level3SWApartments	Flat27XLivingSpace	0.02	N/A	Pass
Level3SWApartments	Flt25XDbIBdrm1	0.00	8.00	Pass
Level3SWApartments	Flt25XDbIBdrm2	0.00	17.17	Pass
UpperFloor	Flat32DoubleBedroom	0.07	46.17	Fail
UpperFloor	Flat34DoubleBedroom	0.28	59.33	Fail
UpperFloor	Flat34KitchenXLiving	2.04	N/A	Pass

- 5.48 Results presented above demonstrate that, based on the design and internal gain assumptions, all rooms meet the TM59 Criterion A. Under Criterion B, the following room types shows a non-compliance under Criterion B:
  - 1. Top Floor South Facing Bedrooms (single-aspect).
- Top-floor dwellings typically present a greater degree of overheating risk due to additional solar radiation absorption through the roof build-up. Typically, this can be mitigated through large window openings, which allow a sufficient volume of fresh air into a space.
- 5.50 The south-facing roof top apartments at Branch Hill House have been designed in line with comments received by the conservation officer, namely to complement the aesthetics of the existing Branch Hill House. This has resulted in small window openings to the south-facing bedrooms. As a result of this the model shows a moderately increased overheating risk.
- 5.51 Criterion B of TM59 has a requirement that during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. (CIBSE Guide A Fixed temperature threshold). 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32.85 hours, so 33 or more hours above 26 °C will be recorded as a fail.
- As detailed above the hours of exceedance for the 2 bedrooms are 46 and 59 hours respectively, meaning a moderate increase over the 33 hour threshold.
- 5.53 It is therefore proposed that the development demonstrates an acceptable level of overheating risk generally.



## **Unregulated CO<sub>2</sub> Emissions**

- 5.54 Unregulated loads (plug-in and specialist process equipment) can contribute to a significant quantum of the overall CO<sub>2</sub> emissions of any development.
- 5.55 The unregulated loads for the residential portion of the development have been calculated using guidance as laid out in Appendix L of SAP 2012 Manual and are presented below:

Table 5.10 – Unregulated load for entire development

Unregulated Load	Unregulated Emissions (tonnes.CO <sub>2</sub> .annum) <sup>2</sup>
Electrical Appliances	26.8

5.56 Unregulated CO<sub>2</sub> emissions associated with landlord areas of the development have not been reported, therefore the following measures and opportunities will be explored and included in a residents/tenant user guide where appropriate;

**Table 5.11 – Unregulated load opportunities** 

Unregulated load opportunity	Measures Employed
Energy Efficient Lifts	<ul> <li>LED lights in lift cars;</li> <li>Variable voltage drives;</li> <li>Regenerative lift motors to be considered.</li> </ul>
External Lighting	<ul> <li>Energy efficient lamps (&gt;65 lamp lumens/circuit watt);</li> <li>Photocell dimming/time clock controls to avoid unnecessary use.</li> </ul>
White Goods (if developer specified)	- All white goods will be minimum A rated.

-

<sup>&</sup>lt;sup>2</sup> Calculated using SAP 10 emission factor for electricity



## Applying the London Plan Energy Hierarchy: Stage 2 – Be Clean

- 5.57 Policy CC1 of the Camden Local Plan (2017) requires development to follow the steps below, in the order listed, to ensure that energy from an efficient source is used where possible:
  - 1. Connect immediately: where feasible, development will be required to connect immediately to existing networks;
  - Connect in immediate future: where networks do not currently exist, developments will be required to assess feasibility of connecting to identified future decentralised energy network opportunities in the vicinity of the site, having regard to Energy Networks identified in the plan and on the London Heat Map specific feasibility studies, energy plans and site allocations.
  - 3. Provide a site wide low carbon network: all major developments that cannot immediately connect to an existing or planned network should evaluate the feasibility of a site wide network using low carbon energy sources such as CHP or other low carbon technologies and examine the feasibility of extending the system beyond the site boundary to other sites within a 500m radius, prioritising communally heated Council buildings.

### Connection to existing heating or cooling networks

5.58 As seen on the map adjacent, there are no existing or planned heat networks in the vicinity of Branch Hill House.

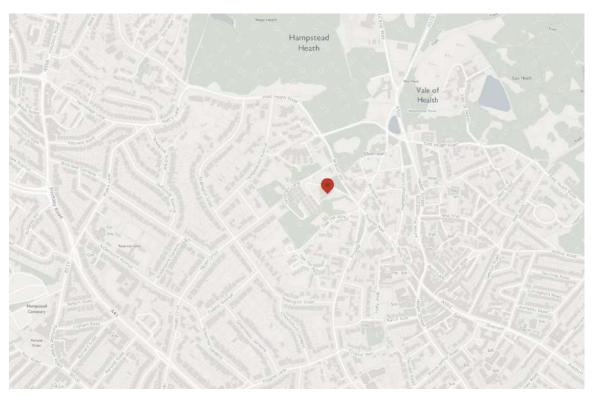


Fig 5.9 - Local Heat Map



## **Future Connection to District Heating**

- As detailed in the 'Be-Green' section, the development proposals include the installation of a shared ground loop array which will deliver low-carbon space and water heating to each dwelling, effectively meeting with the objective of "energy from an efficient source" as required by Policy CC1.
- In this instance, given that no DH networks are available within the vicinity of the site, and given the reasons outlined above, it is suggested that a capped connection at boundary or other similar infrastructure is unnecessary and impractical.
- 5.61 In addition, it is noted that by pursuing an all-electric scheme the development is future-proofed for falling CO<sub>2</sub> emissions as the National Grid continues to decarbonise and therefore a future connection to a DH network would not necessarily result in the scheme having lower CO<sub>2</sub> emissions than an all-electric scheme.



## Applying the London Plan Energy Hierarchy: Stage 3 – Be Green

- 5.62 An analysis of low carbon/renewable technologies was undertaken to determine which would be suitable for application in a development of this size and nature. This analysis has been appended to this document in Appendix I.
- During the design-development period for this scheme, multiple low carbon/renewable systems were examined for both their feasibility and ability to lower carbon emissions insofar as possible. As per the analysis contained in Appendix I, the renewable systems deemed to be the most viable for the development is the installation of a shared ground loop array (SGLA) closed system connecting to individual ground-source heat pumps in each dwelling, providing efficient space and water heating to each dwelling.

### Renewable Energy / Low Carbon Technology – Shared Ground Loop Array

5.64 The development at Branch Hill House is intending to make use of a shared ground loop array (SGLA) as its primary source of space and water heating.

#### **Overview of System**

5.65 Mimicking a traditional gas framework, a series of ground boreholes (120 – 240 meters deep) are linked together to form a shared ground loop array acting as a heat energy source to each dwelling at Branch Hill House. The shared ground loop system transfers ambient temperature low grade heat energy from the ground (-5°C to 20°C) to individual ground source heat pumps (GSHP) located inside each individual dwelling. Each GSHP then upgrades the ground's heat energy to provide independently controllable heat and hot water to the property.



Fig 5.10 – Typical Image of Shared Ground Loop Array



#### **External Design Requirements**

- The typical diameter of each borehole is approximately 150mm. Within the finished borehole there are flow and return pipes for the ground array (40mm diameter each) and a sacrificial pipe that is used to install the grout in the borehole (also 40mm diameter). The top of the borehole is terminated approximately 1m below ground level.
- 5.67 The number of boreholes is dependent on how dwellings are grouped within different ground arrays, which will occur at the detail-design stage. The design assumption at present is 20 boreholes (average depth around 170 metres). with 10 to 12 metres of separation between boreholes.
- 5.68 During detailed design, boreholes will be located exactly within the modelling software to understand how they interact with each other.
- 5.69 The boreholes themselves are fully covered by ground and do not need to be accessed. There will be a flow and return pipe running at about 1m below ground level from the top of each borehole back to a subterranean manifold, which has a manhole cover to enable access in future.<sup>3</sup> From this manifold, each individual borehole can be isolated and flushed/purged/filled. The ground array does not require any annual maintenance. Approximately every 20 years or so, the antifreeze will need to be changed from the manifold.

### **Internal Design Requirements**

- 5.70 The exact dimensions of the risers are subject to detailed design and an agreement on how many apartments will be connected to each array. Riser space has been designed to a 'worst-case' scenario, with 2no. 108mm diameter pipes with 25mm insulation as main risers, branching down to 40mm or 28mm or potentially 22mm when running to each GSHP.
- 5.71 All 1 to 2 bed dwellings will make use of a Shoebox Ground Source Heat Pump (GSHP) with DHW cylinder capacity in line with the details in the 'Be-Lean' section.
- 5.72 Larger dwellings will require the larger EVO GSHP, with DHW cylinder capacity in line with the details in the 'Be-Lean' section.
- 5.73 Datasheets for the GSHP units and cylinders have been provided in Appendix IV.
- Although there is a shared ground loop array, as each dwelling has an individual heat pump, enabling occupants to manage their own electricity supply and therefore have a choice of energy supplier. This is typically not possible in a traditional District Heating (DH) network as metering and billing is managed by one ESCO/management company.

<sup>&</sup>lt;sup>3</sup> Note – this can also be located in a plant room.



#### **Environmental & Geological Considerations**

- 5.75 The proposed shared ground loop array is a 'closed-loop' system, in which a mixture of water and antifreeze flows through a closed network of pipes (known as the ground loop). In one part of the circuit, it exchanges heat with the ground. In the other part, it exchanges that heat with the evaporator of the heat pump. There is no contact between the working fluid and the ground and between the working fluid and the fluid of the heat pump at any point.
- 5.76 This as opposed to an 'open-loop' system which extract heat from ground water, usually abstracted from an aquifer via a borehole.
- 5.77 Section 3.1 of the Environment Agency's 'Ground Source Heat Pump Good Practice Guide' confirms; "Closed loop ground source heating and cooling systems do not currently require any form of permission from us".
- 5.78 This is further confirmed in an email in Appendix V from Kensa Engineering (the proposed manufacturer), which confirms:
  - 1. When drilling closed loop boreholes, no permission is required from the EA;
  - 2. With regards to the local geological suitability for a SGLA, Kensa's Certified Geoexchange Designer has confirmed they are confident the ground will be suitable for installation and will likely consist of:
    - (a) Sand and gravel for approximately 20 metres
    - (b) Clay and gravel for approximately a further 30 metres
    - (c) Chalk with flints to depth from point onwards



## New-Build Residential: Be-Green CO<sub>2</sub> Reductions

5.79 The following tables and graphs represent the Be-Green improvements for the new-build portion over the Target Emission Rate (TER) baseline emissions;

Table 5.12 - New Build Be-Green Improvement over TER

Unit	Total Floor Area for Unit Type (m²)	SAP 10 DER	Total CO2 (kg.CO2.yr)	Regulated Energy (kWh.yr)
GF-2 Bed	232.1	5.25	1,218.16	6,320.62
GF-3/4 Bed	391	4.45	1,740.03	8,403.80
MF-1 Bed	568.9	7.85	4,465.36	17,854.20
MF-2 Bed	212.6	5.47	1,162.61	4,568.20
MF-3/4 Bed	942.1	4.58	4,314.70	19,931.28
TF-1 Bed	109.4	10.77	1,178.55	5,537.14
TF-2 Bed	210.5	6.20	1,304.95	6,279.12
TF-3/4 Bed	191	4.73	904.30	3,909.56
Gatehouse	167	6.07	1,014.05	4,087.91
Triplex	263.3	5.19	1,367.68	5,966.20
		Total =	18,670.38	82,858.03
		Difference over Be-Lean	20823.93	110188.25
		% Difference	52.73%	57.08%
		Difference over Baseline	25387.55	133600.41
		% Difference	57.62%	61.72%

As detailed above, the measures as taken at this stage would result in a 57.62% reduction in the new-build regulated  $CO_2$  emissions over the Building Regulations Part L 2013 Target Emission Rate, calculated using SAP 10 emission factors.



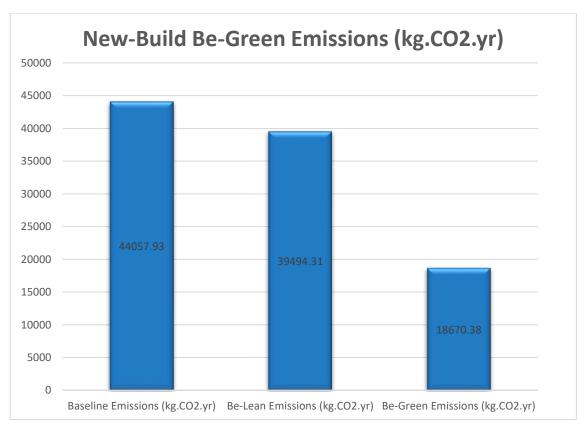


Fig 5.11 – New Build Be-Green Reductions

## Refurbished Residential: Be-Green CO<sub>2</sub> Reductions

5.81 The following tables and graphs represent the Be-Green improvements for the new-build portion over the Target Emission Rate (TER) baseline emissions;

Table 5.13- Refurbished Be-Green Improvement over TER

Unit	Total Floor Area for Unit Type (m²)	SAP 10 DER	Total CO2 (kg.CO2.yr)	Regulated Energy (kWh.yr)
Flat 1	178	7.16	1,275.16	5,472.81
Flat 2	227.6	6.95	1,582.21	6,790.59
Flat 7	250.9	8.46	2,123.59	9,114.12
Flat 16	270	6.18	1,669.78	7,166.45
Flat 24	229	6.74	1,543.80	6,625.76
		Total =	8,194.55	35,169.73
		Difference over Be-Lean	18397.60	91058.59
		% Difference	69.18%	72.14%
		Difference over Baseline	37539.20	181886.65
		% Difference	82.08%	83.80%



As detailed above, the measures as taken at this stage would result in a 82.08% reduction in the refurbished regulated  $CO_2$  emissions over the existing building baseline, calculated using SAP 10 emission factors.

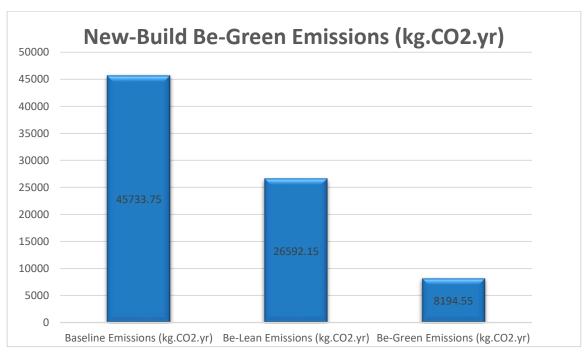


Fig 5.12 - Be-Green Reductions



## Final New-Build Residential CO<sub>2</sub> Reduction Charts & Carbon Offset Payment

5.83 In accordance with the 'GLA guidance on preparing energy assessments', the final carbon emissions and predicted savings are presented below for the entire development. Also included is the predicted carbon offset payment for the development. The final table represents the site wide regulated carbon dioxide emissions and savings.

Table 5.14 - Final New-Build Residential CO<sub>2</sub> reductions

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	44.06	14.10
After energy demand reduction	39.49	14.10
After heat network / CHP	n/a	n/a
After renewable energy	18.67	14.10
	Regulated domestic carb dioxide savings	
	(Tonnes CO <sub>2</sub> per annum)	(%)
Savings from energy demand reduction	4.56	10.36%
Savings from heat network / CHP	n/a	n/a
Savings from renewable energy	20.82	47.26%
Cumulative on-site savings	25.39	57.62%
Annual Savings from off-set payment	18.67	
Cumulative savings for off-set payment ( over 30 Years)	560.11	
Carbon offset Payment (£60 per tonne)	£ 33,606.69	

In order to bring the residential carbon savings up to 100%, the remaining residential carbon emissions are to be offset through a carbon offset payment. As detailed above, the carbon offset payment, priced at £60 per tonne of CO<sub>2</sub> per year (over 30 years) to be paid via a S106 to LB Camden is £33,606.69.



## Final Refurbished Residential CO<sub>2</sub> Reduction Charts

5.85 In accordance with the 'GLA guidance on preparing energy assessments', the final carbon emissions and predicted savings are presented below for the refurbished portion of the development. The final table represents the site wide regulated carbon dioxide emissions and savings.

Table 5.15 - Final Refurbished Residential CO<sub>2</sub> reductions

		Carbon Dioxide Emissions for domestic buildings (Tonnes CO2 per annum)	
		Regulated	Unregulated
	13 of the Building liant Development	45.73	14.10
After energy de	mand reduction	26.59	14.10
After heat network / CHP		n/a	n/a
After renewable energy		8.19	14.10
		Regulated domestic carbon dioxide savings	
		(Tonnes CO2 per annum)	(%)
_	nergy demand	19.14	41.85%
Savings from hea	at network / CHP	n/a	n/a
Savings from re	Savings from renewable energy		40.23%
Cumulative o	n-site savings	37.54	82.08%



## 6 CONCLUSION

- 6.1 This Sustainability and Energy Statement has been prepared by Envision on behalf of Almax Group (The Applicant) and is submitted in support of a full planning application for the change of use of Branch Hill House from a care home (Use Class C2) to residential (Use Class C3) and associated external alterations, demolition of the 1960s extension and erection of replacement building, including basement, comprising residential accommodation (Use Class C3), ancillary plant, access and servicing and car parking.
- The scheme will deliver a series of sustainability measures which are compatible with the GLA and London Borough of Camden's requirements for sustainable design and construction, including:
  - SuDs strategy to achieve a run-off rate of 2 l/s during all events up to and including the 1:100
     AEP event, including a 40% allowance for climate change
  - A comprehensive ecological strategy to deliver a net gain in biodiversity and the Protection, conservation and enhancement of the Site of Importance for Nature Conservation (SINC);
  - Sustainable material selections with timber to be procured with Forest Stewardship Council accreditation;
  - Incorporation of climate adaptation measures, including permeable paving, landscaping and passive building design including MVHR;
  - Water conservation measures within the units to comply with 110 litres / bedspace per day and the provision of communal external rainwater harvesting tank for irrigation purposes;
  - New play space and public realm.
- To minimise energy consumption by the development and to ensure compliance with relevant energy policies, the following design measures are proposed:
  - Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
  - Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
  - High-efficiency ground-source seat pumps providing efficient space and water heating to each dwelling on site;
  - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values;
  - High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing;
  - Mechanical Ventilation Heat Recovery (MVHR), ensuring space heating loads are kept to a minimum;
  - Reduction in solar gain through the use of lower g-values.



- The strategy proposed follows the three-step 'Energy Hierarchy' and meets all policies as outlined in Section 3 of the report, with the development expected to perform as follows:
  - 1. The new-build portions (comprising 29 apartments) overall reduction in carbon emissions over the Part L 2013 (using SAP 10 emission figures) baseline is **57.62%** therefore complying with LB Camden & GLA policy on CO<sub>2</sub> reductions in major residential developments;
  - 2. The 5-dwelling created by change-of-use in the existing Branch Hill House are expected to reduce CO<sub>2</sub> emissions by **82.08%**, when compared to the existing building baseline, and have therefore have maximised CO<sub>2</sub> emission reductions as required by LB Camden Policy CC1.
- 6.5 Further optimising of the ground source heat pump installation will be assessed at the detaildesign phase. For this Energy Report, the solutions have been optimised to suit the predicted energy consumption and carbon emissions as per Envision's calculations.
- The development is therefore considered to comply with the sustainability & energy requirements outlined by Camden and GLA sustainability and energy policies.



## **APPENDIX I – RENEWABLE TECHNOLOGY ANALYSIS**

Renewable	Rating	Comment
Technology	(out of 5)	
Photovoltaics	***	The roof layout is not optimal for the inclusion of PV given the many ridge and gable end roofs. In addition, given the CO <sub>2</sub> reductions already achieved on-site their inclusion is deemed extraneous.  In addition, the CO <sub>2</sub> offset offered by PV using SAP 10 emission factors is halved when compared to previous Part L emission factors, meaning a significant quantum is required to lower CO <sub>2</sub> emissions meaningfully.
Solar Thermal	*	The proposed DHW system (on-site Ground Source Heat Pump) will already provide hot water — the use of a solar thermal system would be an over-design, especially given the limited roof space already allocated for the PV array. They also have a shorter lifespan than PV systems.
Wind Turbine	*	The restricted nature of the site, coupled with the noise, aesthetic (planning) and building vibrations arising from their installation means this system is impractical.
Ground Source Heat Pump	****	A shared ground loop array has been identified as a viable renewable technology for providing space & water heating to the development as;  • The site has been identified as suitable for the installation of the boreholes required for this system;  • Depending on apartment size, the system offers high COPs  • As each apartment has its own individual heat pump, tenants can manage their own metering and billing
Air Source Heat Pump	***	ASHPs are potentially viable for the development and are capable of providing a significant portion of the building's energy from effectively a renewable source, as for each kW of electricity in excess of 3kW of heating will be extracted. Two ASHP solutions were examined for inclusion in the design but were rejected for the following reasons;  Individual ASHP – these offer high COPs but each ASHP would need to be located on the roof (no space) as a condenser farm at ground level would not be suitable.  Communal ASHP – these offer lower COPs than individual ASHPs which would require a larger amount of PV than currently specified. Also space considerations are an issue.
Biomass Communal Boiler	*	The significant plant and in particular, storage space required for a biomass boiler is unsuitable for a development of this size.



## **APPENDIX II – ENVISION SAP 10 CALCULATIONS**



Table 1. CARBON (CO2) FACTORS				
Fuel type Fuel Carbon Factor (kgCO2/kWh)				
SAP 2012 SAP 10				
Natural Gas	0.216	0.210		
Grid Electricity	0.519 0.233			

STEP 1 -	BASELINE (TER	) CALCULATION	IS		REGULA	ATED ENERGY C	ONSUMPTION	PER UNIT (kW	/h.p.a)		SAF	P 2012 CO2 P	ERFORMAN	CE (Regulate	d CO2 Emiss	ions)	SA	NP 10 CO2 PE	RFORMANCE	(Regulated	CO2 Emissio	ons)
Unit	Area (m²)	SAP 10 TER	SAP 2012 TER	Space Heating	Fuel Type	Domestic Hot Water	Fuel Type	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total
GF-2 Bed	140.3	14.24	15.81	6192.83	Natural Gas	2670.35	Natural Gas	510.29	75	n/a	1337.6513	576.7956	264.84051	38.925	n/a	2218.2124	1300.4943	560.7735	118.89757	17.475	n/a	1997.6404
GF-3/4 Bed	220	13.57	14.83	10696.44	Natural Gas	2755.89	Natural Gas	614.62	75	n/a	2310.431	595.27224	318.98778	38.925	n/a	3263.6161	2246.2524	578.7369	143.20646	17.475	n/a	2985.6708
MF-1 Bed	53	15.41	17.53	1425.18	Natural Gas	2109.37	Natural Gas	244.06	75	n/a	307.83888	455.62392	126.66714	38.925	n/a	929.05494	299.2878	442.9677	56.86598	17.475	n/a	816.59648
MF-2 Bed	97.32	12.79	14.51	2772.38	Natural Gas	2631.72	Natural Gas	396.63	75	n/a	598.83408	568.45152	205.85097	38.925	n/a	1412.0616	582.1998	552.6612	92.41479	17.475	n/a	1244.7508
MF-3/4 Bed	169	10.70	12.06	5142.93	Natural Gas	2759.68	Natural Gas	564.52	75	n/a	1110.8729	596.09088	292.98588	38.925	n/a	2038.8746	1080.0153	579.5328	131.53316	17.475	n/a	1808.5563
TF-1 Bed	59.88	18.65	21.08	2703.37	Natural Gas	2164.68	Natural Gas	330.56	75	n/a	583.92792	467.57088	171.56064	38.925	n/a	1261.9844	567.7077	454.5828	77.02048	17.475	n/a	1116.786
TF-2 Bed	118	13.72	15.64	4334.93	Natural Gas	2656.44	Natural Gas	570.08	75	n/a	936.34488	573.79104	295.87152	38.925	n/a	1844.9324	910.3353	557.8524	132.82864	17.475	n/a	1618.4913
TF-3/4 Bed	192.4	13.24	14.62	8616.41	Natural Gas	2747.07	Natural Gas	615.52	75	n/a	1861.1446	593.36712	319.45488	38.925	n/a	2812.8916	1809.4461	576.8847	143.41616	17.475	n/a	2547.222
Gatehouse	156.86	17.37	19.01	9545.99	Natural Gas	2720.16	Natural Gas	566.3	75	n/a	2061.9338	587.55456	293.9097	38.925	n/a	2982.3231	2004.6579	571.2336	131.9479	17.475	n/a	2725.3144
Triplex	267.62	13.38	14.66	13322.32	Natural Gas	2773.41	Natural Gas	784.96	75	n/a	2877.6211	599.05656	407.39424	38.925	n/a	3922.9969	2797.6872	582.4161	182.89568	17.475	n/a	3580.474

STEP 2	- BE-LEAN DER	CALCULATIONS	S		REGULA	ATED ENERGY C	ONSUMPTION	PER UNIT (kW	h.p.a)		SAF	2012 CO2 P	ERFORMANO	CE (Regulated	d CO2 Emissi	ons)	SA	P 10 CO2 PE	RFORMANCE	(Regulated	CO2 Emissio	ons)
Unit	Area (m²)	SAP 10 DER	SAP 2012 DER	Space Heating	Fuel Type	Domestic Hot Water	Fuel Type	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total
GF-2 Bed	140.3	13.54	15.79	5474.06	Natural Gas	2530.28	Natural Gas	514.89	422.83	n/a	1182.397	546.54048	267.22791	219.44877	n/a	2215.6141	1149.5526	531.3588	119.96937	98.51939	n/a	1899.4002
GF-3/4 Bed	220	12.98	15.03	9531.73	Natural Gas	2590.99	Natural Gas	616.65	709.39	n/a	2058.8537	559.65384	320.04135	368.17341	n/a	3306.7223	2001.6633	544.1079	143.67945	165.28787	n/a	2854.7385
MF-1 Bed	53	13.24	16.11	827.96	Natural Gas	1989.73	Natural Gas	244.06	228.59	n/a	178.83936	429.78168	126.66714	118.63821	n/a	853.92639	173.8716	417.8433	56.86598	53.26147	n/a	701.84235
MF-2 Bed	97.32	11.30	13.62	1963.06	Natural Gas	2495.85	Natural Gas	396.63	302.49	n/a	424.02096	539.1036	205.85097	156.99231	n/a	1325.9678	412.2426	524.1285	92.41479	70.48017	n/a	1099.2661
MF-3/4 Bed	169	8.52	10.62	2993.44	Natural Gas	2616.92	Natural Gas	569.73	551.89	n/a	646.58304	565.25472	295.68987	286.43091	n/a	1793.9585	628.6224	549.5532	132.74709	128.59037	n/a	1439.5131
TF-1 Bed	59.88	18.19	21.33	2532.78	Natural Gas	2029.05	Natural Gas	333.16	229.44	n/a	547.08048	438.2748	172.91004	119.07936	n/a	1277.3447	531.8838	426.1005	77.62628	53.45952	n/a	1089.0701
TF-2 Bed	118	13.07	15.57	3834.91	Natural Gas	2516.07	Natural Gas	573.57	323.68	n/a	828.34056	543.47112	297.68283	167.98992	n/a	1837.4844	805.3311	528.3747	133.64181	75.41744	n/a	1542.7651
TF-3/4 Bed	192.4	12.88	14.87	7978.92	Natural Gas	2580.47	Natural Gas	621.47	495.35	n/a	1723.4467	557.38152	322.54293	257.08665	n/a	2860.4578	1675.5732	541.8987	144.80251	115.41655	n/a	2477.691
Gatehouse	156.86	17.28	19.83	9066.58	Natural Gas	2554.14	Natural Gas	571.83	585.48	n/a	1958.3813	551.69424	296.77977	303.86412	n/a	3110.7194	1903.9818	536.3694	133.23639	136.41684	n/a	2710.0044
Triplex	267.62	12.28	14.44	11107.58	Natural Gas	2611.06	Natural Gas	791.38	943.72	n/a	2399.2373	563.98896	410.72622	489.79068	n/a	3863.7431	2332.5918	548.3226	184.39154	219.88676	n/a	3285.1927

STEP 3	- BE-GREEN DE	R CALCULATION	NS		REGULA	ATED ENERGY C	ONSUMPTION	PER UNIT (kW	h.p.a)		SAF	2012 CO2 P	ERFORMAN	CE (Regulated	CO2 Emissi	ons)	SA	P 10 CO2 PE	RFORMANCE	(Regulated	CO2 Emissio	ns)
Unit	Area (m²)	SAP 10 DER	SAP 2012 DER	Space Heating	Fuel Type	Domestic Hot Water	Fuel Type	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total
GF-2 Bed	140.3	5.25	11.69	1533.16	Electricity	719.43	Electricity	514.89	392.83	n/a	795.71004	373.38417	267.22791	203.87877	n/a	1640.2009	357.22628	167.62719	119.96937	91.52939	n/a	736.35223
GF-3/4 Bed	220	4.45	9.91	2151.93	Electricity	753.93	Electricity	616.65	679.39	n/a	1116.8517	391.28967	320.04135	352.60341	n/a	2180.7861	501.39969	175.66569	143.67945	158.29787	n/a	979.0427
MF-1 Bed	53	7.85	17.48	795.08	Electricity	547.69	Electricity	244.06	198.59	n/a	412.64652	284.25111	126.66714	103.06821	n/a	926.63298	185.25364	127.61177	56.86598	46.27147	n/a	416.00286
MF-2 Bed	97.32	5.47	12.18	920.57	Electricity	694.41	Electricity	396.63	272.49	n/a	477.77583	360.39879	205.85097	141.42231	n/a	1185.4479	214.49281	161.79753	92.41479	63.49017	n/a	532.1953
MF-3/4 Bed	169	4.58	10.20	1484.62	Electricity	745.64	Electricity	569.73	521.89	n/a	770.51778	386.98716	295.68987	270.86091	n/a	1724.0557	345.91646	173.73412	132.74709	121.60037	n/a	773.99804
TF-1 Bed	59.88	10.77	24.00	1663.84	Electricity	572.13	Electricity	333.16	199.44	n/a	863.53296	296.93547	172.91004	103.50936	n/a	1436.8878	387.67472	133.30629	77.62628	46.46952	n/a	645.07681
TF-2 Bed	118	6.20	13.81	1560.52	Electricity	711.79	Electricity	573.57	293.68	n/a	809.90988	369.41901	297.68283	152.41992	n/a	1629.4316	363.60116	165.84707	133.64181	68.42744	n/a	731.51748
TF-3/4 Bed	192.4	4.73	10.55	2073.27	Electricity	749.47	Electricity	621.47	465.35	n/a	1076.0271	388.97493	322.54293	241.51665	n/a	2029.0616	483.07191	174.62651	144.80251	108.42655	n/a	910.92748
Gatehouse	156.86	6.07	13.53	2217.05	Electricity	743.55	Electricity	571.83	555.48	n/a	1150.649	385.90245	296.77977	288.29412	n/a	2121.6253	516.57265	173.24715	133.23639	129.42684	n/a	952.48303
Triplex	267.62	5.19	11.57	3475.1	Electricity	786	Electricity	791.38	913.72	n/a	1803.5769	407.934	410.72622	474.22068	n/a	3096.4578	809.6983	183.138	184.39154	212.89676	n/a	1390.1246

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Table 1. CA	RBON (CO2) FA	CTORS
F. al A	Fuel Carb	on Factor
Fuel type	(kgCO	2/kWh)
	SAP 2012	SAP 10
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

TEP 1 - BASELINE E	EXISTING BUIL	DING (DER) C	ALCULATION		REGULAT	ED ENERGY C	CONSUMPTION	N PER UNIT (k	Wh.p.a)		SAP 2	012 CO2 PE	RFORMANO	E (Regulate	ed CO2 Emis	ssions)	SAP	10 CO2 PER	FORMANCE	(Regulated	CO2 Emiss	sions)
Unit	Area (m²)	SAP 10 TER	SAP 2012 TER	Space Heating	Fuel Type	Domestic Hot Water	Fuel Type	Lighting	Auxiliary	Cooling	•	Domestic Hot Water	l lighting	Auxiliary	Cooling	Total	•	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total
Flat 1	178	40.65	43.80	29114.86	Natural Gas	3936.65	Natural Gas	1110.63	156	n/a	6288.81	850.3164	576.417	80.964	n/a	7796.507	6114.121	826.6965	258.7768	36.348	n/a	7235.942
Flat 2	227.6	37.97	40.88	35539.75	Natural Gas	3964.51	Natural Gas	1367.31	120	n/a	7676.586	856.3342	709.6339	62.28	n/a	9304.834	7463.348	832.5471	318.5832	27.96	n/a	8642.438
Flat 7	250.9	43.26	45.88	46342.08	Natural Gas	3975.01	Natural Gas	1116.56	120	n/a	10009.89	858.6022	579.4946	62.28	n/a	11510.27	9731.837	834.7521	260.1585	27.96	n/a	10854.71
Flat 16	270	33.91	36.23	38153.36	Natural Gas	3992.99	Natural Gas	1187.24	120	n/a	8241.126	862.4858	616.1776	62.28	n/a	9782.069	8012.206	838.5279	276.6269	27.96	n/a	9155.32
Flat 24	229	42.99	45.82	41470.89	Natural Gas	3961.7	Natural Gas	1186.84	120	n/a	8957.712	855.7272	615.97	62.28	n/a	10491.69	8708.887	831.957	276.5337	27.96	n/a	9845.338

STEP	2 - BE-LEAN DER	CALCULATIO	NS		REGULAT	ED ENERGY C	ONSUMPTION	N PER UNIT (k	(Wh.p.a)		SAP 2	012 CO2 PE	RFORMANO	CE (Regulate	d CO2 Emis	sions)	SAP	10 CO2 PER	FORMANCE	(Regulated	CO2 Emiss	ions)
Unit	Area (m²)	SAP 10 DER	SAP 2012 DER	Space Heating	Fuel Type	Domestic Hot Water	Fuel Type	Lighting	Auxiliary	Cooling	•	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total	•	Domestic Hot Water	Lighting	Auxiliary	Cooling	Total
Flat 1	178	23.83	25.59	16508.52	Natural Gas	2933.6	Natural Gas	653.31	30	n/a	3565.84	633.6576	339.0679	15.57	n/a	4554.136	3466.789	616.056	152.2212	6.99	n/a	4242.056
Flat 2	227.6	22.99	24.67	21038.67	Natural Gas	2955.25	Natural Gas	804.3	30	n/a	4544.353	638.334	417.4317	15.57	n/a	5615.688	4418.121	620.6025	187.4019	6.99	n/a	5233.115
Flat 7	250.9	25.63	27.13	26900.06	Natural Gas	2964.49	Natural Gas	656.8	30	n/a	5810.413	640.3298	340.8792	15.57	n/a	6807.192	5649.013	622.5429	153.0344	6.99	n/a	6431.58
Flat 16	270	20.52	21.86	22600.8	Natural Gas	2978.39	Natural Gas	698.38	30	n/a	4881.773	643.3322	362.4592	15.57	n/a	5903.134	4746.168	625.4619	162.7225	6.99	n/a	5541.342
Flat 24	229	22.46	23.99	20730.78	Natural Gas	2956.83	Natural Gas	698.14	30	n/a	4477.848	638.6753	362.3347	15.57	n/a	5494.428	4353.464	620.9343	162.6666	6.99	n/a	5144.055

STEP 3 -	BE-GREEN DE	R CALCULATIO	ONS		REGULAT	ED ENERGY C	ONSUMPTION	N PER UNIT (k	Wh.p.a)		SAP 2	012 CO2 PE	RFORMANO	CE (Regulate	ed CO2 Emi	ssions)	SAP	10 CO2 PER	FORMANCE	(Regulated	CO2 Emiss	sions)
Unit	Area (m²)	SAP 10 DER	SAP 2012 DER	Space Heating	Fuel Type	Domestic Hot Water	Fuel Type	Lighting	Auxiliary	Cooling		Domestic Hot Water	Lighting	Auxiliary	Cooling	Total	-	Domestic Hot Water	Llighting	Auxiliary	Cooling	Total
Flat 1	178	7.16	15.96	4017.36	Electricity	802.14	Electricity	653.31	0	n/a	2085.01	416.3107	339.0679	0	n/a	2840.388	936.0449	186.8986	152.2212	0	n/a	1275.165
Flat 2	227.6	6.95	15.48	5176.11	Electricity	810.18	Electricity	804.3	0	n/a	2686.401	420.4834	417.4317	0	n/a	3524.316	1206.034	188.7719	187.4019	0	n/a	1582.207
Flat 7	250.9	8.46	18.85	7643.37	Electricity	813.95	Electricity	656.8	0	n/a	3966.909	422.4401	340.8792	0	n/a	4730.228	1780.905	189.6504	153.0344	0	n/a	2123.59
Flat 16	270	6.18	13.78	5651.03	Electricity	817.04	Electricity	698.38	0	n/a	2932.885	424.0438	362.4592	0	n/a	3719.388	1316.69	190.3703	162.7225	0	n/a	1669.783
Flat 24	229	6.74	15.02	5117.22	Electricity	810.4	Electricity	698.14	0	n/a	2655.837	420.5976	362.3347	0	n/a	3438.769	1192.312	188.8232	162.6666	0	n/a	1543.802

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# **APPENDIX III – SAP SUMMARY SHEETS (NEW-BUILD & REFURB)**



# Block Compliance WorkSheet: Be-Lean (New Build)

#### **User Details**

Assessor Name: Stroma Number:

Software Name: Stroma FSAP Software Version: Version: 1.0.4.23

#### Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Flat 3 - 2B4P - GF (Be Lean)	15.79	15.81	53.4	53.7	140.3
Flat 8 - 4B8P - GF (Be Lean)	15.03	14.83	56.4	58	220
Flat 10 - 1B2P - MF (Be Lean)	16.11	17.53	38.3	38.4	53
Flat 23 - 2B4P - MF (Be Lean)	13.62	14.51	37.5	39	97.32
Flat 15 - 3B6P - MF (Be Lean)	10.62	12.06	34.2	38	169
Flat 33 - 1B2P -TF (Be Lean)	21.33	21.08	58.4	56.8	59.88
Flat 32 - 2B4P - TF (Be Lean)	15.57	15.64	46.6	45.3	118
Flat 31 - 3B6P - TF (Be Lean)	14.87	14.62	54	53.6	192.4
Gate House (Be Lean)	19.83	19.01	71.5	72.3	156.86
Triplex (Be Lean)	14.44	14.66	55.6	57.8	267.62

Total Floor Area	1474.38
Average TER	15.39
Average DER	15.22
Average DFEE	52.12
Average TFEE	53.19
Compliance	Pass
% Improvement DER TER	1.1
% Improvement DFEE TFEE	2.01



# **Block Compliance WorkSheet: Be-Green (New Build)**

**User Details** 

Assessor Name: Stroma Number:

Software Name: Stroma FSAP Software Version: Version: 1.0.4.23

#### Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Flat 3 - 2B4P - GF (Be Green)	11.69	23.32	53.4	53.7	140.3
Flat 8 - 4B8P - GF (Be Green)	9.91	22.1	56.4	58	220
Flat 10 - 1B2P - MF (Be Green)	17.48	25.45	38.3	38.4	53
Flat 23 - 2B4P - MF (Be Green)	12.18	21.11	37.5	39	97.32
Flat 15 - 3B6P - MF (Be Green)	10.2	17.62	34.2	38	169
Flat 33 - 1B2P -TF (Be Green)	24	30.73	58.4	56.8	59.88
Flat 32 - 2B4P - TF (Be Green)	13.81	22.67	46.6	45.3	118
Flat 31 - 3B6P - TF (Be Green)	10.55	21.64	54	53.6	192.4
Gate House (Be Green)	13.53	28.3	71.5	72.3	156.86
Triplex (Be Green)	11.57	21.8	55.6	57.8	267.62

Total Floor Area	1474.38
Average TER	22.70
Average DER	12.19
Average DFEE	52.12
Average TFEE	53.19
Compliance	Pass
% Improvement DER TER	46.3
% Improvement DFEE TFEE	2.01



# **Block Compliance WorkSheet: Existing Building Baseline**

User Details

Assessor Name: Stroma Number:

Software Name: Stroma FSAP Software Version: Version: 1.0.4.23

### Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Flat 1 - Existing - 3B6P - GF	43.8	15.92	114.7	57.9	178
Flat 2 - Existing - 4B8P - GF	40.88	15.86	114.5	61.1	227.6
Flat 7 - Existing - 3B6P - MF	45.88	17.12	133.8	73.2	250.9
Flat 16 - Existing - 3B4P - MF	36.23	13.68	103.8	55.2	270
Flat 24 Existing - 3B4P - TF	45.82	15.24	131.3	59.9	229

Total Floor Area	1155.50
Average TER	15.51
Average DER	42.31
Average DFEE	119.55
Average TFEE	61.62
Compliance	Fail
% Improvement DER TER	N/A
% Improvement DFEE TFEE	N/A



# Block Compliance WorkSheet: Be-Lean (Refurb)

#### User Details

Assessor Name: Stroma Number:

Software Name: Stroma FSAP Software Version: Version: 1.0.4.23

#### Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Flat 1 - Existing Be Lean - 3B6P - GF	25.59	15.99	96.4	57.9	178
Flat 2 - Existing Be Lean - 4B8P - GF	24.67	15.91	94.1	61.1	227.6
Flat 7 - Existing Be Lean- 3B6P - MF	27.13	17.18	112.5	73.2	250.9
Flat 16 - Existing Be Lean - 3B4P - MF	21.86	13.73	86.9	55.2	270
Flat 24Existing Be Lean - 3B4P - TF	23.99	15.3	93.8	59.9	229

Total Floor Area	1155.50
Average TER	15.57
Average DER	24.55
Average DFEE	96.71
Average TFEE	61.62
Compliance	Fail
% Improvement DER TER	N/A
% Improvement DFEE TFEE	N/A



# **Block Compliance WorkSheet: Be-Green (Refurb)**

## User Details

Assessor Name: Stroma Number:

Software Name: Stroma FSAP Software Version: Version: 1.0.4.23

#### Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Flat 1 - Existing Be-Green - 3B6P - GF	15.96	23.64	96.4	57.9	178
Flat 2 - Existing Be-Green - 4B8P - GF	15.48	23.57	94.1	61.1	227.6
Flat 7 - Existing Be-Green - 3B6P - MF	18.85	25.79	112.5	73.2	250.9
Flat 16 - Existing Be-Green - 3B4P - MF	13.78	20.47	86.9	55.2	270
Flat 24 Existing Be-Green - 3B4P - TF	15.02	22.76	93.8	59.9	229

	T
Total Floor Area	1155.50
Average TER	23.18
Average DER	15.80
Average DFEE	96.71
Average TFEE	61.62
Compliance	Fail
% Improvement DER TER	N/A
% Improvement DFEE TFEE	N/A



## **APPENDIX IV – GROUND SOURCE HEAT PUMP DATA**



## TIS - Evo Heat Pump Single - 3.0

# Page(s)

## **Kensa Evo Heat Pump Series**

#### **Features & Benefits**

- Available in 7kW, 9kW, 13kW,15kW and 17kW
- 15% gain in efficiency<sup>\*</sup>
- Increases RHI income<sup>\*</sup>
- ERP A++ rated series
- Increased SCOP performance<sup>®</sup>
- 60°C domestic hot water
- Significantly reduced noise outputs<sup>®</sup>
- Custom built control panel
- Designed for easy installation



The ERP A++ rated <u>Evo series</u> delivers heating and hot water efficiencies of SCOPs up to 4.7 at 35°C along with significantly reduced noise outputs, packaged in a contemporary contoured gunmetal and gloss-white finish, punctuated by a custom built control panel unique to the Kensa series.

Performance: Each model in the Kensa Evo series has optimised sized stainless steel heat exchangers, which allows the compressor to respond more efficiently, increasing SCOP performance and delivering up to 60°C domestic hot water.

**Appearance:** The ergonomic steel casing has been designed with a focus on ease of access, whilst providing sturdy yet stylish protection from ageing and wear and tear.

**Installation:** The Evo has been designed to be easy to handle and install. With cross head screws in its unique bevelled front panel, the Evo's electrical component and wiring terminals are easily accessible.

The heat pump has four rear water connections, two for the ground collectors and two for the



property's heating distribution system. The connections consist of four 28mm straight brass fittings designed with tight tolerances, ensuring compatibility with easy to install push fittings.

The external side panels feature a curved cut-out offering the installer an extra level of flexibility to install the Evo according to the demands of the site, with vertical and horizontal pipework exit points from the sides and top of the unit.

**Controls:** Kensa has developed its own control board which is the brain of the new Evo heat pump. The customer interface is an intuitive touch screen that facilitates commissioning and parameter settings, and provides live status readings supported by LED light indicators.

The custom built software also permits the control board to pre-empt system irregularities using warning safety levels, which may previously have resulted in a fault if left unchecked. This pro-active system will ultimately reduce costs and call outs and enable better diagnostics and system resolution, aided by Kensa's technical support and UK wide installation network.

<sup>\*</sup>against equivalent Kensa compact units



# TIS - Evo Heat Pump Single - 3.0

Page(s)

Single Phase					
Nominal thermal kW rating	7	9	13	17	15
Part No.	K070-S1H	K090-S1H	K130-S1H	K170-S1H	K150-S3H
MCS Approved	BBA0055/ 41	BBA0055/ 42	BBA0055/ 43	BBA0055/ 44	BBA0055/39
Performance data—rated heating output at B0	/W35 BS EN	14511			
Power consumption	1.7	2.16	3.2	4.6	3.8
Coefficient of performance*	4.42	4.35	4.13	3.81	4.18
Immersion heater output	Kensa heat	pumps do n	ot feature b heaters**		cric immersion
Brine (primary) based on 0°C in, -4°C out					
Design flow rate kg/min	29.1	28.4	39.2	50.6	42.8
Pressure drop kPa at design flow rate	12	11	17	29.2	20.6
Max inlet temperature °C	15				
Min temperature °C (Outlet)	-5 (at standard settings)				
Heating water (secondary) based on 30°C in, 35	5°C out				
Design flow rate I/min	22.4	28.5	37.9	51.3	45.9
Pressure drop kPa at design flow rate	4	5.7	10.1	28.3	13.6
Max flow temperature °C***		62		55	63
Electrical Values @B0/W35	Electrical Values @B0/W35				
Rated Voltage	1	220 – 240 V	/ / 50-60 Hz		380-420V / 50-60 Hz
Power supply rating amps	25	25	40	50	16
Rated current (max) amps	17.4	21.8	32.7	37	12
Typical running current @ B0/W35 amps	8.8	12.7	16.4	22	7.3
Starting current amps****	18.2	28.7	41.3	45	74



# TIS - Evo Heat Pump Single - 3.0

Page(s)

Single Phase					
Nominal thermal kW rating	7	9	13	17	15
Refrigerant circuit					
Process medium			R407C		
Fill volume kg	1.9	1.9	2	2.1	2
Compressor type			Scroll		
Dimensions					
H x W x L (mm)		1	145 x 600 x 5	75	
Dry weight kg (Approx)	153	154	167	167	170
Operating pressure					
Brine circuit min (primary) bar g		Settal	ble at commis	sioning	
Heating water circuit min (secondary) bar g		Settal	ble at commis	sioning	
Low pressure reset bar g		Settal	ble at commis	sioning	
Connection sizes					
Primary IN and OUT (brass stubs) mm		28			
Heating flow and return (brass stubs) mm			28		
Performance (based on Average Climate) at	35°C				
ErP rating	A++	A++	A++	A++	A++
SCOP	4.72	4.64	4.40	4.06	4.47
Seasonal space heating energy efficiency	180%	178%	168%	155%	171%
Performance (based on Average Climate) at 55°C					
ErP rating	A++	A++	A++	A+	A++
SCOP	3.67	3.62	3.48	3.16	3.58
Seasonal space heating energy efficiency	139%	137%	131%	118%	135%
Sound Power Level					
Sound Power Level (dB)	49.4	56.1	49.7	56.2	49.2

<sup>\*</sup> The COP figure quoted is calculated as per EN14511.

Note: Design flowrates are for a ground temperature of 0 and -4°C and a load temperature of 30°C and 35°C

The 17kW is sold complete with a hot water cylinder immersion control box to ensure a higher than 60C DHW temperature

<sup>\*\*</sup> In-built immersion heaters will increase running costs and CO<sub>2</sub> emissions as they use direct electricity, because of this Kensa heat pumps do not include them.

<sup>\*\*\*</sup> By increasing the flow temperature from the heat pump the efficiency of the unit will drop and the COP decreases.

<sup>\*\*\*\*</sup> Kensa Evo heat pumps incorporate smart starts as standard to limit the starting current of the compressors. For full details on how the starting currents are calculated please contact Kensa.



## TI-Shoebox heat pump – 5.3



## **Shoebox Heat Pumps**

## **Features and Benefits**

- Quiet operation
- Low running costs
- Low carbon emissions
- Ease of installation inside a dwelling
- Available in 3kW and 6kW
- Single phase
- UK manufactured
- Access to industry grants



## **Product Description**

The Kensa Shoebox range of heat pumps are designed to provide space heating and domestic hot water (optional extra) for well insulated buildings with multiple accommodation. By using a communal ground array this avoids the high heat losses associated with running high temperature pipe throughout buildings improving the overall efficiency of the system.

The Shoebox heat pump is designed specifically to operate with low noise levels enabling easy installation in places such as an apartment's kitchen.

The unit has been specifically designed to provide a renewable alternative for heating multiple apartment blocks. When combined with a <u>District Vertical Array (D-VA)</u> communal ground array,

Shoebox units are eligible for the <u>Renewable Heat</u> <u>Incentive (RHI)</u> commercial tariff.

The Shoebox heat pump is available in two sizes; a 3kW version and 6kW version. Both units come complete with the ground side water pump internal to the unit reducing the complexity of installation.

Kensa Shoebox heat pumps use low grade renewable energy from a communal borehole field and each individual apartment's heat pump concentrates this to a higher temperature to provide heat into the apartment's heating system.

As a UK manufacturer, Kensa offers a high quality product which is supported by leading industry technical support to ensure the application engineering is performed to the highest standard.



# TI-Shoebox heat pump – 5.3

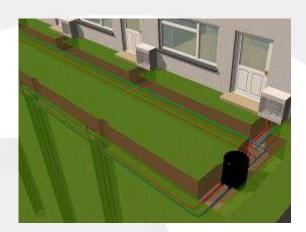
Page(s)

# **Shoebox Heat Pumps**

	Single Phase				
Nominal thermal kW rating	3.0	6.0			
Part No	S3-P0K	S6-P0K			
MCS Approved	BBA0055/31	BBA0055/35			
Performance data—rated heating output at B0/W35 BS EN14511					
Power consumption	0.8kW	1.6kW			
Coefficient of per- formance*	4.05	3.84			
Immersion heater output		s do not feature back- mersion heaters**			
Brine (primary) based on 0°	C in, -4°C out				
Design flow rate kg/min	9.2	18.4			
Pressure drop kPa at design flow rate	5	16			
Max inlet temperature °C	25				
Min temperature °C (Outlet)	-5 (at standard settings)				
Heating water (secondary) k	pased on 30°C in, 35	5°C out			
Design flow rate I/min	8.62	16.88			
Pressure drop kPa at design flow rate	1.0	0.64			
Max flow temperature °C***	65 (RHI applications 64C)	65 (RHI applications 60C)			
Electrical Values @B0/W35					
Rated Voltage	220 – 240	V / 50-60 Hz			
Power supply rating amps	13	25			
Rated current (max) amps	7	14			
Typical running current @ B0/W35 amps	4	8			
Starting current amps	30	34			
Acoustic Performance					
Sound Power Level	47dBA	52dBA			



Apartment Development with a DV-A Communal ground array



Terraced House Communal Ground Array

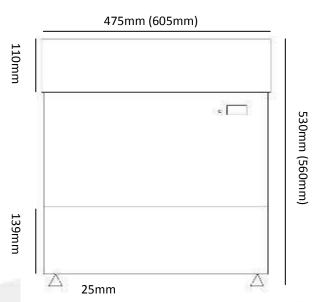


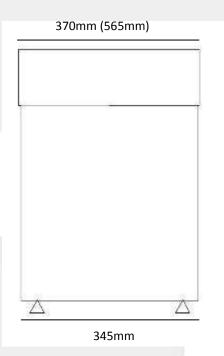
# TI-Shoebox heat pump – 5.3



# **Shoebox Heat Pumps**

	Single Phase			
Nominal thermal kW rating	3.0	6.0		
Refrigerant circuit				
Process medium	R1	.34a		
Fill volume kg	0.7	1.6		
Compressor type	Reci	procal		
Dimensions				
H x W x D (mm)	530 (H) X 475 (W) X 370 (D)	560 (H) X 605(W)X 565(D)		
Nominal weight kg	60	100		
Operating pressure				
Brine circuit min (primary) bar g	0.3			
Heating water circuit min (secondary) bar g	0.6			
Low pressure reset bar g	1.8			
Connection sizes				
Primary IN and OUT	2/4" DCD Dorollol	3/4" BSP Parallel with 22mm Adaptor		
Heating flow and re- turn	valves	itii zziiiii Adaptoi		
Performance (based or	n Average Climate) (	<u></u> @35°С		
ErP rating	A+	A+		
SCOP	3.68	3.45		
Seasonal space heat- ing energy efficiency	139% 130%			
Performance (based on Average Climate) @55°C				
ErP rating	A+	A+		
SCOP	2.99	2.97		
Seasonal space heat- ing energy efficiency	112%	111%		





Dimensions in brackets are for the twin compressor 6kW version.

Note: Design flowrates are for a ground temperature of 0 and  $-4^{\circ}$ C and a load temperature of 30 and 35°C

<sup>\*</sup> The COP figure quoted is calculated as per EN14511

<sup>\*\*</sup> In-built immersion heaters will increase running costs and CO2 emissions as they use direct electricity, because of this Kensa heat pumps do not include them.

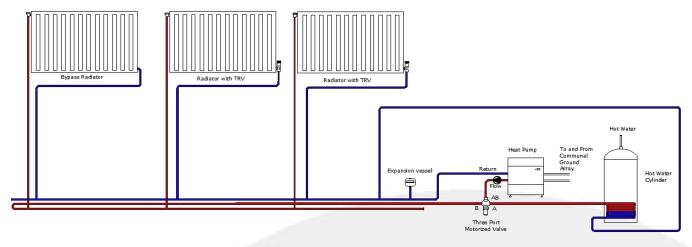
<sup>\*\*\*</sup> By increasing the flow temperature from the heat pump the efficiency of the unit will drop and the COP decreases.



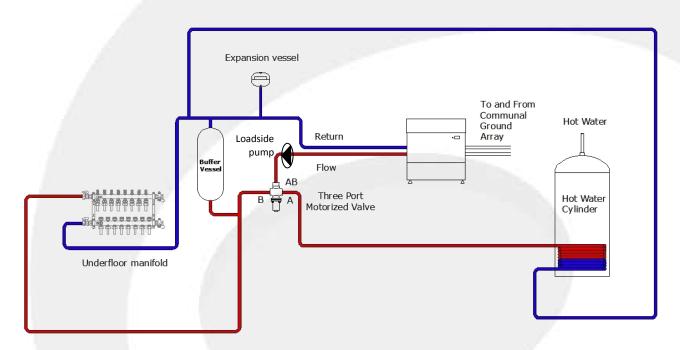
TI-Shoebox heat pump – 5.3



# **Shoebox Heat Pumps**



Shoebox Installation Schematic—Radiators



Shoebox Installation Schematic—Underfloor

# **Technical (TIS)**



# TI-Single Coil Cylinder -9

Page(s)

### **Single Coil** Domestic Hot Water Cylinder

#### **Features and Benefits**

- Designed for heat pump applications
- Large coil to improve heat transfer
- Ease of installation
- Manufactured from Duplex stainless steel
- UK manufactured
- 25 year guarantee for the shell



#### **Product Description**

Kensa has partnered with a <u>leading cylinder</u> <u>manufacturer (Advance Appliances)</u> to design and produce an indirect hot water cylinder designed for use with heat pumps.

The cylinder has a coil specifically designed with a larger surface area to provide a better heat transfer from the heat pump into the cylinder. This improves the actual temperature reached by the domestic hot water and the time taken to reach this temperature.

The vessels are manufactured from corrosion resistant Duplex stainless steel which enables an industry leading 25 year guarantee for the shell of the cylinder.

Tanks installed on private water supplies are sold

without a warranty.

The cylinder is designed using the heat pump as the sole heat source and will provide at least 50°C domestic hot water from the cylinder.

The units meet current Building Regulations, are manufactured in the UK and guaranteed for 25 years (components 2 years).

Also supplied: One 3kW immersion heater and G3 kit.

# **Technical (TIS)**



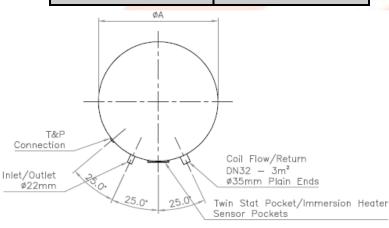
# TI-Single Coil Cylinder -9

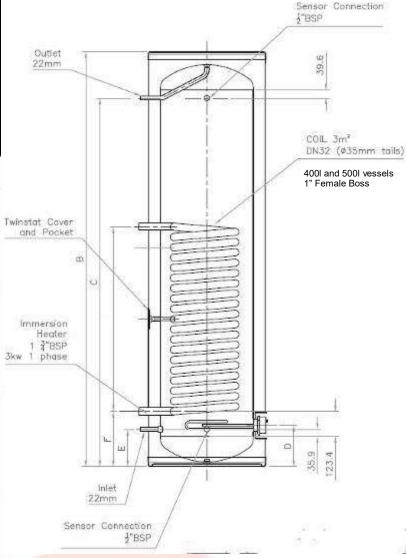


# Single Coil Domestic Hot Water Cylinder (DN32 Coil)

Kensa Model No.	95- 069A	95- 070A	95- 071A	95- 072A
Volume (I)	255	305	400	500
Expansion Vessel capacity (I)	24	24	50	50
Heat Loss kWh/24hrs@55°C	1.49	1.63	2.25	2.38
ErP Rating	С	С	С	С

Material	Duplex Stainless Steel
Operating Pressure Tank and Coils	3 Bar—95°C
P & T Valve Rating	7 Bar—90°C
Pressure Reducing Valve	Max Pressure 12 Bar/ Control Pressure 3 Bar
Safety Relief Valve	6 Bar
Expansion Vessel Charge	3 Bar
Expansion Relief Valve	6 Bar
Flexible Hose for Expansion Vessel	Supplied Loose
Bracket for Expansion Vessel	Supplied Loose
Immersion Heater	13/4—240V-3kW
Tundish	1/2" x 22mm





	А	В	С	D	Е	F	G	Coil Size	Weight Full (kg)
255 (3m²)	575	1750	1527	202	182	270	900	DN32	315
305 (3m²)	575	2023	1800	202	182	270	900	DN32	365
400 (3m²)	580	2190	1830	300	200	375	1080	DN32	485
500 (3m²)	750	1999	1740	330	250	440	1080	DN32	605

All Dimensions are nominal and in mm

# **Technical (TIS)**



# TI-Single Coil Cylinder -9

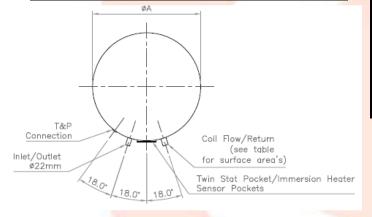


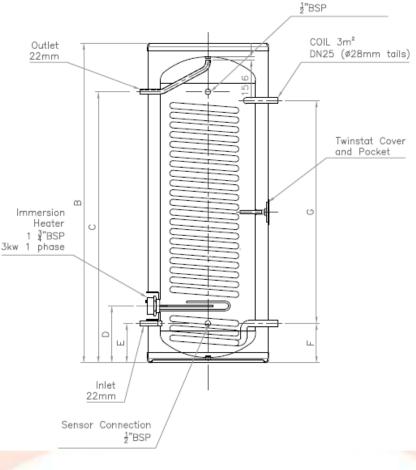
Sensor Connection

# Single Coil Domestic Hot Water Cylinder (DN25 Coil)

Kensa Model No.	95- 060A	95- 061A	95- 062A	95- 063A
Volume (I)	150	215	255	305
Expansion Vessel capacity (I)	12	18	24	24
Heat Loss kWh/24hrs@55°C	0.99	1.41	1.49	1.63
ErP Rating	В	С	С	С

Material	Duplex Stainless Steel
Operating Pressure Tank and Coils	3 Bar—95°C
P & T Valve Rating	7 Bar—90°C
Pressure Reducing Valve	Max Pressure 12 Bar/ Control Pressure 3 Bar
Safety Relief Valve	6 Bar
Expansion Vessel Charge	3 Bar
Expansion Relief Valve	6 Bar
Flexible Hose for Expansion Vessel	Supplied Loose
Bracket for Expansion Vessel	Supplied Loose
Immersion Heater	13/4—240V-3kW
Tundish	1/2" x 22mm





	А	В	С	D	E	F	G	Coil Size	Weight Full (kg)
150 (2m <sup>2</sup> )	575	1083	860	264	182	182	675	DN25	195
215 (3m²)	575	1485	1259	264	182	182	1035	DN25	270
255 (3m²)	575	1750	1527	202	182	272	1035	DN25	310
305 (3m²)	575	2023	1800	202	182	272	1035	DN25	370

All Dimensions are nominal and in mm



### **APPENDIX V – CORRESPONDENCE WITH MANUFACTURER**

#### Sam Wallis | Envision

From: Stuart Gadsden <stuart.gadsden@kensaengineering.com>

Sent:13 September 2019 12:38To:Sam Wallis | EnvisionCc:Ciaran Dorrity | Envision

**Subject:** Re: 190325: Branch Hill House - GSHP Information

Hi Sam,

Good to hear from you and great to hear the project is back on track.

Point 1: I can confirm that when drilling closed loop boreholes, no permission is required from the EA.

Point 2: I have discussed this site with our ground array designer (who is a Certified Geoexchange Designer - one of only 5 in the UK) to get his initial thoughts on underlying geology and suitability for closed loop drilling. The expected geology is very similar to a previous project we carried out for Enfield Council (which required 96 boreholes) and so we are very confident that the ground is suitable. We expect the geology to be approximately:

Sand and gravel for approximately 20 metres Clay and gravel for approximately a further 30 metres Chalk with flints to depth from point onwards

At this stage, no detailed assessments are available for peak heat loss, annual heating demand and annual hot water demand. However, based on some rules of thumb we estimated peak heat loss as 157kW, annual space heating demand as 168,369 kWh/year and annual DHW demand as 72,772 kWh/year. With the expected geology, the estimated borehole requirement is 3,357 metres. From looking at site plans, it appears there would be sufficient space on site for this borehole depth.

Of course, no detailed design has been carried out at this stage and everything is subject to change. However, our initial desktop study does show that we are very confident that a shared ground loop GSHP system can be installed at this site.

Point 3: No permit will be required as per Point 1.

Point 4: All manuals etc will be provided to householders. Kensa also operate a phone line that can be contacted at any time by householders. On-going maintenance would need to be agreed with each householder for their GSHP but it is possible to enter into service agreements with M&E contractors for this (Kensa does not do this). Long-term maintenance of the ground array would also be discussed with the owner of the site and Kensa can enter into an agreement to maintain this.

In terms of the householders, there is no real difference in control and operation to a standard gas boiler system and so not expecting any undue problems with this.

Hope this helps. Let me know if you need anything else.

As an interesting aside, I'm directly speaking to some of Camden Council's asset management team about retrofitting our solution into some of their own social housing. So hopefully the planning department will be keen to support a solution that may well end up in their own buildings!

Cheers

Stuart

On Thu, 12 Sep 2019 at 11:51, Sam Wallis | Envision < <a href="mailto:swallis@envisioneco.com">swallis@envisioneco.com</a>> wrote:



# **APPENDIX VI – TER WORKSHEETS (NEW-BUILD)**



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 3 - 2B4P - GF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 140.3 (1a) x 2.7 (2a) =(3a) 378.81 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)140.3 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =378.81 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.11 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) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.36 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)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 (22)m =5.1 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltr	ation rate (al	lowing for sl	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
0.42	0.41 0.	<del></del>	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39	]	
Calculate effe		-	he appli	cable ca	ise					•		
	al ventilation:		· · · · · · · · · · · · · · · · · · ·			\\	. (00)	\ (00 \			0	(23a)
	eat pump using							) = (23a)			0	(23b)
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(24b)m= 0	ed mechanica	o o	Without	neat red	overy (r	VIV) (240 1 0	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (22)$	20)m + (.   0	23b)   <sub>0</sub>	0	7	(24b)
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,	n < 0.5 × (23		•	•				.5 × (23b	o)			
(24c)m= 0	<del> </del>	0 0	0	0	0	0	0	0	0	0	]	(24c)
,	ventilation or							·	•	•	_	
	n = 1, then (2	<u> </u>	<del> </del>	· `	<del></del>	<del>- `</del>			T 0.57	0.57	1	(24d)
(24d)m= 0.59	0.58 0.5	!	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24u)
(25)m= 0.59	change rate	<del></del>	0.56	0.55 or (24	c) or (24	(a) in box	0.55	0.56	0.57	0.57	1	(25)
(23)11= 0.39	0.38 0	0.57	0.50	0.55	0.55	0.55	0.55	0.50	0.37	0.57	J	(20)
3. Heat losse	es and heat lo	oss paramet	er:					_			_	
ELEMENT	Gross area (m²)	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/	K)	k-valu kJ/m²-		A X k kJ/K
Windows Type	e 1			2.85	<sub>x</sub> 1	/[1/( 1.4 )+	0.04] =	3.78				(27)
Windows Type	e 2			2.85	x1	/[1/( 1.4 )+	0.04] =	3.78	Π			(27)
Windows Type	e 3			8.88	x1	/[1/( 1.4 )+	0.04] =	11.77				(27)
Windows Type	e 4			2.67	x1	/[1/( 1.4 )+	0.04] =	3.54				(27)
Windows Type	e 5			1.78	<sub>x</sub> 1	/[1/( 1.4 )+	0.04] =	2.36				(27)
Floor				139.4	2 x	0.13	=	18.124	6			(28)
Walls Type1	99.06	27.4	ļ.	71.66	6 X	0.18	=	12.9				(29)
Walls Type2	30.1	0		30.1	X	0.18	<u> </u>	5.42				(29)
Total area of e	elements, m²			268.5	i9							(31)
Party wall				25.3	5 X	0		0				(32)
Party ceiling				139.4	2						$\exists \ \Box$	(32b)
* for windows and ** include the are					lated using	g formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragrap	h 3.2	
Fabric heat los			is and par	uuons		(26)(30	) + (32) =				72.77	(33)
Heat capacity		,						(30) + (32	2) + (32a).	(32e) =	27783.4	<del></del>
Thermal mass	,	•	÷ TFA) ir	n kJ/m²K				tive Value		, ,	250	(35)
For design asses	sments where th	ne details of the	,			recisely the				able 1f		(00)
can be used inste Thermal bridg			usina Ar	nandiv	K						40.40	(36)
if details of therm	, ,			•							13.43	(36)
Total fabric he		(00)	(0	,			(33) +	(36) =			86.2	(37)



entilation he	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		
3)m= 73.5	73.07	72.65	70.69	70.32	68.61	68.61	68.29	69.27	70.32	71.06	71.84		(3
eat transfer	coefficie	nt, W/K			-	-		(39)m	= (37) + (	38)m	-		
9)m= 159.69	159.27	158.85	156.88	156.52	154.8	154.8	154.49	155.46	156.52	157.26	158.04		
eat loss par	ameter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> .	12 /12=	156.88	(3
0)m= 1.14	1.14	1.13	1.12	1.12	1.1	1.1	1.1	1.11	1.12	1.12	1.13		
umber of da	ys in mo	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1.</sub>	12 /12=	1.12	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
. Water hea	iting ene	rgy requi	rement:								kWh/ye	ar:	
sumed occ	upancy.	N								2	92		(4
if TFA > 13 if TFA £ 13	.9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		<u> </u>		`
nual avera	ge hot wa									103	3.49		(-
duce the annumore that 12:							to achieve	a water us	se target o	f			
							Aug	Con	Oct	Nov	Doo		
Jan water usage	Feb in litres per	Mar day for ea	Apr ach month	May $Vd, m = fa$	Jun ctor from	Jul Table 1 <mark>c x</mark>	Aug (43)	Sep	Oct	Nov	Dec		
)m= 113.84	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.84		
,,,,	1 100.									m(44) <sub>112</sub> =	l	1241.93	(4
ergy content o	f hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600	0 kWh/mor	oth (see Ta	bles 1b, 1	c, 1d)		
)m= 168.83	147.66	152.37	132.84	127.46	109.99	101.92	116.96	118.35	137.93	150.56	163.5		_
nstantaneous	water heati	na at noint	of use (no	hot water	r storage)	enter () in	hoves (46		Γotal = Su	m(45) <sub>112</sub> =	- <u>[</u>	1628.37	(-
)m= 25.32	22.15	22.86	19.93	19.12	16.5	15.29	17.54	17.75	20.69	22.58	24.52		(
ater storage		22.00	19.93	19.12	10.5	13.29	17.54	17.75	20.09	22.30	24.52		· ·
orage volun	ne (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(-
community	heating a	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)				_		
herwise if n		hot wate	er (this in	cludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
ater storage If manufac		eclared l	oss facto	or is kno	wn (kWł	n/day).				1	89		(-
mperature				), 10 mil	(	"aay).					54		(-
ergy lost fr				ear			(48) x (49	) =			02		(:
	turer's de				or is not	known:		,			02		`
If manufac		factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(
t water sto	_												
t water sto	heating s	ee secti											/
t water sto community lume factor	heating s from Ta	ee section	on 4.3								0		
t water stor community lume factor mperature	heating s from Ta factor fro	ee section ble 2a m Table	on 4.3 2b	ear			(47) x (51	) x (52) x (	53) =		0		( <u>;</u> (;
t water sto community lume factor	heating some from Tate from from from water	ee section ble 2a m Table storage	on 4.3 2b	ear			(47) x (51	) x (52) x (	53) =				•
t water stores community lume factor mperature ergy lost fro	heating s from Ta factor fro om water (54) in (5	ee section ble 2a m Table storage 55)	on 4.3 2b , kWh/ye					) x (52) x (: (55) x (41):			0		(!



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50)$ – $(H11)$ ] $\div$ $(50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 31.64 28.58 31.64 30.62 31.64 30.62 31.64 30.62 31.64 30.62 31.64 30.62 31.64	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m + (61)m$	n
(62)m= 223.73 197.25 207.28 185.97 182.37 163.13 156.83 171.86 171.49 192.84 203.7 218.41	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 223.73 197.25 207.28 185.97 182.37 163.13 156.83 171.86 171.49 192.84 203.7 218.41	_
Output from water heater (annual) <sub>112</sub> 2274.85	(64)
Heat gains from water heating, kWh/month 0.25 $'$ [0.85 $\times$ (45)m + (61)m] + 0.8 $\times$ [(46)m + (57)m + (59)m]	
(65)m= 100.06 88.77 94.59 86.68 86.31 79.08 77.81 82.81 81.86 89.79 92.57 98.29	(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):	
e. Internal gains (eec rasis ea).	
Metabolic gains (Table 5), Watts	
Metabolic gains (Table 5), Watts	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts         Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec         (66)m=       145.88	(66) (67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	, ,
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       145.88	, ,
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 145	(67) (68) (69)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 145.	(67) (68) (69) (70) (71) (72)

Flux

Table 6a Table 6b Table 6c

Orientation: Access Factor Area Table 6d m²

Gains

(W)

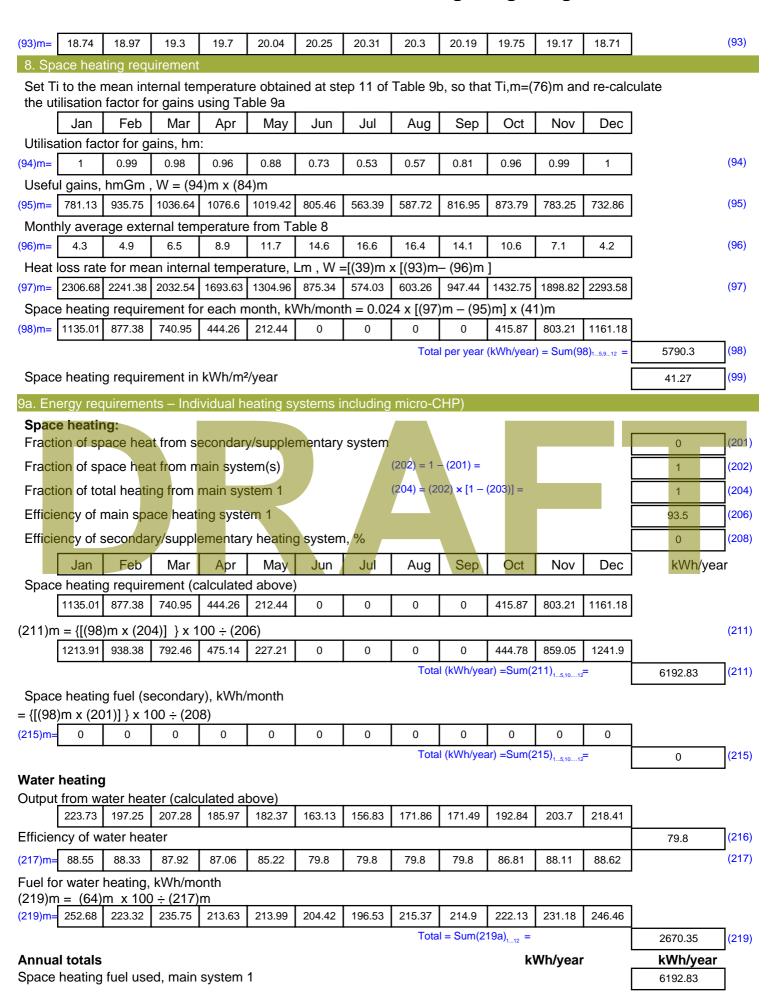


Southeast 0.9x         0.54         x         8.88         x         36.79         x         0.63         x         0.7         =         70.03           Southeast 0.9x         0.54         x         1.78         x         36.79         x         0.63         x         0.7         =         14.04           Southeast 0.9x         0.54         x         8.88         x         62.67         x         0.63         x         0.7         =         23.91           Southeast 0.9x         0.54         x         1.78         x         62.67         x         0.63         x         0.7         =         23.91           Southeast 0.9x         0.54         x         8.88         x         85.75         x         0.63         x         0.7         =         163.21           Southeast 0.9x         0.54         x         1.78         x         85.75         x         0.63         x         0.7         =         32.71           Southeast 0.9x         0.54         x         8.88         x         106.25         x         0.63         x         0.7         =         202.22           Southeast 0.9x         0.54         x	(77) (77) (77) (77) (77) (77) (77) (77)
Southeast 0.9x       0.54       x       8.88       x       62.67       x       0.63       x       0.7       =       119.28         Southeast 0.9x       0.54       x       1.78       x       62.67       x       0.63       x       0.7       =       23.91         Southeast 0.9x       0.54       x       8.88       x       85.75       x       0.63       x       0.7       =       163.21         Southeast 0.9x       0.54       x       1.78       x       85.75       x       0.63       x       0.7       =       32.71         Southeast 0.9x       0.54       x       8.88       x       106.25       x       0.63       x       0.7       =       202.22         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       40.54         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       226.5         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       224.86 </td <td>(77) (77) (77) (77) (77) (77) (77)</td>	(77) (77) (77) (77) (77) (77) (77)
Southeast 0.9x         0.54         x         1.78         x         62.67         x         0.63         x         0.7         =         23.91           Southeast 0.9x         0.54         x         8.88         x         85.75         x         0.63         x         0.7         =         163.21           Southeast 0.9x         0.54         x         1.78         x         85.75         x         0.63         x         0.7         =         32.71           Southeast 0.9x         0.54         x         1.78         x         106.25         x         0.63         x         0.7         =         202.22           Southeast 0.9x         0.54         x         1.78         x         106.25         x         0.63         x         0.7         =         40.54           Southeast 0.9x         0.54         x         1.78         x         119.01         x         0.63         x         0.7         =         226.5           Southeast 0.9x         0.54         x         8.88         x         119.01         x         0.63         x         0.7         =         45.4           Southeast 0.9x         0.54         x	(77) (77) (77) (77) (77) (77) (77)
Southeast 0.9x       0.54       x       8.88       x       85.75       x       0.63       x       0.7       =       163.21         Southeast 0.9x       0.54       x       1.78       x       85.75       x       0.63       x       0.7       =       32.71         Southeast 0.9x       0.54       x       8.88       x       106.25       x       0.63       x       0.7       =       202.22         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       226.5         Southeast 0.9x       0.54       x       1.78       x       119.01       x       0.63       x       0.7       =       45.4         Southeast 0.9x       0.54       x       8.88       x       118.15       x       0.63       x       0.7       =       224.86         Southeast 0.9x       0.54       x       1.78       x       118.15       x       0.63       x       0.7       =       45.07	(77) (77) (77) (77) (77)
Southeast 0.9x       0.54       x       1.78       x       85.75       x       0.63       x       0.7       =       32.71         Southeast 0.9x       0.54       x       8.88       x       106.25       x       0.63       x       0.7       =       202.22         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       40.54         Southeast 0.9x       0.54       x       1.78       x       119.01       x       0.63       x       0.7       =       226.5         Southeast 0.9x       0.54       x       8.88       x       118.15       x       0.63       x       0.7       =       224.86         Southeast 0.9x       0.54       x       1.78       x       118.15       x       0.63       x       0.7       =       45.07	(77) (77) (77) (77)
Southeast 0.9x       0.54       x       8.88       x       106.25       x       0.63       x       0.7       =       202.22         Southeast 0.9x       0.54       x       1.78       x       106.25       x       0.63       x       0.7       =       40.54         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       226.5         Southeast 0.9x       0.54       x       1.78       x       119.01       x       0.63       x       0.7       =       45.4         Southeast 0.9x       0.54       x       8.88       x       118.15       x       0.63       x       0.7       =       224.86         Southeast 0.9x       0.54       x       1.78       x       118.15       x       0.63       x       0.7       =       45.07	(77) (77) (77)
Southeast 0.9x       0.54       x       1.78       x       106.25       x       0.63       x       0.7       =       40.54         Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       226.5         Southeast 0.9x       0.54       x       1.78       x       119.01       x       0.63       x       0.7       =       45.4         Southeast 0.9x       0.54       x       8.88       x       118.15       x       0.63       x       0.7       =       224.86         Southeast 0.9x       0.54       x       1.78       x       118.15       x       0.63       x       0.7       =       45.07	(77) (77)
Southeast 0.9x       0.54       x       8.88       x       119.01       x       0.63       x       0.7       =       226.5         Southeast 0.9x       0.54       x       1.78       x       119.01       x       0.63       x       0.7       =       45.4         Southeast 0.9x       0.54       x       8.88       x       118.15       x       0.63       x       0.7       =       224.86         Southeast 0.9x       0.54       x       1.78       x       118.15       x       0.63       x       0.7       =       45.07	(77)
Southeast 0.9x       0.54       x       1.78       x       119.01       x       0.63       x       0.7       =       45.4         Southeast 0.9x       0.54       x       8.88       x       118.15       x       0.63       x       0.7       =       224.86         Southeast 0.9x       0.54       x       1.78       x       118.15       x       0.63       x       0.7       =       45.07	<u>,</u> 1
Southeast 0.9x	(77)
Southeast 0.9x 0.54 x 1.78 x 118.15 x 0.63 x 0.7 = 45.07	(,
	(77)
Southeast 0.9x 0.54 x 8.88 x 113.91 x 0.63 x 0.7 = 216.79	(77)
	(77)
Southeast 0.9x 0.54 x 1.78 x 113.91 x 0.63 x 0.7 = 43.46	(77)
Southeast 0.9x 0.54 x 8.88 x 104.39 x 0.63 x 0.7 = 198.68	(77)
Southeast 0.9x 0.54 x 1.78 x 104.39 x 0.63 x 0.7 = 39.82	(77)
Southeast 0.9x 0.54 x 8.88 x 92.85 x 0.63 x 0.7 = 176.72	(77)
Southeast 0.9x 0.54 x 1.78 x 92.85 x 0.63 x 0.7 = 35.42	(77)
Southeast 0.9x 0.54 x 8.88 x 69.27 x 0.63 x 0.7 = 131.83	(77)
Southeast 0.9x 0.54 x 1.78 x 69.27 x 0.63 x 0.7 = 26.43	(77)
Southeast 0.9x 0.54 x 8.88 x 44.07 x 0.63 x 0.7 = 83.88	(77)
Southeast 0.9x 0.54 x 1.78 x 44.07 x 0.63 x 0.7 = 16.81	(77)
Southeast 0.9x 0.54 x 8.88 x 31.49 x 0.63 x 0.7 = 59.93	(77)
Southeast 0.9x 0.54 x 1.78 x 31.49 x 0.63 x 0.7 = 12.01	(77)
South 0.9x 0.54 x 2.85 x 46.75 x 0.63 x 0.7 = 57.12	(78)
South 0.9x 0.54 x 2.85 x 46.75 x 0.63 x 0.7 = 57.12	(78)
South 0.9x 0.54 x 2.85 x 76.57 x 0.63 x 0.7 = 93.54	(78)
South 0.9x 0.54 x 2.85 x 76.57 x 0.63 x 0.7 = 93.54	(78)
South 0.9x 0.54 x 2.85 x 97.53 x 0.63 x 0.7 = 119.15	(78)
South 0.9x 0.54 x 2.85 x 97.53 x 0.63 x 0.7 = 119.15	(78)
South 0.9x 0.54 x 2.85 x 110.23 x 0.63 x 0.7 = 134.67	(78)
South 0.9x 0.54 x 2.85 x 110.23 x 0.63 x 0.7 = 134.67	(78)
South 0.9x 0.54 x 2.85 x 114.87 x 0.63 x 0.7 = 140.33	(78)
South 0.9x 0.54 x 2.85 x 114.87 x 0.63 x 0.7 = 140.33	(78)
South 0.9x 0.54 x 2.85 x 110.55 x 0.63 x 0.7 = 135.05	(78)
South 0.9x 0.54 x 2.85 x 110.55 x 0.63 x 0.7 = 135.05	(78)
South 0.9x 0.54 x 2.85 x 108.01 x 0.63 x 0.7 = 131.95	(78)
South 0.9x 0.54 x 2.85 x 108.01 x 0.63 x 0.7 = 131.95	(78)
South 0.9x 0.54 x 2.85 x 104.89 x 0.63 x 0.7 = 128.15	(78)
South 0.9x 0.54 x 2.85 x 104.89 x 0.63 x 0.7 = 128.15	(78)
South 0.9x 0.54 x 2.85 x 101.89 x 0.63 x 0.7 = 124.47	



								_		_				
South 0.9	x 0.54	X	2.8	5	X	10	1.89	X	0.63	X	0.7	=	124.47	(78)
South 0.9	x 0.54	X	2.8	5	X	82	2.59	x	0.63	X	0.7	=	100.89	(78)
South 0.9	x 0.54	Х	2.8	5	X	82	2.59	X	0.63	X	0.7	=	100.89	(78)
South 0.9	x 0.54	X	2.8	5	X	5	5.42	X	0.63	X	0.7	=	67.7	(78)
South 0.9	x 0.54	X	2.8	35	X	5	5.42	X	0.63	x	0.7	=	67.7	(78)
South 0.9	x 0.54	X	2.8	5	X	4	0.4	х	0.63	x	0.7	=	49.35	(78)
South 0.9	x 0.54	X	2.8	35	X	4	0.4	X	0.63	x	0.7	=	49.35	(78)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	3(	6.79		0.63	x	0.7	=	42.11	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	6:	2.67		0.63	X	0.7	=	71.73	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	8	5.75		0.63	X	0.7	=	98.14	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	10	06.25		0.63	x	0.7	=	121.61	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	11	9.01		0.63	X	0.7	=	136.21	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	11	8.15		0.63	x	0.7	=	135.22	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	11	3.91		0.63	x	0.7	=	130.37	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	10	)4.39		0.63	x	0.7	=	119.47	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	9:	2.85		0.63	x	0.7	=	106.27	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	6:	9.27		0.63	x	0.7	=	79.28	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	X	4	4.07		0.63	X	0.7	=	50.44	(79)
Southwest <sub>0.9</sub>	x 0.54	X	2.6	57	Х	3	1.49		0.63	x	0.7		36.04	(79)
Solar gains	in watts, <mark>ca</mark> l	lculated	for eacl	n month	1_			(83)m	= Sum(74)m	.( <mark>8</mark> 2)m			_	
(83)m= 240.	4 402	532.37	633.7	688.78	6	75.27	654.53	( <mark>83)m</mark> 614		.( <mark>82)m</mark> 439.3	2 286.53	206.68	]	(83)
	4 402	532.37	633.7	688.78	6		654.53	_			2 286.53	206.68		(83)
(83)m= 240.	4 402 - internal ar	532.37	633.7 (84)m =	688.78 - (73)m	6 (8	33)m ,	654.53 watts	_	.27 567.35			206.68	]	(83) (84)
(83)m= 240. Total gains - (84)m= 783.3	4 402 - internal ar	532.37 nd solar 1055.01	633.7 (84)m = 1127.27	688.78 = (73)m 1152.22	6 + (8	33)m ,	654.53 watts	614	.27 567.35	439.3				
(83)m= 240. Total gains - (84)m= 783.3 7. Mean int	4 402 - internal ar 31 942.5	532.37 nd solar 1055.01 erature (	633.7 (84)m = 1127.27 (heating	688.78 = (73)m 1152.22 seasor	6 + (8	83)m ,	654.53 watts 1071,39	1037	7.86 1006.22	439.3			21	
(83)m= 240. Total gains - (84)m= 783.3 7. Mean int Temperatu	4 402 - internal ar 31 942.5 ternal tempe	532.37 nd solar 1055.01 erature (	633.7 (84)m = 1127.27 (heating eriods in	688.78 = (73)m 1152.22 season the livi	6 + (8 11 11) ing	33)m , 10.23 area f	654.53 watts 1071.39	1037	7.86 1006.22	439.3			21	(84)
(83)m= 240. Total gains - (84)m= 783.3 7. Mean int Temperatu	4 402  - internal ar  31 942.5  ternal temperer during hereactor for gar	532.37 nd solar 1055.01 erature (	633.7 (84)m = 1127.27 (heating eriods in	688.78 = (73)m 1152.22 season the livi	6' + (8 11) ing	33)m , 10.23 area f	654.53 watts 1071.39	614 1037 ole 9	7.86 1006.22	439.3	788.35		21	(84)
(83)m= 240 Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f	4 402  - internal ar  31 942.5  ternal temperer during hereactor for gar	532.37 nd solar 1055.01 erature ( eating po	633.7 (84)m = 1127.27 (heating eriods in	688.78 = (73)m 1152.22 seasor the livi	6' + (8' 11') ing	33)m , 10.23 area f	654.53 watts 1071,39 rom Tab	614 1037 ole 9	7.86 1006.22 Th1 (°C)	439.3.	788.35	734.34	21	(84)
(83)m= 240. Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Jar (86)m= 1	4 402 - internal ar 31 942.5 ternal tempere during heractor for gar	532.37 nd solar 1055.01 erature (eating points for limits for limi	633.7 (84)m = 1127.27 (heating eriods in ving are Apr 0.97	688.78 = (73)m 1152.22 seasor the living ea, h1,m May 0.92	6 + (8 111) ing n (s	area f ee Tal Jun	654.53 watts 1071.39 rom Tab ble 9a) Jul 0.61	614 1037 ole 9	7.86 1006.22 Th1 (°C)	439.33 907.49	9 788.35 Nov	734.34 Dec	21	(84)
(83)m= 240. Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Jar (86)m= 1	- internal arms 1 942.5  ternal temperare during here actor for game 1 mal temperare	532.37 nd solar 1055.01 erature (eating points for limits for limi	633.7 (84)m = 1127.27 (heating eriods in ving are Apr 0.97	688.78 = (73)m 1152.22 seasor the living ea, h1,m May 0.92	6 + (() 111) ing in (s	area f ee Tal Jun	654.53 watts 1071.39 rom Tab ble 9a) Jul 0.61	614 1037 ole 9	7.86 1006.22  Th1 (°C)  ug Sep 55 0.86  Table 9c)	439.33 907.49	9 788.35 Nov	734.34 Dec	21	(84)
(83)m= 240.4 Total gains - (84)m= 783.3  7. Mean into Temperatu Utilisation f  (86)m= 1  Mean interior (87)m= 19.74	- internal arms 1 942.5  ternal temperare during here actor for game 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	solution of the solution of th	633.7 (84)m = 1127.27 (heating eriods in ving are Apr 0.97 iving are 20.46	688.78 = (73)m 1152.22 seasor the livies, h1,m May 0.92 ea T1 (f	6 + ((( 11) ) ) ing ing old	area f ee Tal Jun 0.79 w step	654.53 watts 1071,39 rom Tabble 9a) Jul 0.61 os 3 to 7 20.98	6144  1037  ble 9  0.66  ' in T 20.	7.86 1006.22  Th1 (°C)  ug Sep 55 0.86  Table 9c)  98 20.86	907.49 907.49 Oct 0.98	Nov 1	734.34 Dec 1	21	(84)
(83)m= 240.4 Total gains - (84)m= 783.3  7. Mean into Temperatu Utilisation f  (86)m= 1  Mean interior (87)m= 19.74	4 402 - internal ar 31 942.5 ternal temper re during her factor for gain Feb 1 nal tempera 4 19.91 re during her	solution of the solution of th	633.7 (84)m = 1127.27 (heating eriods in ving are Apr 0.97 iving are 20.46	688.78 = (73)m 1152.22 seasor the livies, h1,m May 0.92 ea T1 (f	6 + ((( 11) ) ) ing ing old	area f ee Tal Jun 0.79 w step	654.53 watts 1071,39 rom Tabble 9a) Jul 0.61 os 3 to 7 20.98	6144  1037  ble 9  0.66  ' in T 20.	7.86 1006.22  Th1 (°C)  ug Sep 5 0.86  Table 9c) 98 20.86  9, Th2 (°C)	907.49 907.49 Oct 0.98	Nov 1 20.06	734.34 Dec 1	21	(84)
(83)m= 240. Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Mean intern (87)m= 19.7  Temperatu (88)m= 19.9	ernal temperal temper	ond solar 1055.01 erature (eating periods for limited in leading periods for leadin	633.7 (84)m = 1127.27 (heating eriods in Apr 0.97 iving are 20.46 eriods in 19.99	688.78 = (73)m 1152.22 seasor the livities, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99	6 + (((((((((((((((((((((((((((((((((((	area f ee Tal Jun 0.79 w step 0.92 relling	654.53 watts 1071.39 rom Tabble 9a) Jul 0.61 os 3 to 7 20.98 from Ta	614 1037 Al 0.6 7 in T 20.	7.86 1006.22  Th1 (°C)  ug Sep 5 0.86  Table 9c) 98 20.86  9, Th2 (°C)	907.45 907.45 Oct 0.98	Nov 1 20.06	734.34  Dec 1 19.71	21	(84)
(83)m = 240 Total gains - (84)m = 783.3  7. Mean int Temperatu Utilisation f  Mean interi (87)m = 19.7  Temperatu (88)m = 19.9  Utilisation f	4 402 - internal ar 31 942.5  ternal temper re during he factor for ga n Feb 1 nal tempera 4 19.91 re during he 7 19.97	erature (eating points for limited in leading points for limited in leading points for limited in leading points for relating	633.7 (84)m = 1127.27 (heating eriods in ving are 20.46 eriods in 19.99 est of do	688.78 = (73)m 1152.22 seasor the livi ea, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99 welling,	6 + (() 11   11   11   11   11   11   11	area f ee Tal Jun 0.79 w step 0.92 relling 20 m (se	654.53  watts  1071.39  rom Tab ble 9a)  Jul  0.61  0.61  0.5 3 to 7  20.98  from Ta  20  e Table	614  1037  ble 9  A  0.6  ' in T  20.  bble 9  9a)	7.86 1006.22  Th1 (°C)  ug Sep 55 0.86  Table 9c) 98 20.86  9, Th2 (°C) 0 19.99	907.49 907.49 Oct 0.98 20.5	Nov 1 20.06	734.34  Dec 1 19.71 19.98	21	(84) (85) (86) (87) (88)
(83)m= 240 Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Mean interi (87)m= 19.7  Temperatu (88)m= 19.9  Utilisation f (89)m= 1	4 402 - internal ar 31 942.5  ternal temporal are during her actor for gar 1 19.91 re during her are during her	erature (eating points for limited partial point	633.7 (84)m = 1127.27 (heating eriods in ving are 20.46 eriods in 19.99 est of do 0.96	688.78 = (73)m 1152.22 seasor the livies, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99 welling, 0.88	6 + (((((((((((((((((((((((((((((((((((	area f ee Tal Jun 0.79 w step 0.92 relling 20 m (se	654.53  watts  1071.39  rom Tab ble 9a)  Jul  0.61  0.61  0.83 to 7  20.98  from Ta  20  e Table  0.48	614  1037  ble 9  Al  0.6  ' in T  20.  bble 9  20  9a)	7.86 1006.22  Th1 (°C)  ug Sep 55 0.86  Table 9c) 98 20.86  9, Th2 (°C) 0 19.99	Oct 0.98 20.5	Nov 1 20.06	734.34  Dec 1 19.71	21 ]	(84)
(83)m= 240 Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Mean intern (87)m= 19.7  Temperatu (88)m= 19.9  Utilisation f (89)m= 1  Mean intern	a during he duri	sins for rough	633.7 (84)m = 1127.27 (heating eriods in Apr 0.97 iving are 20.46 eriods in 19.99 est of do 0.96 he rest	688.78 = (73)m 1152.22 seasor the livities, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99 welling, 0.88 of dwell	6 + ((((1))) ing (((1))) ing (((1))) (	area f ee Tal Jun 0.79 w step 0.92 relling 20 m (se 0.7	654.53 watts 1071.39 rom Tab ble 9a) Jul 0.61 os 3 to 7 20.98 from Ta 20 e Table 0.48 bllow ste	614  1037  Al  0.6  7 in T  20.  ble 9  0.5  pps 3	7.86 1006.22  Th1 (°C)  ug Sep 5 0.86  Table 9c) 98 20.86  0, Th2 (°C) 0 19.99  3 0.8  to 7 in Table	907.45  Oct 0.98  20.5  19.99  0.97  9 9c)	Nov 1 20.06 19.98	734.34  Dec 1 19.71 19.98	21 ]	(84) (85) (86) (87) (88) (89)
(83)m= 240 Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Mean interi (87)m= 19.7  Temperatu (88)m= 19.9  Utilisation f (89)m= 1	a during he duri	erature (eating points for limited partial point	633.7 (84)m = 1127.27 (heating eriods in ving are 20.46 eriods in 19.99 est of do 0.96	688.78 = (73)m 1152.22 seasor the livies, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99 welling, 0.88	6 + ((((1))) ing (((1))) ing (((1))) (	area f ee Tal Jun 0.79 w step 0.92 relling 20 m (se	654.53  watts  1071.39  rom Tab ble 9a)  Jul  0.61  0.61  0.83 to 7  20.98  from Ta  20  e Table  0.48	614  1037  ble 9  Al  0.6  ' in T  20.  bble 9  20  9a)	7.86 1006.22  Th1 (°C)  ug Sep 55 0.86  Table 9c) 98 20.86  9, Th2 (°C) 0 19.99  13 0.8  to 7 in Table 99 19.88	907.4 907.4 Oct 0.98 20.5 19.99 0.97 e 9c) 19.4	Nov 1 20.06 19.98	734.34  Dec 1 19.71 19.98 1		(84) (85) (86) (87) (88) (89)
(83)m= 240 Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Mean intern (87)m= 19.7  Temperatu (88)m= 19.9  Utilisation f (89)m= 1  Mean intern	a during he duri	sins for rough	633.7 (84)m = 1127.27 (heating eriods in Apr 0.97 iving are 20.46 eriods in 19.99 est of do 0.96 he rest	688.78 = (73)m 1152.22 seasor the livities, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99 welling, 0.88 of dwell	6 + ((((1))) ing (((1))) ing (((1))) (	area f ee Tal Jun 0.79 w step 0.92 relling 20 m (se 0.7	654.53 watts 1071.39 rom Tab ble 9a) Jul 0.61 os 3 to 7 20.98 from Ta 20 e Table 0.48 bllow ste	614  1037  Al  0.6  7 in T  20.  ble 9  0.5  pps 3	7.86 1006.22  Th1 (°C)  ug Sep 55 0.86  Table 9c) 98 20.86  9, Th2 (°C) 0 19.99  13 0.8  to 7 in Table 99 19.88	907.4 907.4 Oct 0.98 20.5 19.99 0.97 e 9c) 19.4	Nov 1 20.06 19.98	734.34  Dec 1 19.71 19.98 1	21	(84) (85) (86) (87) (88) (89)
(83)m= 240 Total gains - (84)m= 783.3  7. Mean int Temperatu Utilisation f  Mean intern (87)m= 19.7  Temperatu (88)m= 19.9  Utilisation f (89)m= 1  Mean intern (90)m= 18.23	at temperal	ond solar 1055.01 erature (eating periods of line) Mar 0.99 eture in l 20.15 eating periods of line) 19.97 eating periods of line for recognition of line solar recognition of line solar recognitions for recogni	633.7 (84)m = 1127.27 (heating eriods in Apr 0.97 iving are 20.46 eriods in 19.99 est of do 0.96 he rest 19.34	688.78 = (73)m 1152.22 seasor the livities, h1,m May 0.92 ea T1 (ff 20.73 rest of 19.99 welling, 0.88 of dwell 19.71 ole dwe	6 + (() 11   11   11   11   11   11   11	area f eee Tal Jun 0.79 w ster 0.92 relling 20 m (se 0.7 T2 (fc 9.94	654.53 watts 1071.39 rom Tab ble 9a) Jul 0.61 0s 3 to 7 20.98 from Ta 20 e Table 0.48 bllow ste 19.99	614  1037  All 1037  All 0.6  7 in T 20.  ble 9  0.5  20  19.  + (1	7.86 1006.22  Th1 (°C)  ug Sep 5 0.86  Table 9c) 98 20.86  9, Th2 (°C) 0 19.99  13 0.8  to 7 in Table 99 19.88  ft  - fLA) × T2	907.4:  Oct 0.98  20.5  19.99  0.97  e 9c) 19.4  A = Liv	Nov 1 20.06 19.98 1 18.76 ving area ÷ (4	734.34  Dec 1 19.71 19.98 1 18.25		(84) (85) (86) (87) (88) (89) (90) (91)
(83)m = 240.  Total gains - (84)m = 783.3  7. Mean int Temperatu Utilisation f  (86)m = 1  Mean interi (87)m = 19.7  Temperatu (88)m = 19.9  Utilisation f (89)m = 1  Mean interi (90)m = 18.2  Mean interi (92)m = 18.7	4 402 - internal ar 31 942.5  ternal temporal are during her actor for gath and temperate during her actor for gath and temperate during her actor for gath actor for gath and temperate during her actor for gath actor for gath and temperate during her actor for gath actor for	erature (eating periods of the second	633.7 (84)m = 1127.27 (heating eriods in ving are 20.46 eriods in 19.99 est of do 0.96 he rest 19.34  r the wh	688.78 = (73)m 1152.22 seasor the livities, h1,m May 0.92 ea T1 (fr 20.73 n rest of 19.99 welling, 0.88 of dwell 19.71 ole dwe 20.04	6 + (() 11   (s)	area f ee Tal Jun 0.79 w step 20.92 relling 20 m (se 0.7 T2 (fc 9.94	654.53 watts 1071.39 rom Tabble 9a) Jul 0.61 0s 3 to 7 20.98 from Ta 20 e Table 0.48 bllow ste 19.99  A × T1 20.31	614  1037  All 0.6  All 0.6  20  9a)  0.5  19.  + (1	7.86 1006.22  Th1 (°C)  ug Sep 5 0.86  Table 9c) 98 20.86  9, Th2 (°C) 0 19.99  13 0.8  to 7 in Table 99 19.88  ft  - fLA) × T2	907.4:  Oct 0.98  20.5  19.99  0.97  19.4  A = Liv	Nov 1 20.06 19.98 1 18.76 ving area ÷ (4	734.34  Dec 1 19.71 19.98 1		(84) (85) (86) (87) (88) (89)







					7
Water heating fuel used				2670.35	_
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)	)(230g) =		75	(231)
Electricity for lighting				510.29	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP				
	<b>Energy</b> kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216	=	1337.65	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	576.8	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1914.45	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	264.84	(268)
Total CO2, kg/year  TER =	sum	of (265)(271) =		2218.21 15.81	(272)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 8 - 4B8P - GF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 220 (1a) x 2.7 (2a) =(3a) 594 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)220 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =594 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.07 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.32 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.27 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
0.34	
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)	(23a)
If heleneed with heat recovery efficiency is 0/ ellewing for in use factor (from Table 4b)	(23b)
	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$	(24a)
	(244)
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	(24b)
	(240)
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)	
(24c)m =	(24c)
d) If natural ventilation or whole house positive input ventilation from loft	, ,
if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$	
(24d)m= 0.56  0.56  0.55  0.54  0.54  0.53  0.53  0.53  0.54  0.54  0.55  0.55	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
(25)m= 0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.55 0.55	(25)
3. Heat losses and heat loss parameter:	_
ELEMENT Gross area (m²) Openings Net Area W/m2K A X U k-value (W/K) kJ/m²-K	A X k kJ/K
Windows Type 1 $6.74$ $\times 1/[1/(1.4) + 0.04] = 8.94$	(27)
Windows Type 2 $0.88 \times 1/[1/(1.4) + 0.04] = 1.17$	(27)
Windows Type 3 $0.88$ $x1/[1/(1.4) + 0.04] = 1.17$	(27)
Windows Type 4	(27)
Windows Type 5 $0.88 \times 1/[1/(1.4) + 0.04] = 1.17$	(27)
Windows Type 6 $4.1 \times 1/[1/(1.4) + 0.04] = 5.44$	(27)
Windows Type 7	(27)
Windows Type 8 2.68 x1/[1/(1.4)+0.04] = 3.55	(27)
Floor 220 x 0.13 = 28.6	(28)
	(29)
	(29)
Total area of elements, m <sup>2</sup> 393.47	(31)
Party wall 35.24 x 0 = 0	(32)
Party ceiling 220	(32b)
* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2  ** include the areas on both sides of internal walls and partitions	
Fabric heat loss, W/K = S (A x U) $(26)(30) + (32) =$ 116.	59 (33)
11 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	()
Heat capacity $Cm = S(A \times k)$ ((28)(30) + (32) + (32a)(32e) = 41061	.02 (34)
Heat capacity $Cm = S(A \times K)$ $((28)(30) + (32) + (32a)(32e) = 41061$ Thermal mass parameter (TMP = $Cm \div TFA$ ) in kJ/m²K Indicative Value: Medium 250	



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)19.67 if details of thermal bridging are not known (36) =  $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)136.26 Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)$ m x (5)Oct Feb Mar Jul Sep Dec .lan Apr May Jun Aug Nov (38)m =109.6 109.15 108.71 106.64 106.25 104.45 104.45 104.11 105.14 106.25 107.04 107.86 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =245.86 245.41 244.97 242.9 242.51 240.71 240.71 240.37 241.4 242.51 243.3 244.12 Average =  $Sum(39)_{1...12}/12=$ (39)242.9 Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m  $\div$  (4)1.09 1.12 1.12 1.11 1.1 1.09 1.09 1.11 (40)m =1.1 1.1 1.11 (40)Average =  $Sum(40)_{1...12}/12=$ 1.1 Number of days in month (Table 1a) Jan Feb Mar Jun Apr May Jul Aug Sep Oct Nov Dec (41)31 28 31 30 31 30 31 31 30 31 30 31 (41)m =4. Water heating energy requirement: Assumed occupancy, N (42)3.03 if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)106.11 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) 116.72 112.48 108.24 103.99 95.5 99.75 103.99 108.24 112.48 116.72 (44)m =99.75 95.5 (44)Total =  $Sum(44)_{1...12}$  = 1273.36 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 =173.1 151.39 156.22 136.2 130.69 112.77 104.5 119.92 121.35 141.42 154.37 167.64 (45)Total =  $Sum(45)_{1...12}$  = 1669.58 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.96 22.71 23.43 20.43 16.92 21.21 23.16 25.15 (46)19.6 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 2.13 (48)Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year  $(48) \times (49) =$ 1.15 (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 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)



Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53) =	0	(54)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$	1.15	(55)
(56)m= 35.73 32.27 35.73 34.57 35.73 34.57 35.73	35.73 34.57 35.73	34.57 35.73	(56)
If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div$			` '
(57)m= 35.73 32.27 35.73 34.57 35.73 34.57 35.73	35.73 34.57 35.73	34.57 35.73	(57)
Primary circuit loss (annual) from Table 3		0	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷	865 × (41)m		
(modified by factor from Table H5 if there is solar water hea	ting and a cylinder thermo	ostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26	23.26 22.51 23.26	22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) $\div$ 365 × (4	1)m		_
(61)m= 0 0 0 0 0 0	0 0 0	0 0	(61)
Total heat required for water heating calculated for each mon	$h (62)m = 0.85 \times (45)m +$	(46)m + (57)m +	(59)m + (61)m
(62)m= 232.09 204.67 215.21 193.29 189.68 169.86 163.49	178.91 178.44 200.41	211.46 226.63	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quan	ity) (enter '0' if no solar contribu	tion to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see A	ppendix G)		_
(63)m= 0 0 0 0 0 0	0 0 0	0 0	(63)
Output from water heater			
(64)m= 232.09 204.67 215.21 193.29 189.68 169.86 163.49	178.91 178.44 200.41	211.46 226.63	
	Output from water heate	r (annual) <sub>112</sub>	2364.13 (64)
Heat gains from water heating, kWh/month 0.25 / [0.85 × (45)	m + (61)m] + 0.8 x [(46)m	+ (57)m + (59)m	1]
(65)m= 104.75 92.96 99.14 90.96 90.64 83.17 81.94	87.06 86.02 94.21	97 102.93	(65)
(65)m= 104.75 92.96 99.14 90.96 90.64 83.17 81.94 include (57)m in calculation of (65)m only if cylinder is in the			(65)
			(65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):			(65)
include (57)m in calculation of (65)m only if cylinder is in the			(65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	dwelling or hot water is f	rom community h	(65)
include (57)m in calculation of (65)m only if cylinder is in the  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul	Aug Sep Oct 151.4 151.4 151.4	nom community h	neating (65)
include (57)m in calculation of (65)m only if cylinder is in the  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul  (66)m= 151.4 151.4 151.4 151.4 151.4 151.4 151.4	Aug Sep Oct 151.4 151.4 151.4	nom community h	neating (65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug         Sep         Oct           151.4         151.4         151.4           also see Table 5         16.87         22.64         28.75	Nov Dec	neating (65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug         Sep         Oct           151.4         151.4         151.4           also see Table 5         16.87         22.64         28.75           13a), also see Table 5	Nov Dec	neating (65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug         Sep         Oct           151.4         151.4         151.4           also see Table 5         16.87         22.64         28.75           13a), also see Table 5         287.48         297.67         319.36	Nov Dec 151.4 151.4 33.55 35.77	(65) neating (66) (67)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug         Sep         Oct           151.4         151.4         151.4           also see Table 5         16.87         22.64         28.75           13a), also see Table 5         287.48         297.67         319.36	Nov Dec 151.4 151.4 33.55 35.77	(65) neating (66) (67)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug Sep Oct 151.4 151.4 151.4 also see Table 5 16.87 22.64 28.75 13a), also see Table 5 287.48 297.67 319.36 a), also see Table 5	Nov Dec 151.4 151.4 33.55 35.77 346.75 372.48	(65) neating (66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug Sep Oct 151.4 151.4 151.4 also see Table 5 16.87 22.64 28.75 13a), also see Table 5 287.48 297.67 319.36 a), also see Table 5	Nov Dec 151.4 151.4 33.55 35.77 346.75 372.48	(65) neating (66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the first state of the first	Aug Sep Oct 151.4 151.4 151.4 also see Table 5 16.87 22.64 28.75 13a), also see Table 5 287.48 297.67 319.36 a), also see Table 5 38.14 38.14 38.14	Nov Dec 151.4 151.4 33.55 35.77 346.75 372.48 38.14 38.14	(65) neating (66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug         Sep         Oct           151.4         151.4         151.4           also see Table 5         16.87         22.64         28.75           13a), also see Table 5         287.48         297.67         319.36           a), also see Table 5         38.14         38.14         38.14           3         3         3	Nov Dec 151.4 151.4 33.55 35.77 346.75 372.48 38.14 38.14	(65) neating (66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug         Sep         Oct           151.4         151.4         151.4           also see Table 5         16.87         22.64         28.75           13a), also see Table 5         287.48         297.67         319.36           a), also see Table 5         38.14         38.14         38.14           3         3         3	Nov Dec 151.4 151.4 33.55 35.77 346.75 372.48 38.14 38.14 3	(65) neating (66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug Sep Oct 151.4 151.4 151.4 also see Table 5 16.87 22.64 28.75 13a), also see Table 5 287.48 297.67 319.36 a), also see Table 5 38.14 38.14 38.14  3 3 3 3 3121.12 -121.12	Nov Dec 151.4 151.4 33.55 35.77 346.75 372.48 38.14 38.14 3	(65) neating (66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug Sep Oct 151.4 151.4 151.4 also see Table 5 16.87 22.64 28.75 13a), also see Table 5 287.48 297.67 319.36 a), also see Table 5 38.14 38.14 38.14  3 3 3 3 3121.12 -121.12	Nov Dec 151.4 151.4 151.4 33.55 35.77 346.75 372.48 38.14 38.14 3 3 3 -121.12 -121.12 134.72 138.35	(65) neating (66) (67) (68) (69) (70) (71)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 151.4	Aug Sep Oct 151.4 151.4 151.4 also see Table 5 16.87 22.64 28.75 13a), also see Table 5 287.48 297.67 319.36 a), also see Table 5 38.14 38.14 38.14 3 3 3 3 3 4 -121.12 -121.12 -121.12 117.02 119.47 126.63 m + (68)m + (69)m + (70)m	Nov Dec 151.4 151.4 151.4 33.55 35.77 346.75 372.48 38.14 38.14 3 3 3 -121.12 -121.12 134.72 138.35	(65) neating (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 Factor Table 6d	•	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.93	0.77	X	6.74	x	10.63	x	0.63	x	0.7	] =	21.9	(74)
North 0.93	0.77	X	11.41	х	10.63	x	0.63	x	0.7	] =	74.16	(74)
North 0.93	0.77	X	2.68	х	10.63	x	0.63	x	0.7	] =	8.71	(74)
North 0.93	0.77	X	6.74	x	20.32	х	0.63	x	0.7	=	41.86	(74)
North 0.93	0.77	X	11.41	x	20.32	х	0.63	x	0.7	] =	141.72	(74)
North 0.93	0.77	X	2.68	x	20.32	x	0.63	x	0.7	] =	16.64	(74)
North 0.93	0.77	X	6.74	x	34.53	x	0.63	X	0.7	=	71.13	(74)
North 0.93	0.77	X	11.41	x	34.53	x	0.63	x	0.7	=	240.82	(74)
North 0.93	0.77	X	2.68	x	34.53	x	0.63	x	0.7	=	28.28	(74)
North 0.93	0.77	X	6.74	x	55.46	x	0.63	x	0.7	=	114.25	(74)
North 0.9	0.77	X	11.41	x	55.46	x	0.63	x	0.7	=	386.81	(74)
North 0.93	0.77	X	2.68	x	55.46	x	0.63	x	0.7	=	45.43	(74)
North 0.9	0.77	X	6.74	x	74.72	x	0.63	x	0.7	=	153.9	(74)
North 0.9	0.77	X	11.41	x	74.72	x	0.63	x	0.7	=	521.07	(74)
North 0.9	0.77	X	2.68	x	74.72	x	0.63	x	0.7	=	61.2	(74)
North 0.93	0.77	X	6.74	X	79.99	X	0.63	X	0.7	=	164.76	(74)
North 0.9	0.77	X	11.41	х	79.99	х	0.63	x	0.7		557.82	(74)
North 0.9	0.77	X	2.68	х	79.99	×	0.63	x	0.7	=	65.51	(74)
North 0.9	0.77	X	6.74	x	74.68	x	0.63	x	0.7	] =	153.82	(74)
North 0.9	0.77	X	11.41	x	74.68	х	0.63	x	0.7	=	520.8	(74)
North 0.9	0.77	X	2.68	x	74.68	X	0.63	x	0.7	=	61.16	(74)
North 0.9	0.77	X	6.74	х	59.25	X	0.63	x	0.7	] =	122.04	(74)
North 0.9	0.77	X	11.41	x	59.25	X	0.63	x	0.7	=	413.19	(74)
North 0.93	0.77	X	2.68	x	59.25	x	0.63	x	0.7	] =	48.53	(74)
North 0.93	0.77	X	6.74	x	41.52	X	0.63	X	0.7	=	85.52	(74)
North 0.93	0.77	X	11.41	x	41.52	x	0.63	x	0.7	=	289.54	(74)
North 0.93	0.77	X	2.68	x	41.52	X	0.63	X	0.7	=	34	(74)
North 0.93	0.77	X	6.74	X	24.19	x	0.63	x	0.7	=	49.83	(74)
North 0.93	0.77	X	11.41	x	24.19	x	0.63	x	0.7	] =	168.7	(74)
North 0.93	0.77	X	2.68	X	24.19	x	0.63	X	0.7	=	19.81	(74)
North 0.9	0.77	X	6.74	X	13.12	X	0.63	X	0.7	=	27.02	(74)
North 0.93	0.77	X	11.41	X	13.12	X	0.63	X	0.7	=	91.48	(74)
North 0.9	0.77	X	2.68	X	13.12	X	0.63	X	0.7	=	10.74	(74)
North 0.9	0.77	X	6.74	X	8.86	X	0.63	X	0.7	=	18.26	(74)
North 0.93	0.77	X	11.41	x	8.86	x	0.63	x	0.7	=	61.82	(74)
North 0.93		X	2.68	x	8.86	x	0.63	X	0.7	] =	7.26	(74)
Northeast 0.93		X	0.88	x	11.28	x	0.63	X	0.7	_	6.07	(75)
Northeast 0.9		X	0.88	x	22.97	x	0.63	x	0.7	] =	12.35	(75)
Northeast 0.93	0.77	X	0.88	X	41.38	X	0.63	X	0.7	=	22.26	(75)



Northeast 0.9x         0.77         x         0.88         x         67.96         x         0.63         x         0.7         =         36.55           Northeast 0.9x         0.77         x         0.88         x         91.35         x         0.63         x         0.7         =         49.13           Northeast 0.9x         0.77         x         0.88         x         97.38         x         0.63         x         0.7         =         52.38           Northeast 0.9x         0.77         x         0.88         x         91.1         x         0.63         x         0.7         =         49           Northeast 0.9x         0.77         x         0.88         x         72.63         x         0.63         x         0.7         =         39.06           Northeast 0.9x         0.77         x         0.88         x         50.42         x         0.63         x         0.7         =         27.12           Northeast 0.9x         0.77         x         0.88         x         28.07         x         0.63         x         0.7         =         15.1	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x       0.77       x       0.88       x       97.38       x       0.63       x       0.7       =       52.38         Northeast 0.9x       0.77       x       0.88       x       91.1       x       0.63       x       0.7       =       49         Northeast 0.9x       0.77       x       0.88       x       72.63       x       0.63       x       0.7       =       39.06         Northeast 0.9x       0.77       x       0.88       x       50.42       x       0.63       x       0.7       =       27.12	(75) (75) (75) (75) (75) (75)
Northeast 0.9x	(75) (75) (75) (75)
Northeast 0.9x	(75) (75) (75)
Northeast 0.9x	(75) (75)
	(75)
Northeast 0.9x 0.77 x 0.88 x 28.07 x 0.63 x 0.7 = 15.1	╡
	(75)
Northeast 0.9x 0.77 x 0.88 x 14.2 x 0.63 x 0.7 = 7.64	
Northeast 0.9x 0.77 x 0.88 x 9.21 x 0.63 x 0.7 = 4.96	(75)
South 0.9x 0.54 x 0.88 x 46.75 x 0.63 x 0.7 = 35.27	(78)
South 0.9x 0.54 x 4.1 x 46.75 x 0.63 x 0.7 = 41.08	(78)
South 0.9x 0.54 x 1.54 x 46.75 x 0.63 x 0.7 = 61.72	(78)
South 0.9x 0.54 x 0.88 x 76.57 x 0.63 x 0.7 = 57.76	(78)
South 0.9x 0.54 x 4.1 x 76.57 x 0.63 x 0.7 = 67.28	(78)
South 0.9x 0.54 x 1.54 x 76.57 x 0.63 x 0.7 = 101.09	(78)
South 0.9x 0.54 x 0.88 x 97.53 x 0.63 x 0.7 = 73.58	(78)
South 0.9x 0.54 x 4.1 x 97.53 x 0.63 x 0.7 = 85.71	(78)
South 0.9x 0.54 x 1.54 x 97.53 x 0.63 x 0.7 = 128.77	(78)
South 0.9x 0.54 x 0.88 x 110.23 x 0.63 x 0.7 = 83.16	(78)
South 0.9x 0.54 x 4.1 x 110.23 x 0.63 x 0.7 = 96.87	(78)
South 0.9x 0.54 x 1.54 x 110.23 x 0.63 x 0.7 = 145.54	(78)
South 0.9x 0.54 x 0.88 x 114.87 x 0.63 x 0.7 = 86.66	(78)
South 0.9x 0.54 x 4.1 x 114.87 x 0.63 x 0.7 = 100.94	(78)
South 0.9x 0.54 x 1.54 x 114.87 x 0.63 x 0.7 = 151.66	(78)
South 0.9x 0.54 x 0.88 x 110.55 x 0.63 x 0.7 = 83.4	(78)
South 0.9x 0.54 x 4.1 x 110.55 x 0.63 x 0.7 = 97.14	(78)
South 0.9x 0.54 x 1.54 x 110.55 x 0.63 x 0.7 = 145.95	(78)
South 0.9x 0.54 x 0.88 x 108.01 x 0.63 x 0.7 = 81.49	(78)
South 0.9x 0.54 x 4.1 x 108.01 x 0.63 x 0.7 = 94.91	(78)
South 0.9x 0.54 x 1.54 x 108.01 x 0.63 x 0.7 = 142.6	(78)
South 0.9x 0.54 x 0.88 x 104.89 x 0.63 x 0.7 = 79.14	(78)
South 0.9x 0.54 x 4.1 x 104.89 x 0.63 x 0.7 = 92.17	(78)
South 0.9x 0.54 x 1.54 x 104.89 x 0.63 x 0.7 = 138.49	(78)
South 0.9x 0.54 x 0.88 x 101.89 x 0.63 x 0.7 = 76.87	(78)
South 0.9x 0.54 x 4.1 x 101.89 x 0.63 x 0.7 = 89.53	(78)
South 0.9x 0.54 x 1.54 x 101.89 x 0.63 x 0.7 = 134.51	(78)
South 0.9x 0.54 x 0.88 x 82.59 x 0.63 x 0.7 = 62.3	(78)
South 0.9x 0.54 x 4.1 x 82.59 x 0.63 x 0.7 = 72.57	(78)
South 0.9x 0.54 x 1.54 x 82.59 x 0.63 x 0.7 = 109.03	(78)
South 0.9x 0.54 x 0.88 x 55.42 x 0.63 x 0.7 = 41.81	(78)
South 0.9x 0.54 x 4.1 x 55.42 x 0.63 x 0.7 = 48.7	(78)



South 0.9x	0.54	X	1.5	4	х	55.42	X	0.63	X	0.7	=	73.16	(78)
South 0.9x	0.54	X	0.8	8	х	40.4	x	0.63	X	0.7	=	30.48	(78)
South 0.9x	0.54	X	4.1	1	x	40.4	x	0.63	x	0.7	=	35.5	(78)
South 0.9x	0.54	X	1.5	4	x	40.4	x	0.63	x	0.7	=	53.34	(78)
Northwest 0.9x	0.77	X	0.8	8	x	11.28	x	0.63	x	0.7	=	6.07	(81)
Northwest 0.9x	0.77	X	0.8	8	x	22.97	x	0.63	x	0.7	_	12.35	(81)
Northwest 0.9x	0.77	X	0.8	8	x	41.38	x	0.63	x	0.7		22.26	(81)
Northwest 0.9x	0.77	X	0.8	8	х 🔚	67.96	x	0.63	x	0.7	_ =	36.55	(81)
Northwest 0.9x	0.77	X	0.8	8	x	91.35	x	0.63	x	0.7	_	49.13	(81)
Northwest 0.9x	0.77	X	0.8	8	x	97.38	x	0.63	x	0.7	=	52.38	(81)
Northwest 0.9x	0.77	X	0.8	8	х 🔚	91.1	x	0.63	x	0.7	=	49	(81)
Northwest 0.9x	0.77	X	0.8	8	х	72.63	x	0.63	x	0.7	=	39.06	(81)
Northwest 0.9x	0.77	X	0.8	8	х 📃	50.42	х	0.63	x	0.7	=	27.12	(81)
Northwest 0.9x	0.77	x	0.8	8	х 🔚	28.07	x	0.63	x	0.7	=	15.1	(81)
Northwest 0.9x	0.77	x	0.8	8	х 🔚	14.2	x	0.63	x	0.7	=	7.64	(81)
Northwest 0.9x	0.77	X	0.8	8	х 🔚	9.21	х	0.63	x	0.7	=	4.96	(81)
•							•						
Solar gains in	watts, cal	lculated	for each	n month			(83)m	Sum(74)m .	(82)m				
(83)m= 254.99		672.8	945.16	1173.7	1219.3	5 1152.79	971.	.68 764.21	512.44	308.19	216.57		(83)
Total gains -	internal ar	nd solar	(84)m =	: (73)m -	⊦ (83)n	n , watts							
(84)m= 891.67	1085.45	1286.13	1523.78	1715.63	1727	1638.85	1464	1.47 1275.41	1058.6	894.63	834.59		(84)
7. Mean inte	rnal tempe	erature	(heating	season	)								
Temperature						a from Tal	ble 9.	Th1 (°C)				21	(85)
Utilisation fa							,						``
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	1	0.98	0.93	0.79	0.62	0.7	<del>-</del>	0.99	1	1		(86)
Mean interna	al temnera	ıtııre in l	iving are	22 T1 (fc	llow st	ens 3 to <sup>-</sup>	7 in T	able 9c)	<u> </u>		ļ.		
(87)m= 19.62	19.77	20.02	20.38	20.72	20.92	-i	20.9		20.37	19.93	19.6		(87)
` ′						_		<u> </u>	<u> </u>		<u> </u>		
Temperature (88)m= 19.99	19.99	19.99	erioas in	20	20.01	20.01	20.0	· · · ·	20	20	19.99		(88)
` '						_		01 20	20	20	19.99		(00)
Utilisation fa	T T		ı		,	1	T –		ı		ı	1	()
(89)m= 1	1	1	0.98	0.9	0.7	0.49	0.5	0.88	0.99	1	1		(89)
Mean interna					~ T2	<i>,,</i> ,	0	to 7 in Tabl	00)				
	al tempera	ture in t	the rest	of dwelli	ng 12	(follow ste	eps 3	to I III Tabl	e 90)				(00)
(90)m= 18.12	al tempera 18.34	18.72	the rest of 19.24	19.7	19.95	20	19.9		19.22	18.58	18.09		(90)
	<del>,                                    </del>	ı	ı			`	r e	99 19.81	19.22	18.58 ring area ÷ (4		0.15	(90)
(90)m= 18.12	18.34	18.72	19.24	19.7	19.95	20	19.9	99 19.81 f	19.22			0.15	<b></b> ` ´
	18.34	18.72	19.24	19.7	19.95	20	19.9	99 19.81 - fLA) × T2	19.22	ring area ÷ (4		0.15	<b></b> ` ´
(90)m= 18.12  Mean interna (92)m= 18.34	18.34 al tempera 18.55	18.72 Iture (fo 18.91	19.24 r the who	19.7 ole dwe	19.95 ling) =	20 fLA × T1 20.14	+ (1	99 19.81 f - fLA) × T2 14 19.96	19.22 LA = Liv	ring area ÷ (4	1 4) =	0.15	(91)
(90)m= 18.12  Mean interna	18.34 al tempera 18.55	18.72 Iture (fo 18.91	19.24 r the who	19.7 ole dwe	19.95 ling) =	20 fLA × T1 20.14	+ (1	99 19.81 f - fLA) × T2 14 19.96 where appro	19.22 LA = Liv	ring area ÷ (-	1 4) =	0.15	(91)
(90)m= 18.12  Mean internation (92)m= 18.34  Apply adjusti	18.34 al tempera 18.55 ment to th	18.72 hture (fo 18.91 e mean 18.91	r the who	19.7 ole dwe 19.85 tempera	19.95 ling) = 20.09 ature f	20 fLA × T1 20.14 rom Table	+ (1 20.2)	99 19.81 f - fLA) × T2 14 19.96 where appro	19.22 LA = Liv 19.39 opriate	ring area ÷ (-	18.31	0.15	(91)
Mean interna (92)m= 18.34 Apply adjust (93)m= 18.34	18.34  al tempera 18.55 ment to th 18.55 ating requi	18.72 ature (fo 18.91 e mean 18.91 irement	19.24 r the who 19.41 internal 19.41	19.7 ole dwe 19.85 temper 19.85	19.95  ling) =  20.09  ature fi	fLA × T1 20.14 rom Table 20.14	+ (1 20.2) 20.2	99 19.81 f - fLA) × T2 14 19.96 where appro	19.22 iLA = Liv 19.39 opriate 19.39	18.78	18.31		(91)

Jun Sep

Jul

Aug

Oct

Nov

Dec

May

Apr

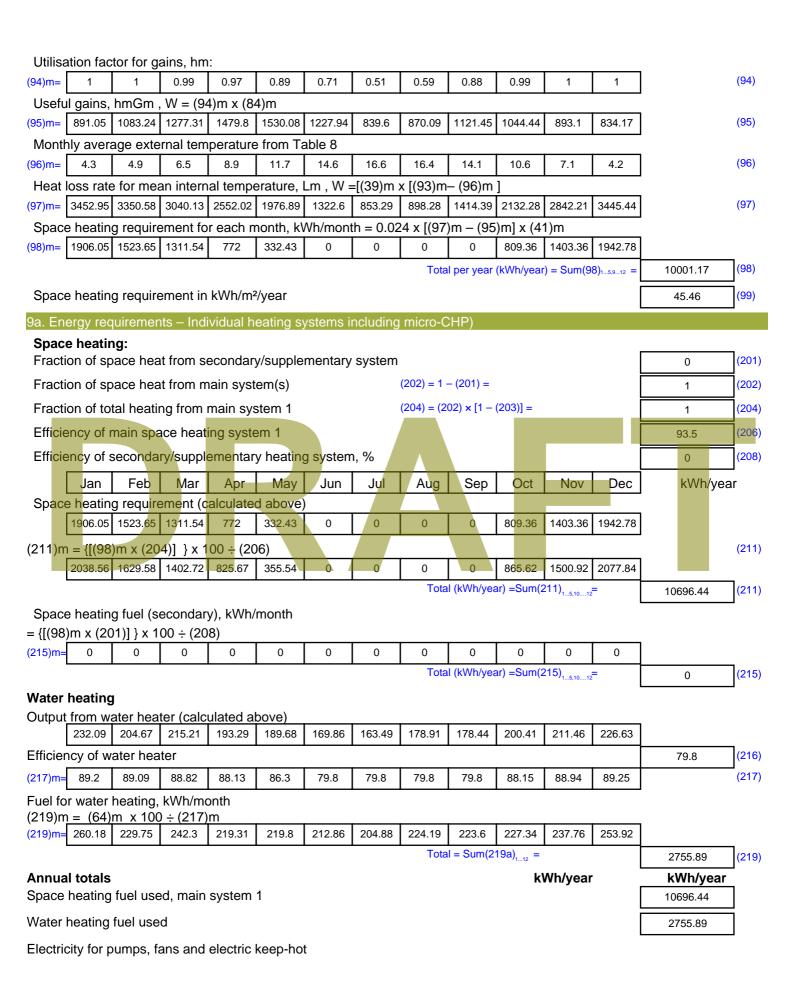
Mar

the utilisation factor for gains using Table 9a

Feb

Jan







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			614.62	(232)

#### 12a. CO2 emissions – Individual heating systems including micro-CHP

	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	2310.43 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	595.27 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2905.7 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	318.99 (268)
Total CO2, kg/year	sum	of (265)(271) =	3263.62 (272)





User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 10 - 1B2P - MF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.7 (2a) =(3a) 53 143.1 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)53 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =143.1 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.14 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)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 (22)m =5.1 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18



Adjusted infiltration rate (al	lowina for shelt	er and wind s	speed) =	: (21a) x	(22a)m					
0.42 0.41 0.		0.36 0.31	0.31	0.31	0.33	0.36	0.37	0.39	]	
Calculate effective air char	•	applicable ca	ise	•		!	•			
If mechanical ventilation		(00.) = (		\\\	. (00)	\ (00 \			0	(23a)
If exhaust air heat pump using						) = (23a)			0	(23b)
If balanced with heat recovery:	-	_							0	(23c)
a) If balanced mechanic	1	<u> </u>	<del>,                                    </del>	<del></del>	<del>í `</del>	<del> </del>	<del>,                                    </del>	<del>' '</del>	) ÷ 100] 1	(0.4-)
( 1)	0 0	0 0	0	0	0	0	0	0		(24a)
b) If balanced mechanics			<del> </del>	<del>- ^ ` ` - </del>	<del>í `</del>	<del>r Ó T</del>	<del></del>	Ι ,	1	(24b)
(24b)m= 0 0 (		0 0	0	0	0	0	0	0	]	(24b)
c) If whole house extract if (22b)m < 0.5 x (23	•	•				5 × (23b	o)		_	
(24c)m = 0 0 0	0	0 0	0	0	0	0	0	0		(24c)
d) If natural ventilation o if (22b)m = 1, then (2		•				0.5]				
(24d)m= 0.59 0.59 0.	58 0.57 0	0.56	0.55	0.55	0.55	0.56	0.57	0.58	]	(24d)
Effective air change rate	- enter (24a) oi	r (24b) or (24	c) or (24	d) in bo	x (25)		•	•		
(25)m= 0.59 0.59 0.	58 0.57 0	0.56 0.55	0.55	0.55	0.55	0.56	0.57	0.58		(25)
3. Heat losses and heat lo	oss parameter:								_	
<b>ELEMENT</b> Gross area (m²)	Openings	Net Aı A ,ı		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-		A X k kJ/K
Windows Type 1		1.39	<sub>x</sub> 1	/[1/( 1.4 )+	0.04] =	1.84				(27)
Windows Type 2		1.39	x1	/[1/( 1.4 )+	- 0.04] =	1.84	Ħ			(27)
Windows Type 3		5.52	x1	/[1/( 1.4 )+	0.04] =	7.32				(27)
Windows Type 4		2.79	x1	/[1/( 1.4 )+	0.04] =	3.7				(27)
Windows Type 5		2.16	<sub>x</sub> 1	/[1/( 1.4 )+	0.04] =	2.86				(27)
Walls Type1 47.55	13.25	34.3	X	0.18	= [	6.17				(29)
Walls Type2 3.78	0	3.78	X	0.18	= [	0.68				(29)
Total area of elements, m <sup>2</sup>		51.33	3							(31)
Party wall		39.50	6 X	0	=	0				(32)
Party floor		53.93	3							(32a)
Party ceiling		53.93	3				Ī			(32b)
* for windows and roof windows, ** include the areas on both sides			lated using	g formula 1	1/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	n 3.2	
Fabric heat loss, W/K = S	A x U)			(26)(30	) + (32) =				24.42	(33)
Heat capacity $Cm = S(A x)$	k )				((28)	(30) + (32	2) + (32a).	(32e) =	8220.47	(34)
Thermal mass parameter (	TMP = Cm ÷ TF	FA) in kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assessments where the can be used instead of a detailed		nstruction are no	t known pi	recisely the	e indicative	values of	TMP in T	able 1f		<del>_</del>
Thermal bridges : S (L x Y)	calculated usir	ng Appendix	K						2.57	(36)
if details of thermal bridging are r. Total fabric heat loss	ot known (36) = 0.0	05 x (31)			(33) +	(36) =			26.99	(37)
						•				`` ′



Ventilation h	eat loss c	alculated	l monthly	<b>V</b>				(38)m	= 0.33 × (	25)m x (5)	ı		
Jan	1	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 27.82	27.66	27.5	26.75	26.61	25.95	25.95	25.83	26.2	26.61	26.89	27.19		(38)
Heat transfer	r coefficie	nt, W/K			•		•	(39)m	= (37) + (37)	38)m			
(39)m= 54.81	54.65	54.49	53.73	53.59	52.94	52.94	52.82	53.19	53.59	53.88	54.18		
Heat loss pa	rameter (l		m²K		•	•	•		Average = = (39)m ÷	Sum(39) <sub>1</sub>	12 /12=	53.73	(39)
(40)m= 1.03	1.03	1.03	1.01	1.01	1	1	1	1	1.01	1.02	1.02		
Number of da	avs in mo	nth (Tab	le 1a)		ļ	Į.		,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.01	(40)
Jan	<del>-i</del>	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 he	ating ene	rgy requi	rement:								kWh/ye	ear:	
Assumed oc	cupancy,	N								1.	78		(42)
if TFA > 13		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (1	ΓFA -13.	.9)			
if TFA £ 13 Annual avera	•	ater usad	ae in litre	s per da	av Vd.av	erage =	(25 x N)	+ 36		76	5.44		(43)
Reduce the ann	ual average	hot water	usage by	5% if the d	lwelling is	designed			se target o				(10)
not more that 12	25 litres per		day (all w	ater use, I	not and co	la)		· · · · ·					
Jan Hot water usage		Mar	Apr	May	Jun	Jul Table 10 Y	Aug	Sep	Oct	Nov	Dec		
							,	74.04	77.07	04.00	04.00		
(44)m= 84.08	81.03	77.97	74.91	71.85	68.8	68.8	71.85	74.91	77.97	81.03	84.08	917.29	(44)
Energy content	of hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	917.29	(++)
(45)m= 124.7	109.06	112.54	98.11	94.14	81.24	75.28	86.38	87.42	101.88	111.2	120.76		
If instantaneous	water heat	ng of point	of upo (no	hot woto	r otorogo)	ontor O in	hoves (46		Γotal = Su	m(45) <sub>112</sub> =	-	1202.71	(45)
If instantaneous									45.00	10.00			(40)
(46)m= 18.7 Water storage	16.36 le loss:	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.11		(46)
Storage volu		) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community	heating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if		hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storag  a) If manufa		eclared l	nss fartí	nr is kna	wn (k\/\/h	n/day).					39		(48)
Temperature				) 10 KHO	WII (ICVVI	ı, aay).					.54		(49)
Energy lost f				ear			(48) x (49)	) =			75		(50)
b) If manufa		_	-		or is not		( -) ( -)			0.	10		(00)
Hot water sto	orage loss	factor fr		e 2 (kW	h/litre/da	ay)					0		(51)
	_												
If community	heating s		on 4.3								_		(50)
If community Volume facto	heating s or from Ta	ble 2a								-	0		(52) (53)
If community Volume facto Temperature	heating sor from Ta	ble 2a m Table	2b	ear			(47) x (51)	) x (52) x (!	53) =		0		(53)
If community Volume facto	r heating sor from Ta e factor from rom water	ble 2a m Table r storage	2b	ear			(47) x (51)	) x (52) x (5	53) =				, ,
If community Volume facto Temperature Energy lost f	r heating sor from Ta e factor from rom water r (54) in (5	ble 2a om Table r storage 55)	2b , kWh/ye				(47) x (51) ((56)m = (				0		(53) (54)



If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	
(57)m= 23.33 21.07 23.33 22.58 23.33 22.58 23.33 22.58 23.33 22.58 23.33	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 171.29 151.15 159.13 143.21 140.74 126.33 121.87 132.98 132.51 148.47 156.3 167.36	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 171.29 151.15 159.13 143.21 140.74 126.33 121.87 132.98 132.51 148.47 156.3 167.36	
Output from water heater (annual) <sub>112</sub> 1751.33	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 78.74 69.93 74.7 68.7 68.58 63.09 62.31 66 65.14 71.15 73.05 77.43	(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	
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
	(66)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         88.	(66) (67)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         88.	, ,
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         88.	, ,
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         88.	(67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 88.93 893 88.93 893 893 893 893 893 893 893 893 893 8	(67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 88.93 893 88.93 893 893 893 893 893 893 893 893 893 8	(67) (68)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         88.	(67) (68)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         88.	(67) (68) (69)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 88.93 89.3 89.	(67) (68) (69) (70)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 88.93 89.3 89.	(67) (68) (69) (70) (71)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 88.93 89.3 89.	(67) (68) (69) (70) (71)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70) (71) (72)

Flux

Table 6a

Table 6b

Table 6c

Area

m²

Orientation: Access Factor

Table 6d

Gains

(W)

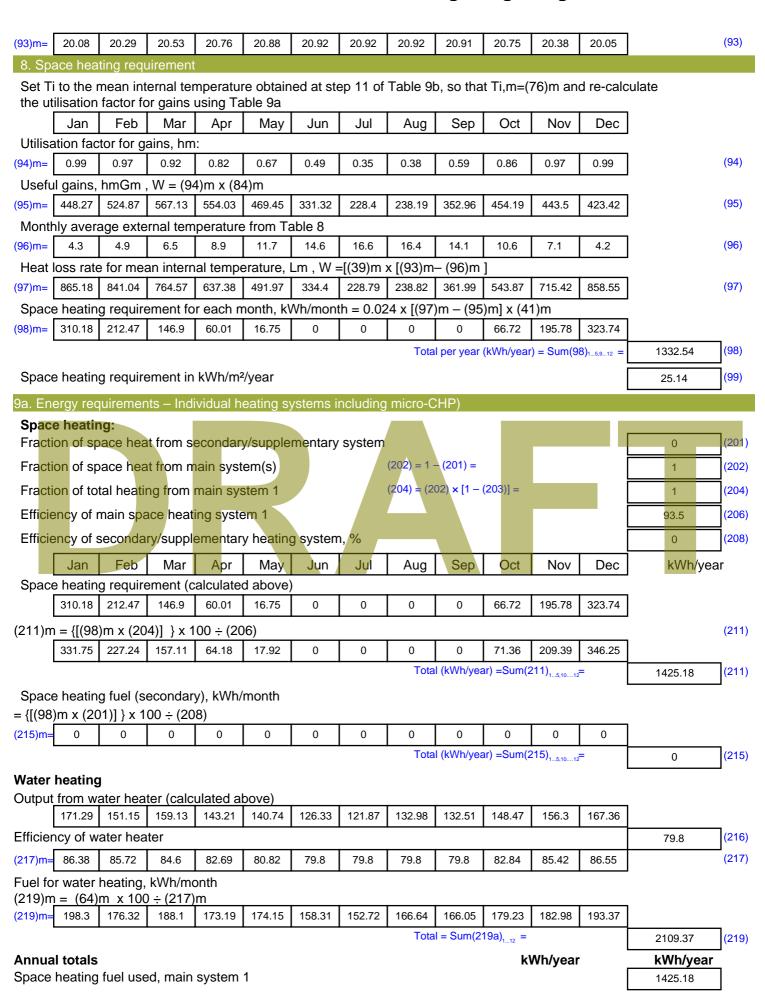


Southeast 0.9x	0.54	X	5.52	X	36.79	X	0.63	X	0.7	=	43.53	(77)
Southeast 0.9x	0.77	x	2.16	x	36.79	x	0.63	x	0.7	=	24.29	(77)
Southeast 0.9x	0.54	X	5.52	X	62.67	X	0.63	x	0.7	=	74.15	(77)
Southeast 0.9x	0.77	X	2.16	x	62.67	x	0.63	x	0.7	=	41.37	(77)
Southeast 0.9x	0.54	X	5.52	x	85.75	x	0.63	x	0.7	=	101.45	(77)
Southeast 0.9x	0.77	X	2.16	x	85.75	x	0.63	x	0.7	=	56.61	(77)
Southeast 0.9x	0.54	X	5.52	x	106.25	X	0.63	x	0.7	=	125.7	(77)
Southeast 0.9x	0.77	X	2.16	x	106.25	X	0.63	x	0.7	=	70.14	(77)
Southeast 0.9x	0.54	X	5.52	X	119.01	X	0.63	x	0.7	=	140.8	(77)
Southeast 0.9x	0.77	X	2.16	X	119.01	X	0.63	x	0.7	=	78.56	(77)
Southeast 0.9x	0.54	X	5.52	X	118.15	X	0.63	x	0.7	=	139.78	(77)
Southeast 0.9x	0.77	X	2.16	X	118.15	X	0.63	x	0.7	=	77.99	(77)
Southeast 0.9x	0.54	X	5.52	x	113.91	x	0.63	x	0.7	=	134.76	(77)
Southeast 0.9x	0.77	X	2.16	x	113.91	X	0.63	x	0.7	=	75.19	(77)
Southeast 0.9x	0.54	X	5.52	x	104.39	x	0.63	x	0.7	=	123.5	(77)
Southeast 0.9x	0.77	x	2.16	x	104.39	x	0.63	x	0.7	=	68.91	(77)
Southeast 0.9x	0.54	X	5.52	x	92.85	X	0.63	x	0.7	=	109.85	(77)
Southeast 0.9x	0.77	X	2.16	X	92.85	X	0.63	X	0.7	=	61.29	(77)
Southeast <sub>0.9x</sub>	0.54	x	5.52	х	69.27	x	0.63	x	0.7	=	81.95	(77)
Southeast <sub>0.9x</sub>	0.77	x	2.16	х	69.27	×	0.63	x	0.7	=	45.73	(77)
Southeast 0.9x	0.54	x	5.52	x	44.07	x	0.63	x	0.7	=	52.14	(77)
Southeast 0.9x	0.77	x	2.16	x	44.07	Х	0.63	x	0.7	=	29.09	(77)
Southeast <sub>0.9x</sub>	0.54	x	5.52	x	31.49	X	0.63	x	0.7	=	37.25	(77)
Southeast <sub>0.9x</sub>	0.77	x	2.16	х	31.49	X	0.63	x	0.7	=	20.79	(77)
South 0.9x	0.77	X	1.39	x	46.75	X	0.63	x	0.7	=	19.86	(78)
South 0.9x	0.77	X	1.39	X	76.57	X	0.63	x	0.7	=	32.53	(78)
South 0.9x	0.77	X	1.39	x	97.53	X	0.63	x	0.7	=	41.43	(78)
South 0.9x	0.77	X	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South 0.9x	0.77	X	1.39	X	114.87	X	0.63	x	0.7	=	48.8	(78)
South 0.9x	0.77	X	1.39	X	110.55	X	0.63	x	0.7	=	46.96	(78)
South 0.9x	0.77	X	1.39	X	108.01	X	0.63	x	0.7	=	45.88	(78)
South 0.9x	0.77	X	1.39	X	104.89	X	0.63	x	0.7	=	44.56	(78)
South 0.9x	0.77	X	1.39	x	101.89	X	0.63	x	0.7	=	43.28	(78)
South 0.9x	0.77	X	1.39	x	82.59	X	0.63	x	0.7	=	35.08	(78)
South 0.9x	0.77	X	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South 0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest <sub>0.9x</sub>	0.77	x	2.79	x	36.79		0.63	x	0.7	=	31.37	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.79	x	62.67		0.63	x	0.7	=	53.44	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.79	x	85.75	]	0.63	x	0.7	=	73.12	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.79	x	106.25		0.63	x	0.7	=	90.6	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.79	x	119.01		0.63	x	0.7	=	101.48	(79)
-											<u> </u>	



		_											
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	1	18.15		0.63	X	0.7	=	100.74	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	1	13.91		0.63	X	0.7	=	97.13	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	10	04.39		0.63	X	0.7	=	89.01	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	9	2.85		0.63	X	0.7	=	79.17	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	6	9.27		0.63	X	0.7	=	59.06	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	4	4.07		0.63	X	0.7	=	37.58	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.79	X	3	1.49		0.63	X	0.7	=	26.85	(79)
West 0.9x	0.77	X	1.39	X	1	9.64	x	0.63	X	0.7	=	8.34	(80)
West 0.9x	0.77	X	1.39	X	3	8.42	x	0.63	X	0.7	=	16.32	(80)
West 0.9x	0.77	X	1.39	X	6	3.27	x	0.63	X	0.7	=	26.88	(80)
West 0.9x	0.77	X	1.39	X	9	2.28	x	0.63	X	0.7	=	39.2	(80)
West 0.9x	0.77	X	1.39	X	1	13.09	x	0.63	X	0.7	=	48.04	(80)
West 0.9x	0.77	X	1.39	X	1	15.77	x	0.63	X	0.7	=	49.18	(80)
West 0.9x	0.77	X	1.39	X	1	10.22	x	0.63	X	0.7	=	46.82	(80)
West 0.9x	0.77	X	1.39	X	9	4.68	x	0.63	X	0.7	=	40.22	(80)
West 0.9x	0.77	X	1.39	X	7	3.59	x	0.63	x	0.7	=	31.26	(80)
West 0.9x	0.77	X	1.39	X	4	5.59	x	0.63	X	0.7	=	19.37	(80)
West 0.9x	0.77	X	1.39	X	2	4.49	Х	0.63	X	0.7	=	10.4	(80)
West 0.9x	0.77	x	1.39	x	1	6.15	x	0.63	x	0.7	=	6.86	(80)
Sola <mark>r gain</mark> s in	watts, calcu	lated	for each	month			(83)m	= Sum(74)m	(8 <mark>2)</mark> m			,	
(83)m= 127.39		9.49			114.66	399.79	366	324.86	241.18	152.75	108.91		(83)
Total gains –				` '	,								
(84)m= $454.74$	543.45 615	5.12	672.06	701.23 6	82.53								()
				_		657.34	628	.65 595.42	527.96	458.15	428.04		(84)
7. Mean inte		_				657.34	628	65 595.42	527.96	458.15	428.04		(84)
7. Mean inte	rnal tempera	ture (	heating s	season)					527.90	458.15	428.04	21	(84)
	rnal tempera during heati	ture (	heating s	season) the living	area f	from Tak			527.90	458.15	428.04	21	
Temperature	rnal tempera during heati	ture (	heating s	season) the living	area f	from Tak	ole 9,		527.96 Oct		428.04 Dec	21	(85)
Temperature Utilisation fa	rnal tempera during heati ctor for gains Feb N	ture (	heating seriods in the ving area	season) the living a, h1,m (s	area f	from Tab	ole 9,	Th1 (°C)				21	
Temperature Utilisation fac	rnal tempera during heati ctor for gains Feb N 0.97 0.	ture (ing performance) for line for lin	heating seriods in the ving area Apr 0.83	season) the living a, h1,m (s May  0.68	area f see Ta Jun 0.49	from Tab ble 9a) Jul 0.35	ole 9,	Th1 (°C) ug Sep	Oct	Nov	Dec	21	(85)
Temperature Utilisation far  Jan (86)m= 0.99	rnal temperate during heating tor for gains  Feb N 0.97 0.  Al temperatur	ture (ing performance) for line for lin	heating seriods in the ving area Apr 0.83	season) the living a, h1,m (s May  0.68	area f see Ta Jun 0.49	from Tab ble 9a) Jul 0.35	ole 9,	Th1 (°C)  ug Sep  9 0.6  able 9c)	Oct	Nov 0.97	Dec	21	(85)
Utilisation far  Utilisation far  Jan  (86)m= 0.99  Mean interna	rnal temperate during heating tor for gains  Feb N 0.97 0.  al temperatur 20.36 20	for ling page of the second se	heating seriods in the ving area Apr 0.83 iving area 20.84	the living a, h1,m (s May 0.68 a T1 (follo	area finalesee Tailousee T	from Tab ble 9a) Jul 0.35 ps 3 to 7	ole 9, 0.3	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98	Oct 0.87	Nov 0.97	Dec 0.99	21	(85)
Temperature Utilisation factorial Jan (86)m= 0.99  Mean internation (87)m= 20.16	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati	for ling page of the second se	cheating seriods in the ving area Apr 0.83 viving area 20.84 eriods in the viving area area area area area area area are	the living a, h1,m (s May 0.68 a T1 (follo	area finalesee Tailousee T	from Tab ble 9a) Jul 0.35 ps 3 to 7	ole 9, 0.3	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98  9, Th2 (°C)	Oct 0.87	Nov 0.97	Dec 0.99	21	(85)
Temperature  Utilisation far  Jan  (86)m= 0.99  Mean internation  (87)m= 20.16  Temperature  (88)m= 20.48	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati 20.48 20	for ling per	cheating seriods in the ving area Apr 0.83 viving area 20.84 eriods in the 20.49	the living a, h1,m (s May 0.68 a T1 (follo 20.96 rest of dv 20.49	area for see Ta Jun 0.49  Dow stee 20.99  velling 20.5	from Tab ble 9a) Jul 0.35 ps 3 to 7 21 from Ta	Al 0.3 in T 2 ble 9	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98  0, Th2 (°C)	Oct 0.87	Nov 0.97	Dec 0.99	21	(85)
Temperature  Utilisation far  Jan  (86)m= 0.99  Mean interna (87)m= 20.16  Temperature	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati 20.48 20 ctor for gains	for ling per	cheating seriods in the ving area Apr 0.83 viving area 20.84 eriods in the 20.49	the living a, h1,m (s May 0.68 a T1 (follo 20.96 rest of dv 20.49 elling, h2	area for see Ta Jun 0.49  Dow stee 20.99  velling 20.5	from Tab ble 9a) Jul 0.35 ps 3 to 7 21 from Ta	Al 0.3 in T 2 ble 9	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98 0, Th2 (°C) 5 20.5	Oct 0.87	Nov 0.97	Dec 0.99	21	(85)
Temperature  Utilisation factoristics  Jan  (86)m= 0.99  Mean internation  (87)m= 20.16  Temperature  (88)m= 20.48  Utilisation factoristics  (89)m= 0.99	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati 20.48 20 ctor for gains 0.97 0.	ture (for ling per li	cheating seriods in the ving area Apr 0.83 civing area 20.84 ceriods in the 20.49 cest of dwo 0.81	the living a, h1,m (s May 0.68 a T1 (follo 20.96 rest of dv 20.49 elling, h2 0.65	area for see Ta Jun 0.49  ow ste 20.99  velling 20.5  c,m (see 0.45	from Table 9a)  Jul  0.35  ps 3 to 7  21  from Ta  20.5  ee Table  0.31	Al 0.3  ' in T 2  ble 9,  20,  9a)  0.3	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98 0, Th2 (°C) 5 20.5	Oct 0.87 20.82 20.49 0.85	Nov 0.97 20.45	Dec 0.99 20.12	21	(85) (86) (87) (88)
Temperature  Utilisation factorial  (86)m= 0.99  Mean internation  (87)m= 20.16  Temperature  (88)m= 20.48  Utilisation factorial  (89)m= 0.99  Mean internation	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati 20.48 20 ctor for gains 0.97 0. al temperatur during heati 20.48 20 ctor for gains 0.97 0. al temperatur	ture (ing performance in line)  for line)  e in line)  for regular for regular in terms and the line in terms are the line in terms and the line in terms and the line in terms	cheating seriods in the ving area Apr 0.83 viving area 20.84 vivin	the living a, h1,m (s May 0.68 a T1 (follo 20.96 rest of dv 20.49 elling, h2 0.65 f dwelling	area for see Ta Jun 0.49  Dow stee 20.99  velling 20.5  c,m (see 0.45	from Table 9a)  Jul  0.35  ps 3 to 7  21  from Ta  20.5  ee Table  0.31  ollow ste	An 0.33  ' in T 2  ble 9,  ble 9,  0.32  ps 3	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98  0, Th2 (°C) 5 20.5  4 0.56  to 7 in Table	Oct 0.87 20.82 20.49 0.85 e 9c)	Nov 0.97 20.45 20.49	Dec 0.99 20.12	21	(85) (86) (87) (88)
Temperature  Utilisation factoristics  Jan  (86)m= 0.99  Mean internation  (87)m= 20.16  Temperature  (88)m= 20.48  Utilisation factoristics  (89)m= 0.99	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati 20.48 20 ctor for gains 0.97 0. al temperatur during heati 20.48 20 ctor for gains 0.97 0. al temperatur	ture (for ling per li	cheating seriods in the ving area Apr 0.83 viving area 20.84 vivin	the living a, h1,m (s May 0.68 a T1 (follo 20.96 rest of dv 20.49 elling, h2 0.65 f dwelling	area for see Ta Jun 0.49  ow ste 20.99  velling 20.5  c,m (see 0.45	from Table 9a)  Jul  0.35  ps 3 to 7  21  from Ta  20.5  ee Table  0.31	Al 0.3  ' in T 2  ble 9,  20,  9a)  0.3	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98 0, Th2 (°C) 5 20.5  4 0.56 to 7 in Table 5 20.49	Oct 0.87 20.82 20.49 0.85 e 9c) 20.35	Nov 0.97 20.45 20.49	Dec 0.99 20.12 20.49 0.99	21	(85) (86) (87) (88) (89)
Temperature  Utilisation far  Jan  (86)m= 0.99  Mean interna (87)m= 20.16  Temperature (88)m= 20.48  Utilisation far (89)m= 0.99  Mean interna (90)m= 19.69	rnal temperare during heating tor for gains  Feb No.97 0.  All temperature 20.36 20  during heating heating 20.48 20  ctor for gains 0.97 0.  All temperature 19.89 20	ture (ing performance in line) for region 1.13	cheating seriods in the ving area and a constant an	the living a, h1,m (s May  0.68  a T1 (follo 20.96  20.49  elling, h2 0.65  f dwelling 20.46	area for see Table 20.99  velling 20.5  2,m (see 0.45  3 T2 (for 20.5)	from Table 9a)  Jul  0.35  ps 3 to 7  21  from Ta  20.5  ee Table  0.31  ollow ste  20.5	Al 0.3 ' in T 2  ble 9,  ' in T 2  20,  9a)  0.3  20,	Th1 (°C)  ug Sep 9 0.6  table 9c) 1 20.98 0, Th2 (°C) 5 20.5  4 0.56 to 7 in Table 5 20.49	Oct 0.87 20.82 20.49 0.85 e 9c) 20.35	Nov 0.97 20.45 20.49 0.97	Dec 0.99 20.12 20.49 0.99		(85) (86) (87) (88)
Temperature  Utilisation far  Jan  (86)m= 0.99  Mean interna  (87)m= 20.16  Temperature  (88)m= 20.48  Utilisation far  (89)m= 0.99  Mean interna  (90)m= 19.69	rnal tempera e during heati ctor for gains Feb N 0.97 0. al temperatur 20.36 20 e during heati 20.48 20 ctor for gains 0.97 0. al temperatur 19.89 20 al temperatur	ture (ing person of the form o	cheating seriods in the ving area and a seriod and a seriod area and a seriod and a seriod area and a seriod area and a seriod and a seriod area and a seriod	the living a, h1,m (s May 0.68 a T1 (follo 20.96 rest of dv 20.49 elling, h2 0.65 f dwelling 20.46	area fine area f	from Table 9a)  Jul  0.35  ps 3 to 7  21  from Ta  20.5  ee Table  0.31  ollow ste  20.5	All 0.3  / in T  2  ble 9  0.3  / on T  2  ble 9  0.3  20  + (1	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98  0, Th2 (°C) 5 20.5  4 0.56  to 7 in Table 5 20.49  ft  - fLA) × T2	Oct 0.87 20.82 20.49 0.85 e 9c) 20.35 LA = Liv	Nov 0.97 20.45 20.49 0.97 19.99	Dec 0.99  20.12  20.49  0.99  19.66  4) =		(85) (86) (87) (88) (89) (90) (91)
Temperature  Utilisation far  Jan  (86)m= 0.99  Mean interna (87)m= 20.16  Temperature (88)m= 20.48  Utilisation far (89)m= 0.99  Mean interna (90)m= 19.69	rnal temperate during heating tor for gains  Feb No.97 0.  All temperature 20.36 20  Control for gains 0.97 0.  All temperature 19.89 20  All temperature 19.89 20  All temperature 19.89 20  All temperature 19.89 20	ture (ing performance in the ing performance	cheating seriods in the ving area and a constant an	the living a, h1,m (s May 0.68 a T1 (follo 20.96 zest of dv 20.49 elling, h2 0.65 f dwelling 20.46	area for see Ta  Jun  0.49  ow ste  20.99  velling  20.5  7,m (se  0.45  g T2 (for  20.5	from Table 9a)  Jul  0.35  ps 3 to 7  21  from Table 20.5  ee Table 0.31  ollow stee 20.5  A × T1  20.92	All 0.3  7 in T 2  200  9a) 0.3  200  + (1 200	Th1 (°C)  ug Sep 9 0.6  able 9c) 1 20.98  0, Th2 (°C) 5 20.5  4 0.56  to 7 in Table 5 20.49  fl  — fLA) × T2 92 20.91	Oct 0.87  20.82  20.49  0.85 e 9c) 20.35 LA = Liv	Nov 0.97 20.45 20.49 0.97 19.99 ring area ÷ (4	Dec 0.99 20.12 20.49 0.99		(85) (86) (87) (88) (89)







Water heating fuel used			ſ	2109.37	1
Electricity for pumps, fans and electric keep-hot			Ĺ		J
central heating pump:		Γ	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			[	244.06	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP		L		J
	<b>Energy</b> kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	= [	307.84	(261)
Space heating (secondary)	(215) x	0.519	= [	0	(263)
Water heating	(219) x	0.216	= [	455.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =			763.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= [	38.93	(267)
Electricity for lighting	(232) x	0.519	= [	126.67	(268)
Total CO2, kg/year  TER =	sum	of (265)(271) =	] [	929.06	(272)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 15 - 3B6P - MF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor (1a) x 2.7 (2a) =(3a) 169 456.3 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)169 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =456.3 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.09 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)O Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.34 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.29 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltra	ation rate	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34		
Calculate effect		•	rate for t	he appli	cable ca	se	•			•			(22-)
If exhaust air he			endix N (2	3h) = (23a	a) × Fmv (e	equation (1	N5)) othe	rwise (23h	) = (23a)			0	(23a)
If balanced with									, (200)			0	(23b) (23c)
a) If balance		-	•	_					2b)m + (	23b) <b>×</b> [	1 – (23c)		(230)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If balance	d mecha	anical ve	entilation	without	heat red	overy (N	MV) (24k	m = (22)	2b)m + (	23b)		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole he				-	•				5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural v if (22b)m				•	•				0.5]				
(24d)m= 0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24d)
Effective air	change i	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in bo	x (25)		-			
(25)m= 0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. Heat losses	s and he	at loss	paramete	er:							_	_	
ELEMENT	Gros area		Openin		Net Ar		U-val		AXU		k-value		A X k
		()	- 11	_	A ,r	n²	W/m2	2K	(W/I	K)	kJ/m²-l	K	kJ/K
Win <mark>dows</mark> Type	: 1	()			3.6		W/m2 /[1/( 1.4 )+		4.77	K)	kJ/m²-l	Χ	(27)
Win <mark>dows</mark> Type Win <mark>dows</mark> Type			"			x1		- 0.04] =	`	K)	kJ/m²-l	X	
	2		"		3.6	x1 x1	/[1/( 1.4 )+	- 0.04] = [ - 0.04] = [	4.77	K)	kJ/m²-1	X.	(27)
Windows Type	2 3				3.6	x1 x1 x1	/[1/( 1.4 )+ /[1/( 1.4 )+	[-0.04] = [-0.04] = [-0.04] = [-0.04]	4.77 3.18	K)	kJ/m²-I	ζ	(27) (27)
Windows Type Windows Type	2 3 4		"		3.6 2.4 9.36	x1 x1 x1 x1	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{bmatrix} -0.04 \end{bmatrix} = \begin{bmatrix} -0.04 \end{bmatrix}$	4.77 3.18 12.41	K)	kJ/m²-I	X .	(27) (27) (27)
Windows Type Windows Type Windows Type	2 2 3 4 4 5 5				3.6 2.4 9.36 2.4	x1 x1 x1 x1 x1 x1	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{array}{l} -0.04] = \begin{bmatrix} \\ -0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ -0.04 \end{bmatrix} = \begin{bmatrix} \\ -0.04 \end{bmatrix} = \begin{bmatrix} \\ -0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ -0.04 \end{bmatrix} = \begin{bmatrix} \\ \end{bmatrix}$	4.77 3.18 12.41 3.18	K)	kJ/m²-l	Χ	(27) (27) (27) (27)
Windows Type Windows Type Windows Type Windows Type	2 2 3 4 4 4 5 5 6 6				3.6 2.4 9.36 2.4 1.78	x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{vmatrix} -0.04 \\ -0.04 \end{vmatrix} = \begin{vmatrix} -$	4.77 3.18 12.41 3.18 2.36	K)	kJ/m²-l	X .	(27) (27) (27) (27) (27)
Windows Type Windows Type Windows Type Windows Type Windows Type	2 2 3 4 4 2 5 2 6 6 2 7				3.6 2.4 9.36 2.4 1.78 1.05	x1	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{ccc} -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ \end{array} $	4.77 3.18 12.41 3.18 2.36 1.39	K)	kJ/m²-l	X .	(27) (27) (27) (27) (27) (27)
Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	2 2 3 4 4 2 5 2 6 6 2 7		27.6		3.6 2.4 9.36 2.4 1.78 1.05 1.05	x1	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{ccc} -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ -0.04 & = & \\ \end{array} $	4.77 3.18 12.41 3.18 2.36 1.39	K)	kJ/m²-l		(27) (27) (27) (27) (27) (27) (27)
Windows Type	2 2 3 4 4 2 5 5 6 6 7 7 8 8	3			3.6 2.4 9.36 2.4 1.78 1.05 3.6	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{cccc} -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ -0.04 & = & & \\ \end{array} $	4.77 3.18 12.41 3.18 2.36 1.39 1.39	K)	kJ/m²-l		(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type Walls Type1	2 2 3 3 4 4 4 5 5 6 6 7 7 8 8 8 8 6.43 27.27	3 7	27.6		3.6 2.4 9.36 2.4 1.78 1.05 1.05 58.79	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{cccc} -0.04 & = & & \\ -0.$	4.77 3.18 12.41 3.18 2.36 1.39 1.39 4.77 10.58	K)	kJ/m²-l		(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type Walls Type1 Walls Type2	2 2 3 3 4 4 4 5 5 6 6 7 7 8 8 8 8 6.43 27.27	3 7	27.6		3.6 2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{cccc} -0.04 & = & & \\ -0.$	4.77 3.18 12.41 3.18 2.36 1.39 1.39 4.77 10.58	K)	kJ/m²-l		(27) (27) (27) (27) (27) (27) (27) (29) (29)
Windows Type Walls Type1 Walls Type2 Total area of e	2 2 3 3 4 4 4 5 5 6 6 7 7 8 8 8 8 6.43 27.27	3 7	27.6		3.6  2.4  9.36  2.4  1.78  1.05  1.05  3.6  58.79  27.27	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.18	- 0.04] = [ - 0.04] = [	4.77 3.18 12.41 3.18 2.36 1.39 1.39 4.77 10.58 4.91		kJ/m²-l		(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type Walls Type1 Walls Type2 Total area of ele	2 2 3 3 4 4 4 5 5 6 6 7 7 8 8 8 8 6.43 27.27	3 7	27.6		3.6  2.4  9.36  2.4  1.78  1.05  1.05  3.6  58.79  27.27  113.7  52.38	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.18	- 0.04] = [ - 0.04] = [	4.77 3.18 12.41 3.18 2.36 1.39 1.39 4.77 10.58 4.91		kJ/m²-·l		(27) (27) (27) (27) (27) (27) (27) (29) (29) (29) (31)
Windows Type Walls Type1 Walls Type2 Total area of ele Party wall Party floor	2 2 3 3 4 4 4 5 5 6 6 6 7 7 8 8 27.25 lements,	3 7 m²	27.6-0	ndow U-va	3.6  2.4  9.36  2.4  1.78  1.05  1.05  3.6  58.79  27.27  113.7  52.38  175.4  175.8  alue calcul	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.18	- 0.04] = [ - 0.0	4.77 3.18 12.41 3.18 2.36 1.39 4.77 10.58 4.91				(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Walls Type1 Walls Type2 Total area of ele Party wall Party floor Party ceiling * for windows and	22 2 3 3 4 4 4 5 5 6 6 6 7 8 8 8 6.44 27.27 27.27 Ilements,	3 7 m² ows, use esides of ir	27.60 0	ndow U-va	3.6  2.4  9.36  2.4  1.78  1.05  1.05  3.6  58.79  27.27  113.7  52.38  175.4  175.8  alue calcul	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.18	$ \begin{array}{c} -0.04 \\ = \\ -0.04 \\ = \\ -0.04 \\ = \\ -0.04 \\ = \\ -0.04 \\ = \\ -0.04 \\ = \\ -0.04 \\ = \\ -0.04 \\ = \\ = \\ -0.04 $	4.77 3.18 12.41 3.18 2.36 1.39 4.77 10.58 4.91				(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type Walls Type1 Walls Type2 Total area of el Party wall Party floor Party ceiling * for windows and ** include the area	22 23 24 25 26 26 27 27.27 31 31 31 31 31 31 31 31 31 31 31 31 31	m <sup>2</sup> ows, use esides of ire  S (A x	27.60 0	ndow U-va	3.6  2.4  9.36  2.4  1.78  1.05  1.05  3.6  58.79  27.27  113.7  52.38  175.4  175.8  alue calcul	x1 x	/[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{vmatrix} -0.04 \\ -0.04 \end{vmatrix} = \begin{vmatrix} -$	4.77 3.18 12.41 3.18 2.36 1.39 4.77 10.58 4.91	as given in	paragraph		(27) (27) (27) (27) (27) (27) (27) (27)

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For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)5.68 if details of thermal bridging are not known (36) =  $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)57.82 Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)$ m x (5)Feb Mar Jul Sep Dec .lan Apr May Jun Aug Oct Nov (38)m =85.37 84.98 84.6 82.79 82.46 80.89 80.89 80.6 81.49 82.46 83.14 83.85 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =143.19 142.8 142.42 140.61 140.28 138.71 138.71 138.42 139.31 140.28 140.96 141.67 Average = Sum(39)<sub>1...12</sub> /12= (39)140.61 Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m  $\div$  (4)0.83 0.82 0.85 0.84 0.84 0.83 0.82 0.82 0.82 0.83 0.83 0.84 (40)m =(40)Average =  $Sum(40)_{1...12}/12=$ 0.83 Number of days in month (Table 1a) Jan Feb Mar Jun Apr May Jul Aug Sep Oct Nov Dec (41)31 28 31 30 31 30 31 31 30 31 30 31 (41)m =4. Water heating energy requirement: Assumed occupancy, N (42)2.96 if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)104.53 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) 114.98 110.8 106.62 102.44 94.08 94.08 98.26 102.44 110.8 114.98 (44)m =98.26 106.62 (44)Total =  $Sum(44)_{1...12}$  = 1254.35 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) 170.52 149.13 111.09 165.13 (45)m =153.89 134.17 128.74 102.94 118.13 119.54 139.31 152.07 (45)Total =  $Sum(45)_{1...12}$  = 1644.65 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.58 22.37 23.08 20.13 19.31 15.44 17.72 17.93 20.9 22.81 24.77 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 2.13 (48)Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year  $(48) \times (49) =$ 1.15 (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 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)



Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53) =	0 1.15	(54) (55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$	1.15	(55)
(56)m= 35.73 32.27 35.73 34.57 35.73 34.57 35.73	35.73 34.57 35.73	34.57 35.73	(56)
If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50)$ – $(H11)]$ ÷			` '
(57)m= 35.73 32.27 35.73 34.57 35.73 34.57 35.73	35.73 34.57 35.73	34.57 35.73	(57)
Primary circuit loss (annual) from Table 3		0	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷	865 × (41)m		•
(modified by factor from Table H5 if there is solar water hea	ting and a cylinder thermo	ostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26	23.26 22.51 23.26	22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) $\div$ 365 × (4	1)m		
(61)m= 0 0 0 0 0 0	0 0 0	0 0	(61)
Total heat required for water heating calculated for each month	$h (62)m = 0.85 \times (45)m +$	(46)m + (57)m +	(59)m + (61)m
(62)m= 229.5 202.41 212.88 191.25 187.73 168.18 161.93	177.12 176.62 198.3	209.15 224.12	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quan	ity) (enter '0' if no solar contribu	tion to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see A	ppendix G)		
(63)m= 0 0 0 0 0 0	0 0 0	0 0	(63)
Output from water heater			
(64)m= 229.5 202.41 212.88 191.25 187.73 168.18 161.93	177.12 176.62 198.3	209.15 224.12	
	Output from water heate	r (annual) <sub>112</sub>	2339.2 (64)
Heat gains from water heating, kWh/month 0.25 / [0.85 x (45)	m + (61)m] + 0.8 x [(4 <mark>6</mark> )m	+ (57)m + (59)m	]
(65)m= 103.89 92.21 98.36 90.28 90 82.61 81.42			
(65)m= 103.89 92.21 98.36 90.28 90 82.61 81.42	86.47 85.42 93.51	96.23 102.1	(65)
include (57)m in calculation of (65)m only if cylinder is in the			
include (57)m in calculation of (65)m only if cylinder is in the			
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):			
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	dwelling or hot water is f  Aug Sep Oct	rom community h	
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul	Aug Sep Oct 148.06 148.06 148.06	om community h	eating
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06	Aug Sep Oct 148.06 148.06 148.06	om community h	eating
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug         Sep         Oct           148.06         148.06         148.06           also see Table 5         15.49         20.8         26.4	Nov Dec 148.06	neating (66)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug         Sep         Oct           148.06         148.06         148.06           also see Table 5         15.49         20.8         26.4           13a), also see Table 5	Nov Dec 148.06	neating (66)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug     Sep     Oct       148.06     148.06     148.06       also see Table 5     15.49     20.8     26.4       13a), also see Table 5       251.22     260.13     279.08	Nov Dec 148.06 148.06 30.82 32.85	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug     Sep     Oct       148.06     148.06     148.06       also see Table 5     15.49     20.8     26.4       13a), also see Table 5       251.22     260.13     279.08	Nov Dec 148.06 148.06 30.82 32.85	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug Sep Oct 148.06 148.06 148.06 also see Table 5 15.49 20.8 26.4 13a), also see Table 5 251.22 260.13 279.08 a), also see Table 5	Nov Dec 148.06 148.06 30.82 32.85 303.01 325.5	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug Sep Oct 148.06 148.06 148.06 also see Table 5 15.49 20.8 26.4 13a), also see Table 5 251.22 260.13 279.08 a), also see Table 5	Nov Dec 148.06 148.06 30.82 32.85 303.01 325.5	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug Sep Oct 148.06 148.06 148.06 also see Table 5 15.49 20.8 26.4 13a), also see Table 5 251.22 260.13 279.08 a), also see Table 5 37.81 37.81 37.81	Nov Dec 148.06 148.06 30.82 32.85 303.01 325.5 37.81 37.81	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug         Sep         Oct           148.06         148.06         148.06           also see Table 5         15.49         20.8         26.4           13a), also see Table 5         251.22         260.13         279.08           a), also see Table 5         37.81         37.81         37.81           3         3         3         3	Nov Dec 148.06 148.06 30.82 32.85 303.01 325.5 37.81 37.81	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug         Sep         Oct           148.06         148.06         148.06           also see Table 5         15.49         20.8         26.4           13a), also see Table 5         251.22         260.13         279.08           a), also see Table 5         37.81         37.81         37.81           3         3         3         3	Nov Dec 148.06 148.06 30.82 32.85 37.81 37.81 37.81 3	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep Oct 148.06 148.06 148.06 also see Table 5 15.49 20.8 26.4 13a), also see Table 5 251.22 260.13 279.08 a), also see Table 5 37.81 37.81 37.81  3 3 3 3 3 -118.45 -118.45 -118.45	Nov Dec 148.06 148.06 30.82 32.85 37.81 37.81 37.81 3	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug Sep Oct 148.06 148.06 148.06 also see Table 5 15.49 20.8 26.4 13a), also see Table 5 251.22 260.13 279.08 a), also see Table 5 37.81 37.81 37.81  3 3 3 3 3 -118.45 -118.45 -118.45	Nov Dec 148.06 148.06 30.82 32.85 37.81 37.81 37.81 3 3 -118.45 -118.45 133.65 137.23	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 148.06 14	Aug Sep Oct 148.06 148.06 148.06 also see Table 5 15.49 20.8 26.4 13a), also see Table 5 251.22 260.13 279.08 a), also see Table 5 37.81 37.81 37.81 3 3 3 3 -118.45 -118.45 -118.45 116.22 118.63 125.69 m + (68)m + (69)m + (70)m +	Nov Dec 148.06 148.06 30.82 32.85 37.81 37.81 37.81 3 3 -118.45 -118.45 133.65 137.23	(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				Flux Table 6a	g_ Table 6b			FF Table 6c	Gains (W)		
North 0.9	0.77	X	3.6	x	10.63	x	0.63	x	0.7	=	11.7	(74)
North 0.9x	0.77	X	2.4	x	10.63	x	0.63	x	0.7	] =	7.8	(74)
North 0.9	0.77	X	3.6	x	10.63	x	0.63	x	0.7	] =	11.7	(74)
North 0.9	0.77	X	3.6	x	20.32	x	0.63	x	0.7	=	22.36	(74)
North 0.9	0.77	X	2.4	x	20.32	x	0.63	x	0.7	] =	14.9	(74)
North 0.9	0.77	X	3.6	x	20.32	x	0.63	x	0.7	=	22.36	(74)
North 0.9	0.77	X	3.6	x	34.53	x	0.63	x	0.7	=	37.99	(74)
North 0.9	0.77	X	2.4	x	34.53	x	0.63	x	0.7	=	25.33	(74)
North 0.9	0.77	X	3.6	x	34.53	x	0.63	x	0.7	=	37.99	(74)
North 0.9	0.77	X	3.6	x	55.46	x	0.63	x	0.7	=	61.02	(74)
North 0.9	0.77	X	2.4	x	55.46	x	0.63	x	0.7	] =	40.68	(74)
North 0.9	0.77	X	3.6	x	55.46	x	0.63	x	0.7	=	61.02	(74)
North 0.9	0.77	X	3.6	x	74.72	x	0.63	x	0.7	] =	82.2	(74)
North 0.9	0.77	X	2.4	X	74.72	x	0.63	X	0.7	=	54.8	(74)
North 0.9	0.77	X	3.6	x	74.72	x	0.63	X	0.7	] =	82.2	(74)
North 0.9	0.77	X	3.6	X	79.99	Х	0.63	X	0.7		88	(74)
North 0.9	0.77	X	2.4	х	79.99	x	0.63	x	0.7	-	58.67	(74)
North 0.9	0.77	X	3.6	х	79.99	×	0.63	x	0.7	=	88	(74)
North 0.9	0.77	X	3.6	x	74.68	X	0.63	x	0.7	=	82.16	(74)
North 0.9	0.77	X	2.4	x	74.68	X	0.63	x	0.7	=	54.77	(74)
North 0.9	0.77	X	3.6	x	74.68	X	0.63	x	0.7	] =	82.16	(74)
North 0.9	0.77	X	3.6	х	59.25	X	0.63	x	0.7	=	65.18	(74)
North 0.9	0.77	X	2.4	x	59.25	x	0.63	X	0.7	=	43.46	(74)
North 0.9	0.77	X	3.6	x	59.25	x	0.63	X	0.7	=	65.18	(74)
North 0.9	0.77	X	3.6	X	41.52	x	0.63	X	0.7	=	45.68	(74)
North 0.9	0.77	X	2.4	X	41.52	x	0.63	X	0.7	] =	30.45	(74)
North 0.9	0.77	X	3.6	X	41.52	x	0.63	X	0.7	=	45.68	(74)
North 0.9	0.77	X	3.6	x	24.19	x	0.63	X	0.7	] =	26.61	(74)
North 0.9	0.77	X	2.4	X	24.19	X	0.63	X	0.7	=	17.74	(74)
North 0.9	0.77	X	3.6	X	24.19	X	0.63	X	0.7	=	26.61	(74)
North 0.9	0.77	X	3.6	X	13.12	X	0.63	X	0.7	=	14.43	(74)
North 0.9	0.77	X	2.4	X	13.12	X	0.63	X	0.7	=	9.62	(74)
North 0.9	0.77	X	3.6	X	13.12	X	0.63	X	0.7	=	14.43	(74)
North 0.9	0.77	X	3.6	X	8.86	X	0.63	X	0.7	=	9.75	(74)
North 0.9	0.77	X	2.4	X	8.86	X	0.63	X	0.7	=	6.5	(74)
North 0.9x		X	3.6	x	8.86	x	0.63	X	0.7	] =	9.75	(74)
Northeast 0.9		X	1.05	x	11.28	x	0.63	X	0.7	] =	3.62	(75)
Northeast 0.9		X	1.05	x	22.97	x	0.63	X	0.7	] =	7.37	(75)
Northeast 0.9	0.77	X	1.05	X	41.38	X	0.63	X	0.7	=	13.28	(75)



Northeast 0.9x	(75)
Northeast 0.9x	
Northeast 0.9x	(75)
Southeast 0.9x         0.77         x         1.78         x         36.79         x         0.63         x         0.7         =         20.02           Southeast 0.9x         0.77         x         1.78         x         62.67         x         0.63         x         0.7         =         34.09           Southeast 0.9x         0.77         x         1.78         x         85.75         x         0.63         x         0.7         =         46.65           Southeast 0.9x         0.77         x         1.78         x         106.25         x         0.63         x         0.7         =         57.8           Southeast 0.9x         0.77         x         1.78         x         119.01         x         0.63         x         0.7         =         64.74           Southeast 0.9x         0.77         x         1.78         x         118.15         x         0.63         x         0.7         =         64.27           Southeast 0.9x         0.77         x         1.78         x         104.39         x         0.63         x         0.7         =         61.97           Southeast 0.9x         0.77         x	(75)
Southeast 0.9x       0.77       x       1.78       x       62.67       x       0.63       x       0.7       =       34.09         Southeast 0.9x       0.77       x       1.78       x       85.75       x       0.63       x       0.7       =       46.65         Southeast 0.9x       0.77       x       1.78       x       106.25       x       0.63       x       0.7       =       57.8         Southeast 0.9x       0.77       x       1.78       x       119.01       x       0.63       x       0.7       =       64.74         Southeast 0.9x       0.77       x       1.78       x       113.91       x       0.63       x       0.7       =       61.97         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       56.79         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       50.51	(75)
Southeast 0.9x       0.77       x       1.78       x       85.75       x       0.63       x       0.7       =       46.65         Southeast 0.9x       0.77       x       1.78       x       106.25       x       0.63       x       0.7       =       57.8         Southeast 0.9x       0.77       x       1.78       x       119.01       x       0.63       x       0.7       =       64.74         Southeast 0.9x       0.77       x       1.78       x       113.91       x       0.63       x       0.7       =       64.27         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       56.79         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       50.51	(77)
Southeast 0.9x       0.77       x       1.78       x       106.25       x       0.63       x       0.7       =       57.8         Southeast 0.9x       0.77       x       1.78       x       119.01       x       0.63       x       0.7       =       64.74         Southeast 0.9x       0.77       x       1.78       x       118.15       x       0.63       x       0.7       =       64.27         Southeast 0.9x       0.77       x       1.78       x       113.91       x       0.63       x       0.7       =       61.97         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       56.79         Southeast 0.9x       0.77       x       1.78       x       92.85       x       0.63       x       0.7       =       50.51	(77)
Southeast 0.9x       0.77       x       1.78       x       119.01       x       0.63       x       0.7       =       64.74         Southeast 0.9x       0.77       x       1.78       x       118.15       x       0.63       x       0.7       =       64.27         Southeast 0.9x       0.77       x       1.78       x       113.91       x       0.63       x       0.7       =       61.97         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       56.79         Southeast 0.9x       0.77       x       1.78       x       92.85       x       0.63       x       0.7       =       50.51	(77)
Southeast 0.9x       0.77       x       1.78       x       118.15       x       0.63       x       0.7       =       64.27         Southeast 0.9x       0.77       x       1.78       x       113.91       x       0.63       x       0.7       =       61.97         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       56.79         Southeast 0.9x       0.77       x       1.78       x       92.85       x       0.63       x       0.7       =       50.51	(77)
Southeast 0.9x       0.77       x       1.78       x       113.91       x       0.63       x       0.7       =       61.97         Southeast 0.9x       0.77       x       1.78       x       104.39       x       0.63       x       0.7       =       56.79         Southeast 0.9x       0.77       x       1.78       x       92.85       x       0.63       x       0.7       =       50.51	(77)
Southeast 0.9x	(77)
Southeast 0.9x 0.77 x 1.78 x 92.85 x 0.63 x 0.7 = 50.51	(77)
	(77)
Cauthoost	(77)
Southeast 0.9x 0.77 x 1.78 x 69.27 x 0.63 x 0.7 = 37.68	(77)
Southeast 0.9x 0.77 x 1.78 x 44.07 x 0.63 x 0.7 = 23.97	(77)
Southeast 0.9x 0.77 x 1.78 x 31.49 x 0.63 x 0.7 = 17.13	(77)
South 0.9x 0.54 x 9.36 x 46.75 x 0.63 x 0.7 = 93.79	(78)
South 0.9x 0.77 x 2.4 x 46.75 x 0.63 x 0.7 = 68.58	(78)
South 0.9x 0.54 x 9.36 x 76.57 x 0.63 x 0.7 = 153.6	(78)
South 0.9x 0.77 x 2.4 x 76.57 x 0.63 x 0.7 = 112.32	(78)
South 0.9x 0.54 x 9.36 x 97.53 x 0.63 x 0.7 = 195.66	(78)
South 0.9x 0.77 x 2.4 x 97.53 x 0.63 x 0.7 = 143.08	(78)
South 0.9x 0.54 x 9.36 x 110.23 x 0.63 x 0.7 = 221.14	(78)
South 0.9x 0.77 x 2.4 x 110.23 x 0.63 x 0.7 = 161.71	(78)
South 0.9x 0.54 x 9.36 x 114.87 x 0.63 x 0.7 = 230.44	(78)
South 0.9x 0.77 x 2.4 x 114.87 x 0.63 x 0.7 = 168.51	(78)
South 0.9x 0.54 x 9.36 x 110.55 x 0.63 x 0.7 = 221.77	(78)
South 0.9x 0.77 x 2.4 x 110.55 x 0.63 x 0.7 = 162.17	(78)
South 0.9x 0.54 x 9.36 x 108.01 x 0.63 x 0.7 = 216.68	(78)
South 0.9x 0.77 x 2.4 x 108.01 x 0.63 x 0.7 = 158.45	(78)
South 0.9x 0.54 x 9.36 x 104.89 x 0.63 x 0.7 = 210.43	(78)
South 0.9x 0.77 x 2.4 x 104.89 x 0.63 x 0.7 = 153.87	(78)
South 0.9x 0.54 x 9.36 x 101.89 x 0.63 x 0.7 = 204.39	(78)
South 0.9x 0.77 x 2.4 x 101.89 x 0.63 x 0.7 = 149.46	(78)
South 0.9x 0.54 x 9.36 x 82.59 x 0.63 x 0.7 = 165.67	(78)
South 0.9x 0.77 x 2.4 x 82.59 x 0.63 x 0.7 = 121.15	(. 5)



South 0.9x	0.54	X	9.3	36	x	55.42	2	x	0.63	x	0.7		• [	111.17	(78)
South 0.9x	0.77	X	2.4	4	x	55.42	2	x	0.63	×	0.7		• [	81.29	(78)
South 0.9x	0.54	X	9.3	36	x	40.4		x	0.63	x	0.7		• [	81.04	(78)
South 0.9x	0.77	X	2.4	4	x	40.4		x	0.63	x	0.7		• [	59.26	(78)
Northwest 0.9x	0.77	X	1.0	)5	x	11.28	3	x	0.63	×	0.7	╗.	- ┌	3.62	(81)
Northwest 0.9x	0.77	х	1.0	)5	X	22.97	7	x	0.63	x	0.7	<b>=</b>	- ┌	7.37	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	41.38	3	x	0.63	×	0.7	<b>=</b>	- ┌	13.28	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	67.96	5	x	0.63	×	0.7	<b>=</b>	- ┌	21.81	(81)
Northwest 0.9x	0.77	х	1.0	)5	X	91.35	5	x	0.63	x	0.7	<b>=</b>	- ┌	29.31	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	97.38	3	x	0.63	×	0.7	<b>=</b>	- ┌	31.25	(81)
Northwest 0.9x	0.77	x	1.0	)5	x	91.1		x	0.63	x	0.7		• Ē	29.23	(81)
Northwest 0.9x	0.77	X	1.0	)5	x	72.63	3	x	0.63	x	0.7	<b>=</b>	• Ē	23.31	(81)
Northwest 0.9x	0.77	X	1.0	)5	x	50.42	2	x	0.63	x	0.7	<b>=</b>	· Ē	16.18	(81)
Northwest 0.9x	0.77	х	1.0	)5	X	28.07	7	x	0.63	×	0.7	<b>=</b>	- ┌	9.01	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	14.2		x	0.63	×	0.7	<b>-</b>	•	4.56	(81)
Northwest 0.9x	0.77	x	1.0	)5	x	9.21		x	0.63	×	0.7	<b>=</b>	- ┌	2.96	(81)
													_		
Solar gains in	n watts, ca	lculated	for eacl	h month			(8	83)m =	Sum(74)m .	(8 <mark>2</mark> )m					
(83)m= 220.83	374.38	513.25	646.99	741.52	7.	45.38 71	4.65	641.52	558.53	413.49	264.04	189.3	5		(83)
Total gains -	internal a	nd solar	(84)m =	= (73)m	+ (8	33)m , wa	atts								
(84)m= 803.3	954.47	1074.12	1176.47	1238.24	12	11.34 116	61 19 1	1094.8	1028.5	915.08	801.94	<b>75</b> 5.3	6		(84)
							01.10	1094.0	1020.3	313.00	001.94	7 00.0			. ,
7. Mean inte	ernal temp	erature					01.10	1094.8	020.3	313.00	001.94	700.0		-	
7. Mean inte			(hea <mark>ting</mark>	seasor	1)					313.00	001.94	700.0	<u> </u>	21	(85)
Temperatur	e during h	eating p	(heating eriods ir	season the livi	i) ing	area fron	n Table			310.00	001.94	700.0		21	
	e during h	eating p	(heating eriods ir	season the livi	ing n (se	area fron	n Table		h1 (°C)	Oct	Nov	Dec		21	
Temperatur Utilisation fa	e during h	eating pains for I	(heating eriods ir iving are	seasor the livi	n) ing n (s	area fron ee Table Jun	n Table	e 9, T	h1 (°C)					21	
Temperatur Utilisation fa  Jan (86)m= 1	e during heactor for ga	eating pains for I Mar 0.99	(heating eriods ir iving are Apr 0.97	seasor the livi ea, h1,m May	n) ing n (se	area fron	n Table 9a) Jul	e 9, T Aug 0.57	h1 (°C) Sep 0.84	Oct	Nov	Dec		21	(85)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern	e during heactor for garage Feb 1 al tempera	eating p ains for I Mar 0.99	(heating eriods ir iving are Apr 0.97	season the livi ea, h1,m May 0.89	ing (so	area from ee Table Jun C 0.71 0 w steps 3	n Table 9a) Jul	e 9, T Aug 0.57	h1 (°C) Sep 0.84	Oct	Nov	Dec		21	(85)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.07	re during heactor for garage Feb 1 1 al tempera 20.21	eating pains for Mar 0.99 ature in I 20.41	(heating eriods ir iving are 0.97	season the livi ea, h1,m May 0.89 ea T1 (fo	ollo	area from ee Table Jun C 0.71 0 w steps 3	9a) Jul 9.52 3 to 7 i	e 9, T  Aug  0.57  in Tak  21	Sep 0.84 ole 9c) 20.94	Oct 0.98	Nov 1	Dec		21	(86)
Temperatur  Utilisation fa  Jan  (86)m= 1  Mean intern (87)m= 20.07  Temperatur	e during heactor for garage Feb 1 al tempera 20.21 e during he	eating p ains for l Mar 0.99 ature in l 20.41 eating p	(heating eriods ir iving are 0.97 living are 20.67 eriods ir	season the livi ea, h1,m May 0.89 ea T1 (for 20.88	ollo	area from ee Table Jun 0.71 0 w steps 3 0.98	9a) Jul 0.52 3 to 7 i 21	e 9, T  Aug  0.57  in Tak  21	Sep 0.84 ole 9c) 20.94 Th2 (°C)	Oct 0.98	Nov 1	Dec 1 20.04		21	(85)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21	re during heactor for garage Feb 1 1 al tempera 20.21 e during heactor for garage feb 1 20.21	eating p Ains for Mar 0.99 Ature in 1 20.41 eating p 20.22	criods ir Apr 0.97 living are 20.67 eriods ir 20.23	season the living the hand the	ng (se ollo	area from ee Table Jun 0.71 0 w steps 3 0.98 elling fro 0.24 20	9a) Jul 0.52 3 to 7 i 21 0m Tab	e 9, T  Aug 0.57  in Tak 21  ile 9, 20.24	Sep 0.84 ole 9c) 20.94	Oct 0.98	Nov 1	Dec		21	(86)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa	re during heactor for gase Feb 1 1 al tempera 20.21 e during heactor for gase actor for gase 1 actor for gas	eating p Ains for I Mar 0.99 Ature in I 20.41 eating p 20.22 Ains for r	cheating eriods ir iving are 0.97 living are 20.67 eriods ir 20.23	season the livi ea, h1,m May 0.89 ea T1 (for 20.88 or rest of 20.23	ollo 2 h2,	area from ee Table Jun 0.71 0 w steps 3 0.98 2 elling from 0.24 20 m (see T	9a) Jul 0.52 3 to 7 i 21 0m Table 0.24 Table 9	e 9, T  Aug  0.57  in Tak  21  ile 9,  20.24	Sep 0.84 ole 9c) 20.94 Th2 (°C) 20.23	Oct 0.98 20.67	Nov 1 20.32 20.22	Dec 1 20.04 20.22		21	(85) (86) (87) (88)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21	re during heactor for garage Feb 1 1 al tempera 20.21 e during heactor for garage feb 1 20.21	eating p Ains for Mar 0.99 Ature in 1 20.41 eating p 20.22	criods ir Apr 0.97 living are 20.67 eriods ir 20.23	season the living the hand the	ollo 2 h2,	area from ee Table Jun 0.71 0 w steps 3 0.98 2 elling from 0.24 20 m (see T	9a) Jul 0.52 3 to 7 i 21 0m Tab	e 9, T  Aug 0.57  in Tak 21  ile 9, 20.24	Sep 0.84 ole 9c) 20.94 Th2 (°C)	Oct 0.98	Nov 1	Dec 1 20.04		21	(85)
Temperatur  Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.07  Temperatur  (88)m= 20.21  Utilisation fa  (89)m= 1  Mean intern	e during heactor for gase sector for gase sect	eating p Ains for I Mar 0.99 Ature in I 20.41 eating p 20.22 Ains for r 0.99 Ature in t	criods ir 20.67 eriods ir 20.67 eriods ir 20.23 est of do 0.96	season the living, hay 0.89 ea T1 (for 20.88 or rest of 20.23 welling, 0.85 of dwell	ollo ollo 2 h2,	area from ee Table Jun 0.71 0 w steps 3 0.98 2 elling from 0.24 20 m (see Table 20 T2 (follow	m Table 9a) Jul   0.52   3 to 7 i   21   0.24	Aug 0.57 in Tak 21 ole 9, 20.24 0a) 0.48	Sep 0.84  ole 9c) 20.94  Th2 (°C) 20.23  0.78	Oct 0.98 20.67 20.23 0.97 e 9c)	Nov 1 20.32 20.22	Dec 1 20.04 20.22		21	(85) (86) (87) (88) (89)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1	e during heactor for gase sector for gase sect	eating p Ains for I Mar 0.99 Ature in I 20.41 eating p 20.22 Ains for r 0.99	cheating eriods ir iving are 20.67 eriods ir 20.23 eest of do 0.96	season the livies, h1,m May 0.89 ea T1 (for 20.88 or rest of 20.23 welling, 0.85	ollo ollo 2 h2,	area from ee Table Jun 0.71 0 w steps 3 0.98 2 elling from 0.24 20 m (see Table 20 T2 (follow	m Table 9a) Jul   0.52   3 to 7 i   21   0.24	e 9, T  Aug 0.57 in Tak 21 ile 9, 20.24 0a) 0.48	Sep 0.84   0.84   0.94   0.78   0.78   0.78   0.78   0.78   0.718   0.	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83	Nov 1 20.32 20.22	Dec 1 20.04 20.22 1 1 18.91			(85) (86) (87) (88) (89)
Temperatur  Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.07  Temperatur  (88)m= 20.21  Utilisation fa  (89)m= 1  Mean intern	e during heactor for gase sector for gase sect	eating p Ains for I Mar 0.99 Ature in I 20.41 eating p 20.22 Ains for r 0.99 Ature in t	criods ir 20.67 eriods ir 20.67 eriods ir 20.23 est of do 0.96	season the living, hay 0.89 ea T1 (for 20.88 or rest of 20.23 welling, 0.85 of dwell	ollo ollo 2 h2,	area from ee Table Jun 0.71 0 w steps 3 0.98 2 elling from 0.24 20 m (see Table 20 T2 (follow	m Table 9a) Jul   0.52   3 to 7 i   21   0.24	Aug 0.57 in Tak 21 ole 9, 20.24 0a) 0.48	Sep 0.84   0.84   0.94   0.78   0.78   0.78   0.78   0.78   0.718   0.	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83	Nov 1 20.32 20.22	Dec 1 20.04 20.22 1 1 18.91		0.24	(85) (86) (87) (88) (89)
Temperatur Utilisation fa  [86]m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1  Mean intern	re during heactor for gase sector for gase sec	eating pains for I Mar 0.99 eature in I 20.41 eating pains for range of the control of the contr	cheating eriods ir iving are 20.67 eriods ir 20.23 est of do 0.96 the rest 19.83	season the living the	ollo 2 h2,	area from ee Table Jun 0.71 0 w steps 3 0.98 2 elling from 0.24 20 m (see T 0.63 0 T2 (follow 0.22 20	n Table 9a) Jul   0.52   3 to 7 i   21   0.24	e 9, T  Aug 0.57 in Tak 21 ile 9, 20.24 in 0.48 is 3 to 20.23	Sep 0.84   0.84   0.84   0.94   0.78   0.78   0.78   0.78   0.18	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83	Nov 1 20.32 20.22	Dec 1 20.04 20.22 1 1 18.91			(85) (86) (87) (88) (89)
Temperatur Utilisation fa  [86]m= 1  Mean interm (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1  Mean interm (90)m= 18.94	re during heactor for gase leading heactor for	eating pains for I Mar 0.99 eature in I 20.41 eating pains for range of the control of the contr	cheating eriods ir iving are 20.67 eriods ir 20.23 est of do 0.96 the rest 19.83	season the living the	n) ng (sollo) 2 h2, (iing) 2	area from ee Table Jun 0.71 0 w steps 3 0.98 2 0.98 2 0.63 0 T2 (follow 0.22 20 g) = fLA 3	m Table 9a) Jul 0.52 3 to 7 i 21 mm Tab 0.24 Table 9 0.43 w step 0.23	e 9, T  Aug 0.57 in Tak 21 ile 9, 20.24 in 0.48 is 3 to 20.23	Sep 0.84   0.84   0.84   0.94   0.78   0.78   0.78   0.78   0.18	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83	Nov 1 20.32 20.22	Dec 1 20.04 20.22 1 1 18.91			(85) (86) (87) (88) (89)
Temperatur Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1  Mean intern (90)m= 18.94	re during heactor for gase sector for gase sec	eating pains for Mar 0.99 eature in 1 20.41 eating pains for range of 19.45 eature in 1 19.45 eature in 1 19.45	cheating eriods ir iving are 20.67 eriods ir 20.23 eest of do 0.96 the rest 19.83 er the who 20.03	season the living the	ollo ollo properties of the second se	area from ee Table Jun	n Table 9a) Jul 0.52 3 to 7 i 21 cm Table 0.24 Table 9 0.43 w step 0.23  × T1 + 0.42	e 9, T  Aug 0.57 in Tab 21 ile 9, 20.24 in 20.24 in 20.24 in 20.24 in 20.24 in 20.24	Sep 0.84  ole 9c) 20.94  Th2 (°C) 20.23  0.78  0.7 in Table 20.18  ftLA) × T2 20.37	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83 LA = Liv	Nov 1 20.32 20.22 1 19.32 ing area ÷ (4	Dec 1 20.04 20.22 1 18.91			(85) (86) (87) (88) (89) (90) (91)
Temperatur Utilisation fa  [86]m= 1  Mean interm (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1  Mean interm (90)m= 18.94  Mean interm (92)m= 19.22	re during heactor for gas al tempera 19.41 tment to the actor for gas al tempera 19.41	eating pains for Mar 0.99 eature in 1 20.41 eating pains for range of 19.45 eature in 1 19.45 eature in 1 19.45	cheating eriods ir iving are 20.67 eriods ir 20.23 eest of do 0.96 the rest 19.83 er the who 20.03	season the living the	h2, (sing 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	area from ee Table Jun 0.71 0 w steps 3 0.98 2 0.98 2 0.024 20 0.24 20 0.63 0 T2 (follor 0.22 20 0.41 20 0.41 20 0.41 20 0.41 20 0.41 20	m Table 9a) Jul 0.52 3 to 7 i 21 mm Tab 0.24  Table 9 0.43 w step 0.23  × T1 + 0.42  Table 4	e 9, T  Aug 0.57 in Tab 21 ile 9, 20.24 in 20.24 in 20.24 in 20.24 in 20.24 in 20.24	Sep 0.84  ole 9c) 20.94  Th2 (°C) 20.23  0.78  0.7 in Table 20.18  ftLA) × T2 20.37	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83 LA = Liv	Nov 1 20.32 20.22 1 19.32 ing area ÷ (4	Dec 1 20.04 20.22 1 18.91			(85) (86) (87) (88) (89) (90) (91)
Temperatur Utilisation fa  [86]m= 1  Mean intern (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1  Mean intern (90)m= 18.94  Mean intern (92)m= 19.22  Apply adjus	re during heactor for gase sector for gase sec	eating pains for land of land	criods ir 20.23 rest of dr 0.96 the rest 19.83 r the wh 20.03 internal	season the livi ea, h1,m May 0.89 ea T1 (for 20.88 n rest of 20.23 welling, 0.85 of dwell 20.11 ole dwe 20.3 I temper	h2, (sing 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	area from ee Table Jun 0.71 0 w steps 3 0.98 2 0.98 2 0.024 20 0.24 20 0.63 0 T2 (follor 0.22 20 0.41 20 0.41 20 0.41 20 0.41 20 0.41 20	m Table 9a) Jul 0.52 3 to 7 i 21 mm Tab 0.24  Table 9 0.43 w step 0.23  × T1 + 0.42  Table 4	e 9, T  Aug 0.57  in Tak 21  ble 9, 20.24  0a) 0.48  os 3 to 20.23  (1 - 20.42  1e, wh	Sep 0.84  ole 9c) 20.94  Th2 (°C) 20.23  0.78  7 in Table 20.18  fLA) × T2 20.37  here approximates	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83 LA = Liv	Nov 1 20.32 20.22 1 19.32 ing area ÷ (4	Dec 1 20.04 20.22 1 18.91 4) =			(85) (86) (87) (88) (89) (90) (91)
Temperatur Utilisation fa  [86]m= 1  Mean interm (87)m= 20.07  Temperatur (88)m= 20.21  Utilisation fa (89)m= 1  Mean interm (90)m= 18.94  Mean interm (92)m= 19.22  Apply adjus (93)m= 19.22	re during heactor for gase sector for gase sec	eating pains for pains for rature in 1 20.41 eating pains for rature in 1 19.45 eature (for 19.69 eature mean 19.69 eature in tall terment ernal terment	cheating eriods ir iving are 20.67 living are 20.67 eriods ir 20.23 rest of drough the rest 19.83 rest of drough the rest 20.03 internal 20.03	season the livi ea, h1,m May 0.89 ea T1 (for 20.88 n rest of 20.23 welling, 0.85 of dwell 20.11  ole dwe 20.3 temper 20.3	h2,  (colling 2)  h2,  (colling 2)  ratu  2	area from ee Table Jun 0.71 0 w steps 3 0.98 2 0.98 2 0.024 20 m (see T 0.63 0 T2 (follor 0.22 20 g) = fLA 3 0.41 20 re from T 0.41 20	m Table 9a) Jul 0.52 3 to 7 i 21 cm Tab 0.24  Table 9 0.43  w step 0.23  x T1 + 0.42  Table 4 0.42	e 9, T  Aug 0.57 in Tak 21 lle 9, 20.24 0a) 0.48 0s 3 to 20.23 (1 - 20.42 1e, wh 20.42	Sep 0.84  ole 9c) 20.94  Th2 (°C) 20.23  0.78  7 in Table 20.18  fLA) × T2 20.37  nere approximate approximates approximat	Oct 0.98 20.67 20.23 0.97 e 9c) 19.83 LA = Liv	Nov 1 20.32 20.22 1 19.32 ing area ÷ (4 19.56	Dec 1 20.04 20.22 1 18.91 19.19		0.24	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

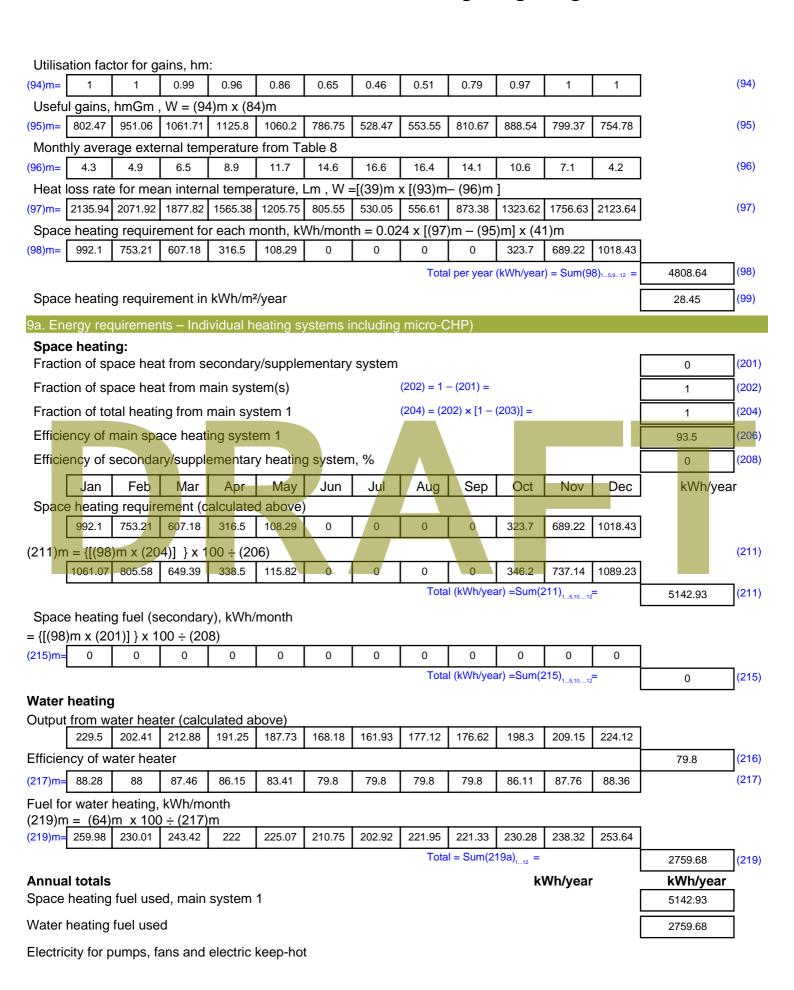
Dec

Mar

Jan

Feb







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			564.52	(232)

### 12a. CO2 emissions – Individual heating systems including micro-CHP

	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1110.87 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216	596.09 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1706.96 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	292.98 (268)
Total CO2, kg/year	sum	of (265)(271) =	2038.87 (272)





User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 23 - 2B4P - MF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 97.32 (1a) x 2.7 (2a) =(3a) 262.76 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)97.32 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =262.76 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)3 30 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.11 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) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.36 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.31 Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m =5.1 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) =	· (21a) x (22a)m	
0.39 0.39 0.38 0.34 0.33 0.29 0.29	<del>`````</del>	.36
Calculate effective air change rate for the applicable case		
If mechanical ventilation:		0 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (		0 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (fror	n Table 4h) =	0 (23c)
a) If balanced mechanical ventilation with heat recovery (MV	HR) $(24a)$ m = $(22b)$ m + $(23b)$ × $[1 - (24a)]$	<u>`                                    </u>
(24a)m= 0 0 0 0 0 0	0 0 0 0	0 (24a)
b) If balanced mechanical ventilation without heat recovery (I	MV) (24b)m = (22b)m + (23b)	
(24b)m= 0 0 0 0 0 0	0 0 0 0	0 (24b)
c) If whole house extract ventilation or positive input ventilation if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c)$		
(24c)m= 0 0 0 0 0 0	0 0 0 0	0 (24c)
d) If natural ventilation or whole house positive input ventilation if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m =		
(24d)m= 0.58 0.57 0.57 0.56 0.56 0.54 0.54	<del> </del>	.57 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24	ld) in box (25)	
(25)m= 0.58 0.57 0.57 0.56 0.56 0.54 0.54	<del>' ' '                                </del>	.57 (25)
3. Heat losses and heat loss parameter:  ELEMENT Gross Openings Net Area A,m²		value A X k l/m²-K kJ/K
	/[1/( 1.4 )+ 0.04] = 3.35	(27)
	/[1/( 1.4 )+ 0.04] = 3.35	(27)
	/[1/( 1.4 )+ 0.04] = 10.46	(27)
	/[1/( 1.4 )+ 0.04] = 3.14	(27)
	/[1/( 1.4 )+ 0.04] = 2.09	(27)
Walls Type1 92.42 24.33 68.09 x	0.18 = 12.26	(29)
Walls Type2 29.89 0 29.89 x	0.18 = 5.38	(29)
Total area of elements, m <sup>2</sup> 122.31		(31)
Party wall 23.22 x	0 = 0	(32)
Party floor 97.32		(32a)
Party ceiling 97.32		(32b)
* for windows and roof windows, use effective window U-value calculated using ** include the areas on both sides of internal walls and partitions	g formula 1/[(1/U-value)+0.04] as given in para	
Fabric heat loss, W/K = S (A x U)	(26)(30) + (32) =	49.89 (33)
Heat capacity Cm = S(A x k)	((28)(30) + (32) + (32a)(32	2e) = 14715.9 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250 (35)
For design assessments where the details of the construction are not known particles of the construction are not known particles.	recisely the indicative values of TMP in Table	, ,
Thermal bridges: S (L x Y) calculated using Appendix K		6.12 (36)
if details of thermal bridging are not known (36) = $0.05 \times (31)$		
Total fabric heat loss	(33) + (36) =	56.01 (37)



ntilation 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		
)m= 50.11	49.85	49.59	48.38	48.16	47.11	47.11	46.91	47.51	48.16	48.61	49.09		(38
eat transfer o	coefficier	nt, W/K						(39)m	= (37) + (	38)m	•		
)m= 106.12	105.85	105.6	104.39	104.16	103.11	103.11	102.92	103.52	104.16	104.62	105.1		
	!							,	Average =	Sum(39) <sub>1</sub>	12 /12=	104.39	(39
at loss para	meter (H	HLP), W/	m²K						= (39)m ÷	•			
)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		<b></b> ,,
ımber of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.07	(40
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
. Water hea	ting ene	rgy requi	irement:								kWh/ye	ar:	
sumed occu	ıpancy, l	N								2.	.71		(4
if TFA > 13.		+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.				
if TFA £ 13.9 Inual averag	•	otor uco	ao io litro	oc par da	w Vd av	orago –	(25 v N)	. 26			1		
du <mark>ce the annua</mark>									se target o		3.64		(4
more that 125	litres per	person per	day (all w	ater use, l	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t w <mark>ater u</mark> sage i	n litres per	day for ea	ach m <mark>onth</mark>	Vd,m = fa	ctor from T	Table 1c x	(43)						
)m= 108.5	104.56	100.61	96.67	92.72	88.78	88.78	92.72	96.67	100.61	104.56	108.5		
ergy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	1183.69	(4
)m= 160.91	140.73	145.22	126.61	121.48	104.83	97.14	111.47	112.8	131.46	143.5	155.83		
							ļ		Total = Su	m(45) <sub>112</sub> =	=	1552	(4
nstantaneous พ	vater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)			-		
)m= 24.14	21.11	21.78	18.99	18.22	15.72	14.57	16.72	16.92	19.72	21.53	23.37		(4
ater storage													
orage volum	` '		•			•		ame ves	sel		150		(4
community h	•			•			` '	ore) onto	or 'O' in <i>(</i>	<b>17</b> \			
ater storage		not wate	i (uno n	iciuu <del>c</del> s i	HStaritai	ieous cc	ווטט וטוווו	cis) cill	ווו ט ווו (	41)			
If manufact		eclared l	oss facto	or is kno	wn (kWh	n/day):				1.	.91		(4
mperature f	actor fro	m Table	2b							0.	.54		(4
ergy lost fro				ear			(48) x (49)	=		1	.03		(!
If manufact		_	-		or is not	known:							•
t water stor	•			e 2 (kW	h/litre/da	ıy)					0		( !
community h	_		on 4.3										
lume factor mperature f			2h							_	0		(5
·							(47) (51)	··· (EO) · · ·	<b>50</b> )		0		(5
ergy lost fro		_	, KVVh/ye	ear			(47) x (51)	x (52) x (	53) =	-	0		(5
nter (50) or o	. , .	,	for oask	month			(/EG\~~ '	EE) (44)	~	1.	.03		(5
ater storage	ioss cal	cuiated 1	or each	เบอกเท			((56)m = (	ວວ <i>)</i> × (41)ເ	Ш				
)m= 32.03	28.93	32.03	30.99		30.99	32.03				30.99	32.03		(!



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= 32.03 28.93 32.03 30.99 32.03 30.99 32.03 30.99 32.03 30.99 32.03 30.99 32.03	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)$	m
(62)m= 216.2 190.67 200.51 180.12 176.77 158.34 152.43 166.76 166.31 186.75 197.01 211.12	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 216.2 190.67 200.51 180.12 176.77 158.34 152.43 166.76 166.31 186.75 197.01 211.12	_
Output from water heater (annual) <sub>112</sub> 2202.99	(64)
Heat gains from water heating, kWh/month $0.25 (0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$	
(65)m= 97.73 86.74 92.52 84.9 84.63 77.66 76.53 81.3 80.31 87.94 90.52 96.05	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
F. Internal gains (one Table F and Fo):	
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Metabolic gains (Table 5), Watts	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       135.66	(66) (67)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       135.66	, ,
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       135.66	, ,
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 135.66 135	(67) (68) (69) (70) (71)

Flux

Table 6a

Table 6b

Table 6c

Area

m²

Orientation: Access Factor

Table 6d

Gains

(W)

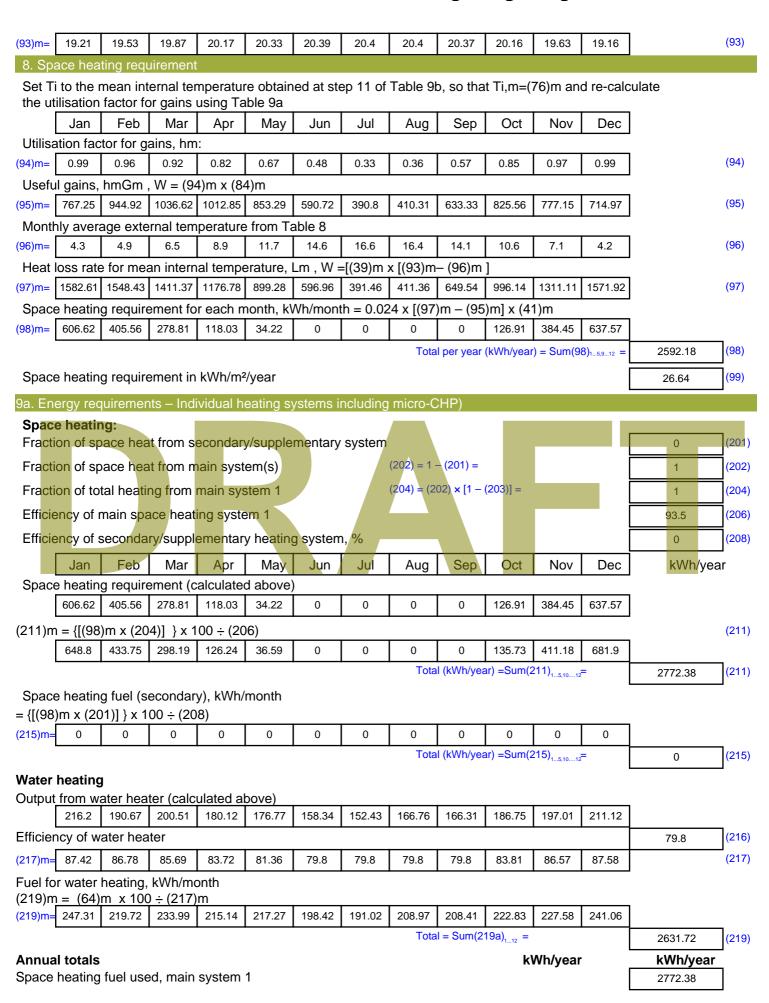


Southeast 9													
Southeast 0 to 1 to 2 to 3	Southeast 0.9x	0.77	X	7.89	X	36.79	X	0.63	x	0.7	=	88.72	(77)
Southeast 0.50	Southeast 0.9x	0.77	X	1.58	x	36.79	x	0.63	x	0.7	=	17.77	(77)
Southeast 0.sk	Southeast 0.9x	0.77	X	7.89	X	62.67	X	0.63	x	0.7	=	151.12	(77)
Southeast 0.5%	Southeast 0.9x	0.77	X	1.58	x	62.67	x	0.63	x	0.7	=	30.26	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	x	85.75	x	0.63	x	0.7	=	206.77	(77)
Southeast 0,9x	Southeast 0.9x	0.77	X	1.58	x	85.75	x	0.63	x	0.7	=	41.41	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	x	106.25	X	0.63	x	0.7	=	256.2	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.58	x	106.25	X	0.63	x	0.7	=	51.31	(77)
Southeast 0,5x	Southeast 0.9x	0.77	X	7.89	X	119.01	X	0.63	x	0.7	=	286.97	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.58	X	119.01	X	0.63	x	0.7	=	57.47	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	X	118.15	X	0.63	x	0.7	] =	284.89	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.58	x	118.15	X	0.63	x	0.7	=	57.05	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	x	113.91	X	0.63	x	0.7	] =	274.67	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.58	X	113.91	X	0.63	X	0.7	=	55	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	x	104.39	X	0.63	x	0.7	=	251.72	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.58	x	104.39	X	0.63	x	0.7	] =	50.41	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	x	92.85	X	0.63	x	0.7	=	223.89	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	1.58	X	92.85	X	0.63	X	0.7	=	44.84	(77)
Southeast 0.9x	Southeast 0.9x	0.77	x	7.89	х	69.27	X	0.63	x	0.7	=	167.02	(77)
Southeast 0.9x	Southeast 0.9x	0.77	x	1.58	x	69.27	×	0.63	x	0.7	=	33.45	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	7.89	X	44.07	X	0.63	x	0.7	=	106.27	(77)
Southeast 0.9x         0.77         x         1.58         x         31.49         x         0.63         x         0.7         =         15.2         (77)           South         0.9x         0.77         x         2.53         x         46.75         x         0.63         x         0.7         =         72.3         (78)           South         0.9x         0.77         x         2.53         x         46.75         x         0.63         x         0.7         =         72.3         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x </td <td>Southeast 0.9x</td> <td>0.77</td> <td>x</td> <td>1.58</td> <td>x</td> <td>44.07</td> <td>Х</td> <td>0.63</td> <td>x</td> <td>0.7</td> <td>=</td> <td>21.28</td> <td>(77)</td>	Southeast 0.9x	0.77	x	1.58	x	44.07	Х	0.63	x	0.7	=	21.28	(77)
South         0.9x         0.77         x         2.53         x         46.75         x         0.63         x         0.7         =         72.3         (78)           South         0.9x         0.77         x         2.53         x         46.75         x         0.63         x         0.7         =         72.3         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23	Southeast 0.9x	0.77	x	7.89	x	31.49	X	0.63	x	0.7	=	75.93	(77)
South         0.9x         0.77         x         2.53         x         46.75         x         0.63         x         0.7         =         72.3         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         111.23 <td>Southeast <sub>0.9x</sub></td> <td>0.77</td> <td>X</td> <td>1.58</td> <td>x</td> <td>31.49</td> <td>X</td> <td>0.63</td> <td>x</td> <td>0.7</td> <td>=</td> <td>15.2</td> <td>(77)</td>	Southeast <sub>0.9x</sub>	0.77	X	1.58	x	31.49	X	0.63	x	0.7	=	15.2	(77)
South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         114.87	South 0.9x	0.77	X	2.53	x	46.75	X	0.63	X	0.7	=	72.3	(78)
South         0.9x         0.77         x         2.53         x         76.57         x         0.63         x         0.7         =         118.4         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.	South 0.9x	0.77	X	2.53	X	46.75	X	0.63	X	0.7	=	72.3	(78)
South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         11	South 0.9x	0.77	X	2.53	x	76.57	X	0.63	X	0.7	=	118.4	(78)
South         0.9x         0.77         x         2.53         x         97.53         x         0.63         x         0.7         =         150.83         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         1	South 0.9x	0.77	X	2.53	X	76.57	x	0.63	X	0.7	=	118.4	(78)
South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         170.95         (78)           South         0.9x         0.77         x         2.53         x         108.01         x         0.63         x         0.7         =         167.03         (78)           South         0.9x         0.77         x         2.53         x	South <sub>0.9x</sub>	0.77	X	2.53	X	97.53	X	0.63	X	0.7	=	150.83	(78)
South         0.9x         0.77         x         2.53         x         110.23         x         0.63         x         0.7         =         170.47         (78)           South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         170.95         (78)           South         0.9x         0.77         x         2.53         x         108.01         x         0.63         x         0.7         =         167.03         (78)           South         0.9x         0.77         x         2.53         x	South 0.9x	0.77	X	2.53	X	97.53	X	0.63	X	0.7	=	150.83	(78)
South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         114.87         x         0.63         x         0.7         =         177.64         (78)           South         0.9x         0.77         x         2.53         x         110.55         x         0.63         x         0.7         =         170.95         (78)           South         0.9x         0.77         x         2.53         x         108.01         x         0.63         x         0.7         =         170.95         (78)           South         0.9x         0.77         x         2.53         x         108.01         x         0.63         x         0.7         =         167.03         (78)           South         0.9x         0.77         x         2.53         x         104.89         x         0.63         x         0.7         =         167.03         (78)           South         0.9x         0.77         x         2.53         x	South <sub>0.9x</sub>	0.77	X	2.53	X	110.23	X	0.63	X	0.7	=	170.47	(78)
South       0.9x       0.77       x       2.53       x       114.87       x       0.63       x       0.7       =       177.64       (78)         South       0.9x       0.77       x       2.53       x       110.55       x       0.63       x       0.7       =       170.95       (78)         South       0.9x       0.77       x       2.53       x       110.55       x       0.63       x       0.7       =       170.95       (78)         South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78) <td>South <sub>0.9x</sub></td> <td>0.77</td> <td>X</td> <td>2.53</td> <td>X</td> <td>110.23</td> <td>X</td> <td>0.63</td> <td>X</td> <td>0.7</td> <td>=</td> <td>170.47</td> <td>(78)</td>	South <sub>0.9x</sub>	0.77	X	2.53	X	110.23	X	0.63	X	0.7	=	170.47	(78)
South       0.9x       0.77       x       2.53       x       110.55       x       0.63       x       0.7       =       170.95       (78)         South       0.9x       0.77       x       2.53       x       110.55       x       0.63       x       0.7       =       170.95       (78)         South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)	South 0.9x	0.77	X	2.53	X	114.87	X	0.63	X	0.7	=	177.64	(78)
South       0.9x       0.77       x       2.53       x       110.55       x       0.63       x       0.7       =       170.95       (78)         South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)	South 0.9x	0.77	X	2.53	X	114.87	X	0.63	X	0.7	=	177.64	(78)
South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)	South 0.9x	0.77	×	2.53	x	110.55	X	0.63	x	0.7	] =	170.95	(78)
South       0.9x       0.77       x       2.53       x       108.01       x       0.63       x       0.7       =       167.03       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)	South 0.9x	0.77	X	2.53	x	110.55	X	0.63	x	0.7	=	170.95	(78)
South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)         South       0.9x       0.77       x       2.53       x       104.89       x       0.63       x       0.7       =       162.21       (78)	<u>L</u>	0.77	×	2.53	x	108.01	X	0.63	x	0.7	] =	167.03	(78)
South 0.9x 0.77 x 2.53 x 104.89 x 0.63 x 0.7 = 162.21 (78)	<u>L</u>	0.77	×	2.53	x	108.01	X	0.63	X	0.7	] =	167.03	(78)
	<u>L</u>	0.77	×	2.53	x	104.89	X	0.63	x	0.7	] =	162.21	(78)
South 0.9x 0.77 x 2.53 x 101.89 x 0.63 x 0.7 = 157.56 (78)	<u>L</u>	0.77	×	2.53	x	104.89	X	0.63	X	0.7	] =	162.21	(78)
	South 0.9x	0.77	X	2.53	X	101.89	X	0.63	X	0.7	=	157.56	(78)



South 0.9x	0.77	X	2.53	3	x	101.89	X	0.63	X	0.7	=	157.56	(78)
South 0.9x	0.77	X	2.53	3	x	82.59	x	0.63	X	0.7	=	127.71	(78)
South 0.9x	0.77	X	2.53	3	x	82.59	X	0.63	X	0.7	=	127.71	(78)
South 0.9x	0.77	X	2.53	3	x	55.42	X	0.63	X	0.7	=	85.7	(78)
South 0.9x	0.77	X	2.53	3	х	55.42	x	0.63	X	0.7	=	85.7	(78)
South 0.9x	0.77	X	2.53	3	x	40.4	X	0.63	X	0.7	=	62.47	(78)
South 0.9x	0.77	X	2.53	3	x	40.4	X	0.63	X	0.7	=	62.47	(78)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	36.79		0.63	X	0.7	=	53.3	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	62.67		0.63	X	0.7	=	90.79	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	85.75		0.63	X	0.7	=	124.22	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	106.25		0.63	X	0.7	=	153.92	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	119.01		0.63	X	0.7	=	172.4	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	118.15	]	0.63	×	0.7	=	171.15	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	113.91		0.63	X	0.7	=	165.01	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	104.39	]	0.63	X	0.7	=	151.22	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	92.85		0.63	x	0.7		134.51	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	69.27		0.63	X	0.7	=	100.34	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.3	7	x	44.07		0.63	X	0.7	=	63.84	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.3	7 ;	×	31.49	] ,	0.63	x	0.7	=	45.61	(79)
Sola <mark>r gain</mark> s in	watts, cal	lculated	for each	month			(83)m	n = Sum(74)m	.(8 <mark>2</mark> )m			,	
(83)m= 304.38	508.99	674.06	802.36	872.11	855	828.74	777	.76 718.35	556.23	362.78	261.69		(83)
			15.0			_							
Total gains –			<u> </u>	` '								1	(2.4)
Total gains – (84)m= 776.82		nd solar 1129.28	(84)m = 1233.18	` '	(83)n		1150	0.47 1103.64	966.1	5 801.02	721.37		(84)
	979.25	1129.28	1233.18	1277.95			1150	0.47 1103.64	966.1	5 801.02	721.37		(84)
(84)m= 776.82	979.25	1129.28 erature (	1233.18 (heating	1277.95 season)	1236.9	1195.15			966.1	5 801.02	721.37	21	(84)
(84)m= 776.82 7. Mean inte	979.25 rnal tempe e during he	1129.28 erature (	1233.18 (heating eriods in	season)	1236.9	1195,15 a from Tak			966.1	5 801.02	721.37	21	
776.82  7. Mean inte	979.25 rnal tempe e during he	1129.28 erature (	1233.18 (heating eriods in	season)	1236.9	1195,15 a from Tab	ole 9		966.11 Oct		721.37 Dec	21	(85)
7. Mean inte Temperature Utilisation fac	979.25 rnal tempe e during he ctor for ga	erature (eating points for li	heating eriods in ving are	season) the livin	1236.9	1195,15 a from Tab	ole 9	, Th1 (°C)				21	
7. Mean inte Temperature Utilisation far	979.25  rnal temper during he ctor for ga  Feb  0.98	erature (eating points for limits of limits)	theating eriods in a ving are Apr 0.85	season) the livin a, h1,m May 0.71	g area (see T Jun 0.52	a from Tab able 9a) Jul 0.38	ole 9	, Th1 (°C) ug Sep	Oct	Nov	Dec	21	(85)
7. Mean inte Temperature Utilisation far  Jan (86)m= 0.99	979.25  rnal temper during he ctor for ga  Feb  0.98	erature (eating points for limits of limits)	theating eriods in a ving are Apr 0.85	season) the livin a, h1,m May 0.71	g area (see T Jun 0.52	a from Tab able 9a) Jul 0.38	ole 9	, Th1 (°C)  ug Sep  11 0.62  Table 9c)	Oct	Nov 0.98	Dec	21	(85)
7. Mean inte Temperature Utilisation far  (86)m= 0.99  Mean interna	rnal temper e during he ctor for ga Feb 0.98 al tempera 20.27	erature (eating points for lims for lim	heating eriods in ving are Apr 0.85 iving are 20.79	season) the livin a, h1,m May 0.71 ea T1 (fo	1236.9 ag area (see T Jun 0.52 llow st 20.99	1195,15 a from Tak able 9a) Jul 0.38 teps 3 to 7	ole 9  A  0.4  7 in T	sep   Sep   1   0.62   Table 9c)   1   20.97	Oct 0.89	Nov 0.98	Dec 0.99	21	(85)
7. Mean inte Temperature Utilisation far  (86)m= 0.99  Mean internation (87)m= 20.02	rnal temper e during he ctor for ga Feb 0.98 al tempera 20.27	erature (eating points for lims for lim	heating eriods in ving are Apr 0.85 iving are 20.79	season) the livin a, h1,m May 0.71 ea T1 (fo	1236.9 ag area (see T Jun 0.52 llow st 20.99	1195,15 a from Tak able 9a) Jul 0.38 teps 3 to 7 21	ole 9  A  0.4  7 in T	y, Th1 (°C)  ug Sep  1 0.62  Table 9c) 1 20.97  9, Th2 (°C)	Oct 0.89	Nov 0.98	Dec 0.99	21	(85)
776.82  7. Mean interpretature  Temperature  Utilisation far  Jan  (86)m= 0.99  Mean internation  (87)m= 20.02  Temperature  (88)m= 20.01	979.25  rnal temper e during he ctor for ga  Feb  0.98  al tempera  20.27  e during he 20.01	erature (eating poins for limited Mar 0.94 atture in lace) 20.54 eating poins 20.01	theating eriods in ving are Apr 0.85 ving are 20.79 eriods in 20.02	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03	1236.9  In garea (see T  Jun  0.52  Illow st  20.99  dwellin  20.03	1195,15 a from Take Table 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03	ole 9  A  0.4  7 in T  2  able 9	y, Th1 (°C)  ug Sep  1 0.62  Table 9c) 1 20.97  9, Th2 (°C)	Oct 0.89	Nov 0.98	Dec 0.99	21	(86)
776.82  7. Mean inte Temperature Utilisation far  Jan (86)m= 0.99  Mean interna (87)m= 20.02  Temperature	979.25  rnal temper e during he ctor for ga  Feb  0.98  al tempera  20.27  e during he 20.01	erature (eating poins for limited Mar 0.94 atture in lace) 20.54 eating poins 20.01	theating eriods in ving are Apr 0.85 ving are 20.79 eriods in 20.02	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03	1236.9  Ig area (see T  Jun 0.52  Illow st 20.99  dwellin 20.03	1195,15 a from Take Table 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03	ole 9  A  0.4  7 in T  2  able 9	Table 9c) 1 20.97 9, Th2 (°C) 04 20.03	Oct 0.89	Nov 0.98	Dec 0.99	21	(86)
7. Mean intercontrol (84)m= 776.82  7. Mean intercontrol (86)m= 0.99  Mean intercontrol (87)m= 20.02  Temperature (88)m= 20.01  Utilisation factor (89)m= 0.99	rnal tempera during her ctor for gar lempera 20.27 e during her 20.01 ctor for gar lempera 0.97	erature of eating points for line atting points for line atting points for rough of the eating points for rough of the eatin	heating eriods in ving are 0.85 iving are 20.79 eriods in 20.02 est of dw	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03 velling, h 0.65	1236.9  ag area (see T  Jun 0.52  Illow st 20.99  dwellin 20.03  a2,m (s	1195,15 a from Tak able 9a) Jul 0.38 teps 3 to 7 21 ag from Tak 20.03 see Table 0.3	A 0.4  7 in 1  2  20.  9a)  0.3	Table 9c) 1 20.97 9, Th2 (°C) 04 20.03	Oct 0.89 20.78 20.03	Nov 0.98 20.35	Dec 0.99 19.98	21	(85) (86) (87) (88)
776.82  7. Mean interpretation for Jan (86)m= 0.99  Mean interna (87)m= 20.02  Temperature (88)m= 20.01  Utilisation for (89)m= 0.99  Mean interna	rnal tempera during he ctor for ga	erature (eating points for line 120.54 eating points for rough) eating points for rough atture in terms for rough eating points for rough eating point	heating eriods in ving are Apr 0.85 ving are 20.79 eriods in 20.02 est of dw 0.82 he rest of	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03 velling, h 0.65	1236.9 ag area (see T  Jun 0.52 llow st 20.99 dwellin 20.03 a2,m (s 0.45 ag T2	1195,15 a from Take Table 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03 see Table 0.3 (follow steeps)	A 0.47 in 1 2 20. 9a) 0.3	y, Th1 (°C)  ug Sep  1 0.62  Table 9c) 1 20.97  9, Th2 (°C) 04 20.03  32 0.55  1 to 7 in Table	Oct 0.89 20.78 20.03 0.85 9c)	Nov 0.98 20.35 20.02	Dec 0.99 19.98	21	(85) (86) (87) (88)
7. Mean intercontrol (84)m= 776.82  7. Mean intercontrol (86)m= 0.99  Mean intercontrol (87)m= 20.02  Temperature (88)m= 20.01  Utilisation factor (89)m= 0.99	rnal tempera during her ctor for gar lempera 20.27 e during her 20.01 ctor for gar lempera 0.97	erature of eating points for line atting points for line atting points for rough of the eating points for rough of the eatin	heating eriods in ving are 0.85 iving are 20.79 eriods in 20.02 est of dw	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03 velling, h 0.65	1236.9  ag area (see T  Jun 0.52  Illow st 20.99  dwellin 20.03  a2,m (s	1195,15 a from Take Table 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03 see Table 0.3 (follow steeps)	A 0.4  7 in 1  2  20.  9a)  0.3	Table 9c) 1 20.97 9, Th2 (°C) 04 20.03 1 20.03 1 20.01	Oct 0.89  20.78  20.03  0.85  9c) 19.79	Nov 0.98 20.35 20.02	Dec 0.99 19.98 20.02 0.99		(85) (86) (87) (88) (89)
7. Mean internation (84)m = 776.82  7. Mean internation far Jan (86)m = 0.99  Mean internation (87)m = 20.02  Temperature (88)m = 20.01  Utilisation far (89)m = 0.99  Mean internation (90)m = 18.73	rnal tempera de during he ctor for ga	erature (eating points for line 10.94 eating points for rough) atture in the 19.46 eating points for rough eating	heating eriods in ving are Apr 0.85 viving are 20.79 eriods in 20.02 est of dw 0.82 he rest of 19.8	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03 velling, h 0.65 of dwellin 19.97	1236.9  In a grade (see T Jun 0.52  Illow st 20.99  In a grade (see T Jun 0.52  Illow st 20.03  In a grade (see T Jun 0.45  In grade (see T Jun 0.45)  In grade (	1195,15 a from Take Table 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03 see Table 0.3 (follow stee 20.03	A 0.4 7 in 1 2 20. 9a) 0.3 20.	Table 9c) 1 20.97 9, Th2 (°C) 04 20.03 1 20.05 1 to 7 in Table 03 20.01	Oct 0.89  20.78  20.03  0.85  9c) 19.79	Nov 0.98 20.35 20.02 0.97	Dec 0.99 19.98 20.02 0.99	21	(85) (86) (87) (88)
776.82  7. Mean interpretation factor (86)m= 0.99  Mean internation factor (87)m= 20.02  Temperature (88)m= 20.01  Utilisation factor (89)m= 0.99  Mean internation factor (90)m= 18.73	rnal tempera during he ctor for ga	erature (eating poins for line 19.54 eating point 20.54 eating point 19.46 eating point 1	heating eriods in ving are Apr 0.85 ving are 20.79 eriods in 20.02 est of dw 0.82 he rest of the rest of the whole of the	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03 velling, h 0.65 of dwellin 19.97	1236.9  In g area (see T Jun 0.52  Illow st 20.99  In g T2 10.03  In g T2 10.03  Illing) =	1195,15 a from Take able 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03 see Table 0.3 (follow stee 20.03	A 0.4 0.4 10 10 10 10 10 10 10 10 10 10 10 10 10	y, Th1 (°C)  ug Sep 1 0.62  Table 9c) 1 20.97  9, Th2 (°C) 04 20.03  32 0.55  1 to 7 in Table 03 20.01  ft  - fLA) × T2	Oct 0.89  20.78  20.03  0.85  9 9c)  19.79  A = Liv	Nov 0.98 20.35 20.02 0.97 19.2 ving area ÷ (4	Dec 0.99 19.98 20.02 0.99 18.66		(85) (86) (87) (88) (89) (90) (91)
7. Mean internation (84)m = 776.82  7. Mean internation far Jan (86)m = 0.99  Mean internation (87)m = 20.02  Temperature (88)m = 20.01  Utilisation far (89)m = 0.99  Mean internation (90)m = 18.73	rnal tempera during he ctor for gar 20.27 de during he 20.01 ctor for gar 19.08 de la tempera 19.08 de la tempera 19.08 de la tempera 19.53	erature eating points for line for rough of the later of	heating eriods in ving are 20.79 eriods in 20.02 est of dw 0.82 he rest of 19.8 eriods in 19.8 e	season) the livin a, h1,m May 0.71 ea T1 (fo 20.94 rest of c 20.03 velling, h 0.65 of dwellin 19.97 ole dwell 20.33	1236.9  In a graph of the second of the seco	1195,15 a from Take Table 9a) Jul 0.38 teps 3 to 7 21 ag from Take 20.03 see Table 0.3 (follow stee 20.03	Dole 9  A 0.4  7 in 1  2  9a)  0.3  + (1  20	y Th1 (°C)  ug Sep 10.62  Table 9c) 1 20.97  9, Th2 (°C) 04 20.03  32 0.55  1 to 7 in Table 03 20.01  ft  ft - fLA) × T2  4 20.37	Oct 0.89 20.78 20.03 0.85 9 9c) 19.79 A = Liv	Nov 0.98 20.35 20.02 0.97 19.2 ving area ÷ (4	Dec 0.99 19.98 20.02 0.99		(85) (86) (87) (88) (89)







					,
Water heating fuel used				2631.72	
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				396.63	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP				
	<b>Energy</b> kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	=	598.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	568.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1167.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	205.85	(268)
Total CO2, kg/year  TER =	sum	of (265)(271) =		1412.06 14.51	(272)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 31 - 3B6P - TF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 192.4 (1a) x (2a) =(3a) 2.6 500.24 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)192.4 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =500.24 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.08 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.33 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.31 Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Monthly average wind speed from Table 7 (22)m =5.1 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36		
Calculate effe		•	rate for t	he appli	cable ca	se				!		•	<u> </u>
If mechanicated If exhaust air h			andiv N. (2	2h) _ (22c	) v Emy (c	auation (	VEVV otho	avica (22h	) - (222)			0	
If balanced with		0 11		, ,	,	. ,	,, .	,	) = (23a)			0	(2
		-	-	_					26\ma(	00h) [	4 (00-)	0	(2
a) If balance	o mech	anicai ve	ntilation 0	with nea	at recove		$\frac{HR}{0}$ (248	$\frac{1)m = (22)}{0}$	2b)m + (	230) × [	1 – (23C) 1 0	1 ÷ 100] ]	(2
	<u> </u>	<u> </u>			<u> </u>	<u> </u>			<u> </u>		<u> </u>	J	(
b) If balance			0	0 Without	0	0	0 0	0	0	0	0	l	(
c) If whole h	<u> </u>	<u> </u>									0	J	`
			tiliation ( then (24)	-	-				5 x (23h	o)			
lc)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
d) If natural	ventilatio	n or wh	ole hous	e positiv	/e input	L ventilatio	on from I	oft	<u> </u>		ļ.	J	
			m = (22l)						0.5]				
1d)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	(25)				_	
5)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(
. Heat losse	s and he	eat loss i	naramete	or.						_	_		
LEMENT	Gros		Openin		Net Ar	ea	U-val	Je	AXU		k-value	e /	λΧk
	area		m		A ,r		W/m2		(W/I	K)	kJ/m²-l		J/K
in <mark>dows</mark> Type	e 1				10.34	μ χ1,	/[1/( 1.4 )+	0.04] =	13.71				(
in <mark>dows</mark> Type	2				9.9	x1	/[1/( 1.4 )+	0.04] =	13.12				(
indows Type	3				5.25	x1	/[1/( 1.4 )+	0.04] =	6.96				(
indows Type	e 4				5.5	x1.	/[1/( 1.4 )+	0.04] =	7.29	5			(
alls Type1	146.	45	30.99	€	115.4	6 X	0.18	i	20.78	<b>=</b> [			
alls Type2	26.7	<b>'</b> 3	0		26.73	3 x	0.18	<b>=</b>	4.81	Ħ i		7 F	
oof	191		0		191	X	0.13	<b>=</b>	24.83	F i		<b>-</b>	$\overline{}$
otal area of e	lements	 , m²	L		364.1	8							(
arty floor		•			191					Г			
or windows and	roof wind	ows. use e	effective wi	ndow U-va		l ated usinc	n formula 1	/[(1/U-valu	ıe)+0.041 a	L as aiven in	paragraph	 1 3.2	\
include the area							,		, -	Ü	, ,		
bric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				91.51	(
eat capacity	Cm = S(	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	19312.16	(
nermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(
r design asses				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
n be used inste nermal bridg				icina An	nondiy l							40.04	<u> </u>
letails of therma	•	,			•	`						18.21	
otal fabric he		are not ki	- (30) -	- 0.00 X (0	'')			(33) +	(36) =			109.72	
	at loss ca	alculated	d monthly	/				(38)m	= 0.33 × (	[25)m x (5]	)		
entilation hea	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
entilation hea			<del></del>		-		<del>l                                     </del>	<u> </u>	04.40	00.07	<del>1</del>	1	,
	94.55	94.08	91.84	91.43	89.48	89.48	89.12	90.23	91.43	92.27	93.16		(
Jan	94.55	<u> </u>	91.84	91.43	89.48	89.48	89.12		= (37) + (37)	<u> </u>	93.16		(



0)m= 1.06	<u> </u>	ILP), W/ı		4.05	4.04	4.04	4.00		= (39)m ÷		4.05		
	1.06	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.05	1.05	(4
umber of day	s in mor	nth (Tabl	e 1a)					,	Average =	Sum(40) <sub>1.</sub>	12 / 12=	1.05	(-
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
´													
. Water heat	ing ener	av requi	romont:								kWh/yea	ar:	
. vvalei neal	ing ener	gy requi	rement.								KVVII/yea	u.	
sumed occu					40 /TF	- 40.0	.0\1 0.0	2040 /-	FF 4 40		99		(4
if TFA > 13.9 if TFA £ 13.9		+ 1.76 X	[1 - exp	(-0.0003	49 x (1F	·A -13.9)	(2)] + 0.0	)013 x (	IFA -13.	9)			
nual averag	,	iter usag	e in litre	s per da	y Vd,av	erage =	(25 x N)	+ 36		105	5.26		(4
duce the annua	al average	hot water i	usage by 5	5% if the d	welling is	designed t			se target o		,,		`
more that 125	litres per p	erson per	day (all w	ater use, h	ot and co	(d)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usage ii	า litres per	day for ea	ch month	Vd,m = fac	ctor from 1	able 1c x	(43)						
)m= 115.79	111.58	107.37	103.16	98.94	94.73	94.73	98.94	103.16	107.37	111.58	115.79		_
	1 (				100 1/-/		T., (0000		Total = Su			1263.13	(4
ergy content of		used - cald			190 x Va,n			) kwn/mor					
)m= 171.71	150.18	154.97	135.11	129.64	111.87	103.66	118.95	120.37	140.28	153.13	166.29		_
nstantaneous w	vater heatir	ng at point	of use (no	hot water	etorage)	ontor () in	hoves (16		Total = Sui	m(45) <sub>112</sub> =		1656.16	(4
													,
)m= 25.76 ater storage	22.53	23.25	20.27	19.45	16.78	15.55	17.84	18.06	21.04	22.97	24.94		(4
orage volum		includin	g anv sc	olar or W	WHRS:	storage	within sa	ame ves	sel		150		(4
community h			•							<u> </u>			`
herwise if no	•			_			, ,	ers) ente	er '0' in (	47)			
ater storage	loss:												
If manufact	urer's de	clared lo	oss facto	r is knov	wn (kWh	ı/day):				2.	13		(4
	actor fror	m Table	2b							0.	54		(4
mperature fa		ctorage									15		
ergy lost fro		-	-				(48) x (49)	) =		1.	10		(5
ergy lost fro If manufact	urer's de	eclared c	ylinder l	oss facto		known:	(48) x (49)	) =					
ergy lost fro If manufact It water stora	urer's de age loss	eclared c factor fro	ylinder l om Tabl	oss facto		known:	(48) x (49)	) =			0		
ergy lost fro If manufact of water stora community h	urer's de age loss leating se	eclared c factor fro ee section	ylinder l om Tabl	oss facto		known:	(48) x (49)	) =			0		(5
ergy lost fro If manufact If water store community h lume factor	urer's de age loss leating se from Tab	eclared c factor fro ee section ole 2a	ylinder loom Table on 4.3	oss facto		known:	(48) x (49)	) =			0		(5
ergy lost fro If manufact It water store community h lume factor mperature fa	urer's de age loss leating so from Tab actor fror	eclared c factor fro ee sectionale ole 2a m Table	ylinder loom Table on 4.3 2b	oss facto e 2 (kWł		known: y)			53) =		0		(£
ergy lost fro If manufact It water stora community h lume factor mperature fa	urer's de age loss leating se from Tab actor fror m water	eclared c factor from ee section ole 2a m Table storage,	ylinder loom Table on 4.3 2b	oss facto e 2 (kWł		known: y)	(48) x (49)		53) =		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(\$ (\$ (\$ (\$
ergy lost fro If manufact of water store community h lume factor mperature fa ergy lost fro nter (50) or (	urer's de age loss eating so from Tab actor from m water (54) in (5	eclared c factor from ee section ole 2a m Table storage,	ylinder l om Tabl on 4.3 2b , kWh/ye	oss facto e 2 (kWh ear		known: y)	(47) x (51)	) × (52) × (			0		(£ (£ (£
ergy lost fro If manufact It water stora community h lume factor mperature fa ergy lost fro nter (50) or (	urer's de age loss eating so from Tab actor from m water (54) in (5 loss cald	eclared c factor from ee section ole 2a m Table storage, (5) culated for	ylinder loom Table on 4.3 2b , kWh/ye	oss factore 2 (kWhee	n/litre/da	known: y)	(47) x (51)	) × (52) × (5 55) × (41)1	m	1.	0 0 0 0 0 0 15		(£ (£ (£ (£
ergy lost fro If manufact of water stora community h lume factor mperature fa ergy lost fro nter (50) or ( ater storage	urer's de age loss eating so from Tab actor from m water (54) in (5 loss calce 32.27	eclared c factor from ee section ole 2a m Table storage, (5) culated for	ylinder loom Table on 4.3  2b , kWh/ye or each	oss factore 2 (kWhee	n/litre/da 34.57	known: y) 35.73	(47) × (51) ((56)m = (-35.73)	55) × (41) 34.57	m 35.73	1.	0 0 0 0 0 15 35.73	Н	(£ (£ (£
ergy lost fro If manufact of water stora community h lume factor mperature fa ergy lost fro nter (50) or ( atter storage )m= 35.73 ylinder contains	urer's de age loss eating se from Tabactor from water (54) in (5 loss calculated agents agreement (52) agents agents agreement (53).	eclared c factor from the estimate of the 2a m Table storage, (55) culated for 35.73 display a solar storage.	ylinder loom Table on 4.3  2b , kWh/ye or each 34.57	ear month 35.73 n = (56)m	34.57 × [(50) – (	known: y) 35.73 H11)] ÷ (50	((47) x (51) ((56)m = (35.73) 0), else (57)	55) × (41)ı 34.57 7)m = (56)	35.73 m where (l	1. 34.57 H11) is fro	0 0 0 0 15 35.73 m Appendix	Н	(E) (E) (E) (E)
ergy lost fro If manufact of water stora community h lume factor mperature fa ergy lost fro nter (50) or ( atter storage )m= 35.73 ylinder contains	urer's de age loss eating so from Tab actor from m water (54) in (5 loss calce 32.27	eclared c factor from ee section ole 2a m Table storage, (5) culated for	ylinder loom Table on 4.3  2b , kWh/ye or each	oss factore 2 (kWhee	n/litre/da 34.57	known: y) 35.73	(47) × (51) ((56)m = (-35.73)	55) × (41) 34.57	m 35.73	1.	0 0 0 0 0 15 35.73	Н	(E) (E) (E) (E)
ergy lost fro If manufact It water stora community h lume factor mperature fa ergy lost fro nter (50) or ( ater storage )m= 35.73 ylinder contains	urer's de age loss eating se from Table actor from water (54) in (5 loss calcombined actor) agreement (52) agreement (53).27	eclared c factor from the estimate of the 2a m Table storage, (55) culated from 35.73 disolar storage, (56) disolar storage, (57) di	ylinder loom Table on 4.3  2b , kWh/ye or each 34.57  age, (57)r	ear month 35.73 n = (56)m 35.73	34.57 × [(50) – (	known: y) 35.73 H11)] ÷ (50	((47) x (51) ((56)m = (35.73) 0), else (57)	55) × (41)ı 34.57 7)m = (56)	35.73 m where (l	34.57 H11) is fro	0 0 0 0 15 35.73 m Appendix	Н	(£ (£ (£

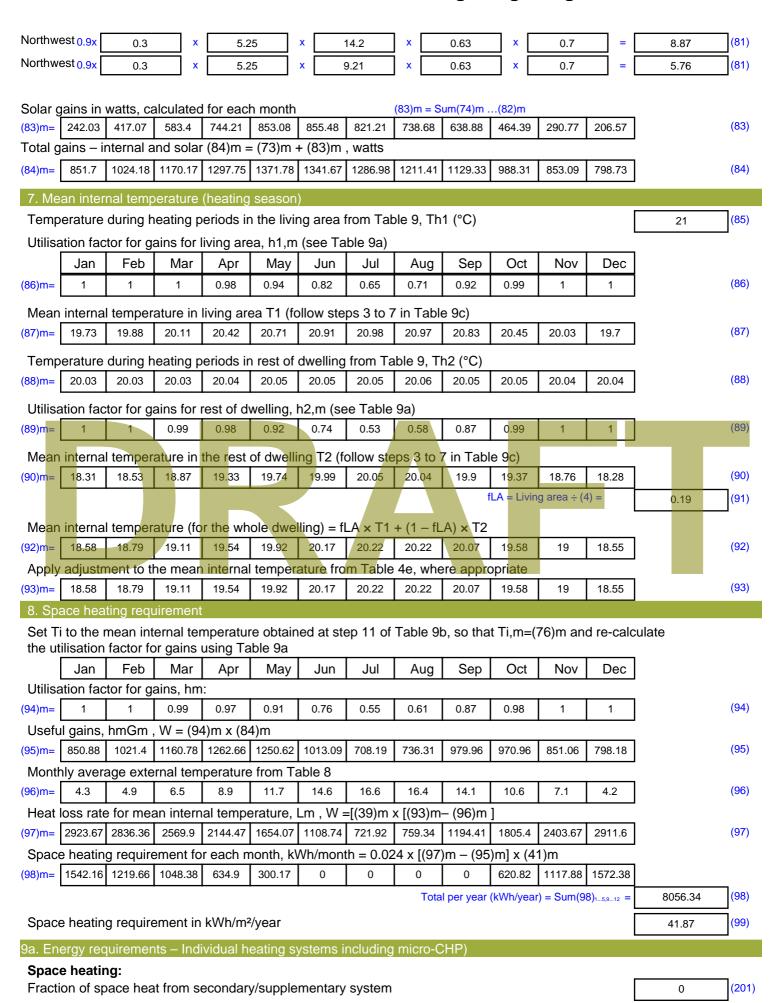


Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ $(62)m = 230.7  203.46  213.96  192.19  188.63  168.95  162.65  177.94  177.46  199.27  210.22  225.28$ $(62)$
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)  (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (63)
Output from water heater
(64)m= 230.7 203.46 213.96 192.19 188.63 168.95 162.65 177.94 177.46 199.27 210.22 225.28
Output from water heater (annual) <sub>112</sub> 2350.71 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]
(65)m= 104.28 92.56 98.72 90.59 90.3 82.86 81.66 86.74 85.69 93.84 96.59 102.48 (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= 149.6 149.6 149.6 149.6 149.6 149.6 149.6 149.6 149.6 149.6 149.6 149.6 149.6 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
(67)m= 34.85 30.96 25.18 19.06 14.25 12.03 13 16.89 22.67 28.79 33.6 35.82 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 363.76 367.54 358.03 337.78 312.21 288.19 272.14 268.36 277.88 298.13 323.69 347.71 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 37.96 37.96 37.96 37.96 37.96 37.96 37.96 37.96 37.96 37.96 37.96 37.96 (69)
Pumps and fans gains (Table 5a)
(70)m= 3 3 3 3 3 3 3 3 3 3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)
(71)m= -119.68
Water heating gains (Table 5)
(72)m= 140.17 137.74 132.69 125.82 121.37 115.09 109.76 116.59 119.02 126.12 134.15 137.75 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (71)m + (72)m$
(73)m= 609.66 607.11 586.77 553.54 518.71 486.19 465.77 472.73 490.45 523.92 562.32 592.16 (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)
Northeast 0.9x 0.3 x 5.5 x 11.28 x 0.63 x 0.7 = 7.39 (75)
Northeast 0.9x 0.3 x 5.5 x 22.97 x 0.63 x 0.7 = 15.04 (75)
Northeast 0.9x 0.3 x 5.5 x 41.38 x 0.63 x 0.7 = 27.1 (75)
Northeast 0.9x 0.3 x 5.5 x 67.96 x 0.63 x 0.7 = 44.5 (75)
Northeast 0.9x 0.3 x 5.5 x 91.35 x 0.63 x 0.7 = 59.82 (75)



Northeast 0.ax	N 4		,		1				1		,		_
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.3	X	5.5	X	97.38	X	0.63	X	0.7	=	63.78	(75)
Northeast 0.9x	<u>L</u>	0.3	X	5.5	X	91.1	X	0.63	X	0.7	=	59.66	(75)
Northeast 0.9x	<u> </u>	0.3	X	5.5	X	72.63	X	0.63	X	0.7	=	47.56	(75)
Northeast 0.8x	<u>L</u>	0.3	X	5.5	X	50.42	X	0.63	X	0.7	=	33.02	(75)
Northeast 0.0x	<u> </u>	0.3	X	5.5	x	28.07	X	0.63	X	0.7	=	18.38	(75)
Southeast 0, sk	<u> </u>	0.3	X	5.5	x	14.2	X	0.63	X	0.7	=	9.3	(75)
Southeast 0.9x 0.77 x 9.9 x 85.75 x 0.63 x 0.7 = 189.62 (77) Southeast 0.9x 0.77 x 9.9 x 106.25 x 0.63 x 0.7 = 259.45 (77) Southeast 0.9x 0.77 x 9.9 x 119.01 x 0.63 x 0.7 = 321.47 (77) Southeast 0.9x 0.77 x 9.9 x 119.01 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 113.91 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 113.91 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 113.91 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 10.34 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 9.9 x 0.285 x 0.63 x 0.7 = 209.57 (77) Southeast 0.9x 0.77 x 10.34 x 0.53 x 0.7 = 116.27 (79) Southeast 0.9x 0.77 x 10.34 x 119.01 x 0.63 x 0.7 = 220.98 (79) Southeast 0.9x 0.77 x 10.34 x 119.01 x 0.63 x 0.7 = 220.98 (79) Southeast 0.9x 0.77 x 10.34 x 119.01 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7 = 232.32 (79) Southeast 0.9x 0.77 x 10.34 x 113.91 x 0.63 x 0.7	<u> </u>	0.3	X	5.5	X	9.21	X	0.63	X	0.7	=	6.03	(75)
Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.63 x 0.7 = 321.47 (77) Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.63 x 0.7 = 360.07 (77) Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.63 x 0.7 = 331.54 (77) Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.63 x 0.7 = 346.44 (77) Southeast 0.9x 0.77 x 9.9 x 104.39 x 0.63 x 0.7 = 346.44 (77) Southeast 0.9x 0.77 x 9.9 x 0.63 x 0.7 = 260.93 (77) Southeast 0.9x 0.77 x 9.9 x 0.63 x 0.7 = 260.93 (77) Southeast 0.9x 0.77 x 9.9 x 0.63 x 0.7 = 260.93 (77) Southeast 0.9x 0.77 x 9.9 x 0.63 x 0.7 = 260.93 (77) Southeast 0.9x 0.77 x 9.9 x 0.63 x 0.7 = 260.93 (77) Southeast 0.9x 0.77 x 10.34 x 10.39 x 0.63 x 0.7 = 270.98 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 335.76 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 335.76 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 335.76 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 335.76 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 335.76 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 335.76 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 = 233.42 (79) Southwest 0.9x 0.77 x 10.34 x 10.34 x 10.39 x 0.63 x 0.7 =	Southeast 0.9x	0.77	X	9.9	x	36.79	X	0.63	X	0.7	=	111.32	(77)
Southeast 0.9x	<u> </u>	0.77	X	9.9	x	62.67	X	0.63	X	0.7	=	189.62	(77)
Southeast 0.9x	<u> </u>	0.77	X	9.9	X	85.75	X	0.63	X	0.7	=	259.45	(77)
Southeast 0.9x	<u>L</u>	0.77	X	9.9	x	106.25	X	0.63	X	0.7	=	321.47	(77)
Southeast 0.9x	<u> </u>	0.77	X	9.9	x	119.01	X	0.63	X	0.7	=	360.07	(77)
Southeast 0,9x	<u> </u>	0.77	X	9.9	x	118.15	X	0.63	X	0.7	=	357.47	(77)
Southeast 0.9x	<u> </u>	0.77	X	9.9	X	113.91	X	0.63	X	0.7	=	344.64	(77)
Southeast 0.9x	<u> </u>	0.77	X	9.9	X	104.39	X	0.63	X	0.7	=	315.84	(77)
Southeast 0.9x	<u> </u>	0.77	X	9.9	X	92.85	X	0.63	X	0.7	=	280.93	(77)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	69.27	X	0.63	X	0.7	=	209.57	(77)
Southwesto, 9x 0.77	<u> </u>	0.77	X	9.9	X	44.07	Х	0.63	X	0.7	=	133.34	(77)
Southwesto.9x		0.77	X	9.9	х	31.49	X	0.63	x	0.7	=	95.27	(77)
Southwesto.9x	<u> </u>	0.77	X	10.34	х	36.79		0.63	X	0.7	=	116.27	(79)
Southwesto.9x         0.77         x         10.34         x         106.25         0.63         x         0.7         =         335.76         (79)           Southwesto.9x         0.77         x         10.34         x         118.15         0.63         x         0.7         =         376.08         (79)           Southwesto.9x         0.77         x         10.34         x         118.15         0.63         x         0.7         =         373.36         (79)           Southwesto.9x         0.77         x         10.34         x         113.91         0.63         x         0.7         =         359.96         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.63         x         0.7         =         329.88         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         229.42         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.3 <td>Southwest<sub>0.9x</sub></td> <td>0.77</td> <td>X</td> <td>10.34</td> <td>X</td> <td>62.67</td> <td></td> <td>0.63</td> <td>X</td> <td>0.7</td> <td>=</td> <td>198.05</td> <td>(79)</td>	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	62.67		0.63	X	0.7	=	198.05	(79)
Southwest0.9x         0.77         x         10.34         x         119.01         0.63         x         0.7         =         376.08         (79)           Southwest0.9x         0.77         x         10.34         x         118.15         0.63         x         0.7         =         373.36         (79)           Southwest0.9x         0.77         x         10.34         x         104.39         0.63         x         0.7         =         359.96         (79)           Southwest0.9x         0.77         x         10.34         x         92.85         0.63         x         0.7         =         329.88         (79)           Southwest0.9x         0.77         x         10.34         x         92.85         0.63         x         0.7         =         329.88         (79)           Southwest0.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         218.89         (79)           Southwest0.9x         0.77         x         10.34         x         31.49         0.63         x         0.7         =         139.26         (79)           Southwest0.9x         0.3	Southwest <sub>0.9x</sub>	0.77	x	10.34	x	85.7 <mark>5</mark>		0.63	x	0.7	=	270.98	(79)
Southwesto.9x         0.77         x         10.34         x         118.15         0.63         x         0.7         =         373.36         (79)           Southwesto.9x         0.77         x         10.34         x         113.91         0.63         x         0.7         =         359.96         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.63         x         0.7         =         329.88         (79)           Southwesto.9x         0.77         x         10.34         x         92.85         0.63         x         0.7         =         293.42         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         293.42         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.63         x         0.7         =         99.5         (79)           Northwest 0.9x         0.3	Southwest <sub>0.9x</sub>	0.77	X	10.34	х	106.25		0.63	X	0.7	=	335.76	(79)
Southwesto.9x         0.77         x         10.34         x         113.91         0.63         x         0.7         =         359.96         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.63         x         0.7         =         329.88         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         293.42         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.63         x         0.7         =         139.26         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.63         x         0.7         =         7.05         (81)           Northwest 0.9x	Southwest <sub>0.9x</sub>	0.77	X	10.34	х	119.01	]	0.63	X	0.7	=	376.08	(79)
Southwesto.9x         0.77         x         10.34         x         104.39         0.63         x         0.7         =         329.88         (79)           Southwesto.9x         0.77         x         10.34         x         92.85         0.63         x         0.7         =         293.42         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         139.26         (79)           Southwesto.9x         0.3         x         5.25         x         11.28         x         0.63         x         0.7         =         99.5         (79)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.63         x         0.7         =         14.36         (81)           Northwest	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	118.15		0.63	X	0.7	=	373.36	(79)
Southwesto.9x         0.77         x         10.34         x         92.85         0.63         x         0.7         =         293.42         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         139.26         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.63         x         0.7         =         139.26         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.63         x         0.7         =         99.5         (79)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.63         x         0.7         =         14.36         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.63         x         0.7         =         25.87         (81)	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	113.91		0.63	X	0.7	=	359.96	(79)
Southwesto.9x         0.77         x         10.34         x         69.27         0.63         x         0.7         =         218.89         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         139.26         (79)           Southwesto.9x         0.37         x         10.34         x         31.49         0.63         x         0.7         =         99.5         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.63         x         0.7         =         99.5         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.63         x         0.7         =         7.05         (81)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.63         x         0.7         =         25.87         (81)           Northwest 0.9x         0.3         x         5.25         x         67.96         x         0.63         x         0.7         =         57.1         (81)	L	0.77	X	10.34	X	104.39		0.63	X	0.7	=	329.88	(79)
Southwest0.9x         0.77         x         10.34         x         44.07         0.63         x         0.7         =         139.26         (79)           Southwest0.9x         0.77         x         10.34         x         31.49         0.63         x         0.7         =         99.5         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.63         x         0.7         =         7.05         (81)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.63         x         0.7         =         14.36         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.63         x         0.7         =         14.36         (81)           Northwest 0.9x         0.3         x         5.25         x         67.96         x         0.63         x         0.7         =         42.48         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.63         x         0.7         =         56.95         (	<u> </u>	0.77	x	10.34	x	92.85		0.63	X	0.7	=	293.42	(79)
Southwest0.9x       0.77       x       10.34       x       31.49       0.63       x       0.7       =       99.5       (79)         Northwest 0.9x       0.3       x       5.25       x       11.28       x       0.63       x       0.7       =       7.05       (81)         Northwest 0.9x       0.3       x       5.25       x       22.97       x       0.63       x       0.7       =       14.36       (81)         Northwest 0.9x       0.3       x       5.25       x       41.38       x       0.63       x       0.7       =       25.87       (81)         Northwest 0.9x       0.3       x       5.25       x       67.96       x       0.63       x       0.7       =       42.48       (81)         Northwest 0.9x       0.3       x       5.25       x       91.35       x       0.63       x       0.7       =       57.1       (81)         Northwest 0.9x       0.3       x       5.25       x       97.38       x       0.63       x       0.7       =       60.88       (81)         Northwest 0.9x       0.3       x       5.25       x       91.1	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	69.27		0.63	X	0.7	=	218.89	(79)
Northwest 0.9x	<u>L</u>	0.77	X	10.34	X	44.07		0.63	X	0.7	=	139.26	(79)
Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.63         x         0.7         =         14.36         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.63         x         0.7         =         25.87         (81)           Northwest 0.9x         0.3         x         5.25         x         67.96         x         0.63         x         0.7         =         42.48         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.63         x         0.7         =         57.1         (81)           Northwest 0.9x         0.3         x         5.25         x         97.38         x         0.63         x         0.7         =         60.88         (81)           Northwest 0.9x         0.3         x         5.25         x         91.1         x         0.63         x         0.7         =         56.95         (81)           Northwest 0.9x         0.3         x         5.25         x         72.63         x         0.63         x         0.7         =	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	31.49		0.63	X	0.7	=	99.5	(79)
Northwest 0.9x	Northwest <sub>0.9x</sub>	0.3	X	5.25	X	11.28	X	0.63	X	0.7	=	7.05	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	22.97	X	0.63	X	0.7	=	14.36	(81)
Northwest 0.9x	<u>L</u>	0.3	X	5.25	X	41.38	X	0.63	X	0.7	=	25.87	(81)
Northwest 0.9x	Northwest <sub>0.9x</sub>	0.3	X	5.25	X	67.96	X	0.63	X	0.7	=	42.48	(81)
Northwest 0.9x	L	0.3	X	5.25	x	91.35	x	0.63	x	0.7	=	57.1	(81)
Northwest 0.9x	<u> </u>	0.3	x	5.25	x	97.38	x	0.63	x	0.7	=	60.88	(81)
Nigotherest Control Co	Northwest <sub>0.9x</sub>	0.3	x	5.25	x	91.1	x	0.63	x	0.7	=	56.95	(81)
Northwest on war and w	L	0.3	X	5.25	x	72.63	X	0.63	x	0.7	=	45.4	(81)
	Northwest <sub>0.9x</sub>	0.3	X	5.25	x	50.42	x	0.63	x	0.7	=	31.52	(81)
Northwest $0.9x$ 0.3 x 5.25 x 28.07 x 0.63 x 0.7 = 17.55 (81)	Northwest <sub>0.9x</sub>	0.3	X	5.25	X	28.07	X	0.63	X	0.7	=	17.55	(81)







Fraction of space heat from main system(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from main system 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1								93.5	(206)
Efficiency of secondary/supplementary heating s	system	, %						0	(208)
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)						l <u></u>	l	1	
1542.16 1219.66 1048.38 634.9 300.17	0	0	0	0	620.82	1117.88	1572.38		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$ $1649.37  1304.45  1121.27  679.04  321.03$	0	0	0	0	663.98	1105 50	1681.69		(211)
1045.57 1504.45 1121.27 075.04 521.05					ar) =Sum(2			8616.41	(211)
Space heating fuel (secondary), kWh/month					,	715,1012		0010.41	
= {[(98)m x (201)] } x 100 ÷ (208)									
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		_
			Total	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water heating									
Output from water heater (calculated above)  230.7 203.46 213.96 192.19 188.63 1	168.95	162.65	177.94	177.46	199.27	210.22	225.28		
Efficiency of water heater							l	79.8	(216)
(217)m= 88.95 88.8 88.49 87.77 86.05	79.8	79.8	79.8	79.8	87.64	88.62	89		(217)
Fuel for water heating, kWh/month									
$(219)m = (64)m \times 100 \div (217)m$ (219)m = 259.36  229.12  241.79  218.98  219.21  2	211.72	203.82	222.99	222.38	227.37	237.21	253.11	1	
2000 22012 21110 21000 21011 2		200.02		I = Sum(2		207.21	200.11	2747.07	(219)
Annual totals					k'	Wh/yeaı	•	kWh/yeaı	•
Annual totals Space heating fuel used, main system 1					k¹	Wh/yeaı	r	<b>kWh/yea</b> i 8616.41	
					k¹	Wh/yeaı			
Space heating fuel used, main system 1					k'	Wh/yeaı		8616.41	
Space heating fuel used, main system 1 Water heating fuel used					k'	Wh/year	30	8616.41	(230c)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot					k'	Wh/yeaı		8616.41	
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue			sum	of (230a).	(230g) =		30	8616.41	(230c) (230e)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year			sum	of (230a).			30	8616.41 2747.07	(230c) (230e) (231)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	as inclu	ding mi					30	8616.41 2747.07	(230c) (230e)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year					(230g) =		30 45	8616.41 2747.07 75 615.52	(230c) (230e) (231) (232)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	Ene	ergy			(230g) =	ion fac	30 45	8616.41 2747.07 75 615.52	(230c) (230e) (231) (232)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system	<b>En</b> e	<b>ergy</b> h/year			(230g) = <b>Emiss</b> kg CO:	ion fac 2/kWh	30 45	75 615.52 Emissions kg CO2/ye	(230c) (230e) (231) (232)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system Space heating (main system 1)	<b>Ene</b> kW (211	e <b>rgy</b> h/year ) ×			(230g) =  Emiss kg CO	ion fac 2/kWh	30 45 <b>tor</b>	75 615.52 Emissions kg CO2/ye	(230c) (230e) (231) (232) (232)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system  Space heating (main system 1) Space heating (secondary)	Ene kW (211	ergy h/year ) x			(230g) =  Emiss kg CO:  0.2	<b>ion fac</b> 2/kWh 16	30 45 <b>tor</b> = =	75 615.52  Emissions kg CO2/ye 1861.14	(230c) (230e) (231) (232) (232) (261) (263)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system  Space heating (main system 1) Space heating (secondary) Water heating	Ene kW (211 (215 (219	ergy h/year ) × ) ×	cro-CHP		(230g) =  Emiss kg CO	<b>ion fac</b> 2/kWh 16	30 45 <b>tor</b>	8616.41 2747.07  75 615.52  Emissions kg CO2/ye 1861.14 0 593.37	(230c) (230e) (231) (232)  ar (261) (263) (264)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system  Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Ene kW (211 (215 (219	ergy h/year ) x ) x ) x			(230g) =  Emiss kg CO:  0.2	<b>ion fac</b> 2/kWh 16	30 45 <b>tor</b> = =	75 615.52  Emissions kg CO2/ye 1861.14 0 593.37 2454.51	(230c) (230e) (231) (232)  ar (261) (263) (264) (265)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting  12a. CO2 emissions – Individual heating system  Space heating (main system 1) Space heating Space and water heating Electricity for pumps, fans and electric keep-hot	Ene kW (211 (215 (219 (261 (231	ergy h/year ) x ) x ) x ) + (262) -	cro-CHP		(230g) =  Emiss kg CO:  0.2	<b>ion fac</b> 2/kWh 16	30 45 <b>tor</b> = =	8616.41 2747.07  75 615.52  Emissions kg CO2/ye 1861.14 0 593.37	(230c) (230e) (231) (232)  ar (261) (263) (264)
Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system  Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Ene kW (211 (215 (219	ergy h/year ) x ) x ) x ) + (262) -	cro-CHP		(230g) =  Emiss kg CO:  0.2  0.5	ion fac 2/kWh 16 19	30 45 <b>tor</b> = =	75 615.52  Emissions kg CO2/ye 1861.14 0 593.37 2454.51	(230c) (230e) (231) (232)  ar (261) (263) (264) (265)



Total CO2, kg/year sum of (265)...(271) = 2812.

2812.89 (272)

TER = 14.62 (273)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 32 - 2B4P - TF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.4 (2a) =283.2 (3a) 118 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)118 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =283.2 (5) total m³ per hour main secondary other heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.14 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)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 (22)m =5.1 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18



0.42	0.42	e (allowi <sub>0.41</sub>	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39	l	
Calculate effec	-	l '			1		0.31	0.33	0.36	0.37	0.39	İ	
If mechanica	l ventila	ition:										0	
If exhaust air he	at pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	
If balanced with	heat reco	overy: effic	iency in %	allowing f	for in-use f	actor (fron	n Table 4h	) =				0	
a) If balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	)m = (22	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	j	
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	MV) (24b	)m = (22	2b)m + (2	23b)		_	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0	j	
c) If whole ho				•	•				5 × (23b	o)			
4c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	
d) If natural v					•				0.5]		•	ı	
4d)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 (24k	b) or (24	c) or (24	d) 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		
. Heat losses	and he	eat loss i	naramet	or.									
LEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	<)	k-value kJ/m²-l		A X I kJ/K
in <mark>dows</mark> Type	1				6.2	x1.	/[1/( 1.4 )+	0.04] =	8.22				
in <mark>dows</mark> Type	2				0.36	x1	/[1/( 1.4 )+	0.04] =	0.48	Ħ			
alls Type1	103.	96	6.56		97.4	X	0.18	7 = [	17.53	Ħ ſ		7 6	
alls Type2	4.93	3	0	<b>=</b>	4.93	X	0.18	=	0.89	٦ i		<b>≒</b>	
oof	118	3	0	=	118	x	0.13	<b>=</b>	15.34	≓ i		<b>f</b> F	
tal area of el					226.8	<u> </u>							
or windows and			effective wi	ndow U-va			g formula 1	/[(1/U-valu	re)+0.04] a	ns given in	paragraph	1 3.2	
nclude the area						_			, -	-			
bric heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				42.4	ł6
eat capacity (	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	8224	.82
nermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		250	)
r design assessi				construct	tion are no	t known pr	recisely the	indicative	values of	TMP in Ta	able 1f		
<i>n be used instea</i> nermal bridge				ısina Ar	nendix k	<						11.3	24
letails of therma	`	,			•	`						11.3	14
tal fabric hea			()		,			(33) +	(36) =			53.8	8
entilation hea	t loss ca	alculated	d monthly	/				(38)m	= 0.33 × (	25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
3)m= 55.13	54.8	54.48	52.98	52.7	51.39	51.39	51.15	51.9	52.7	53.27	53.86		
eat transfer c	oefficier	nt, W/K			-	-	-	(39)m	= (37) + (37)	 38)m	-	'	
			400.70	400.5	105.19	105 10	104.05				407.00	i	
9)m=   108.93	108.6	108.28	106.78	106.5	105.19	105.19	104.95	105.7	106.5	107.07	107.66		

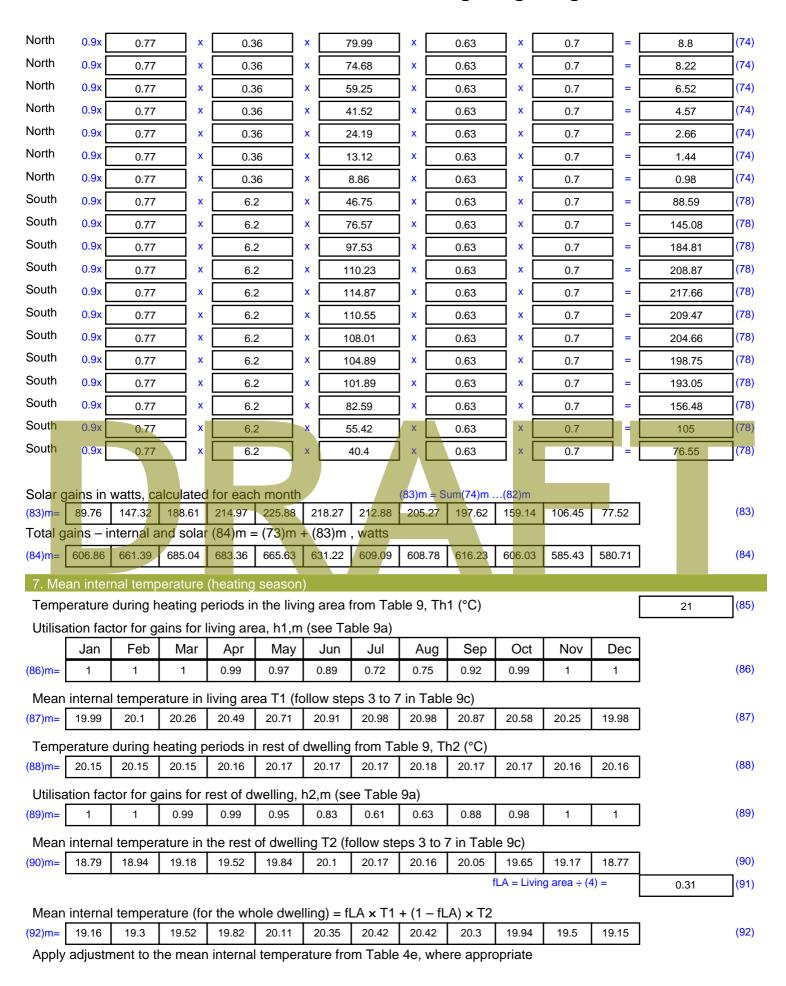


	· `	HLP), W/	m²K		ı	ı		<del>- ` ´</del>	= (39)m ÷	- (4)			
)m= 0.92	0.92	0.92	0.9	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.91		
mber of day	ıs in moı	nth <i>(</i> Tahl	e 1a)						Average =	Sum(40) <sub>1.</sub>	12 /12=	0.9	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
sumed occu	ıpancy, l	N								2.	.86		(4
f TFA > 13.9 f TFA £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.	.9)			
nual averag	•	ater usag	je in litre	s per da	ay Vd,av	erage =	(25 x N)	+ 36		102	2.01		(4
duce the annua	al average	hot water	usage by	5% if the a	lwelling is	designed			se target o				Ì
more that 125	· ·					·			<u> </u>	<del></del>			
Jan t water usage i	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
)m= 112.21	108.13	104.05	99.97	95.89	91.81	91.81	95.89	99.97	104.05	108.13	112.21		
)111= 112.21	100.13	104.03	99.91	95.69	91.01	91.01	95.09	ļ		m(44) <sub>112</sub> =	L .	1224.14	(4
ergy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	7m / 3600						
)m= 166.41	145.54	150.19	130.94	125.64	108.41	100.46	115.28	116.66	135.95	148.41	161.16		
									Total = Su	m(45) <sub>112</sub> =		1605.05	(4
st <mark>antane</mark> ous w	vater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	to (61)					
)m= 24.96	21.83	22.53	19.64	18.85	16.26	15.07	17.29	17.5	20.39	22.26	24.17		(4
ater storage orage volum		includin	a any so	olar or W	/WHRS	storage	within s	ame ves	sel		150		(4
community h	,										100		(
herwise if no	•			_			, ,	ers) ente	er '0' in (	(47)			
ater storage													
If manufact				or is kno	wn (kWh	n/day):				1.	89		(4
mperature f										0.	54		(4
ergy lost fro If manufact		_	-		or is not		(48) x (49	) =		1.	.02		(5
t water stor			-								0		(5
community h	•		on 4.3										
lume factor											0		(5
											0		(;
•	m water	_	, kWh/ye	ear			(47) x (51	) x (52) x (	53) =		0		(!
ergy lost fro							((E6)m - (	(EE) (A1)	<b></b>	1.	.02		(;
ergy lost fronter (50) or	(54) in (5	,	or ooob	month			((00))	$(55) \times (41)$	m				
ergy lost fronter (50) or other storage	(54) in (5 loss cal	culated f			T					T			
ergy lost fronter (50) or other storage	(54) in (5 loss cal	culated f	30.62	31.64	30.62 x [(50) = (	31.64	31.64	30.62	31.64	30.62	31.64	y H	(5
ergy lost fronter (50) or eater storage )m= 31.64 //linder contains	(54) in (5 loss cal 28.58 s dedicate	culated f 31.64 d solar sto	30.62 rage, (57)	31.64 m = (56)m	x [(50) – (	31.64 H11)] ÷ (5	31.64 0), else (5	30.62 7)m = (56)	31.64 m where (	H11) is fro	m Appendi	хН	
mperature f ergy lost fro nter (50) or 6 ater storage )m= 31.64 ylinder contain: )m= 31.64	(54) in (5 loss cal	culated f	30.62	31.64		31.64	31.64	30.62	31.64			хН	(5 (5
ergy lost fronter (50) or other storage    mail of the storage   31.64     mary circuit	(54) in (5 loss cal 28.58 s dedicate 28.58	31.64 d solar stor 31.64 annual) fro	30.62 rage, (57) 30.62 om Table	31.64 m = (56)m 31.64	x [(50) – ( 30.62	31.64 H11)] ÷ (5 31.64	31.64 0), else (5 31.64	30.62 7)m = (56) 30.62	31.64 m where (	H11) is fro	m Appendi	хН	
ergy lost fronter (50) or eater storage )m= 31.64 //linder contains	loss cal 28.58 s dedicate 28.58 c loss (ar	31.64 d solar stor 31.64 annual) fro	30.62 rage, (57)i 30.62 om Table for each	31.64 m = (56)m 31.64 31.64 month (	x [(50) - ( 30.62 59)m = (	31.64 H11)] ÷ (5 31.64	31.64 0), else (5 31.64 65 × (41)	30.62 7)m = (56) 30.62	31.64 m where ( 31.64	H11) is fro	31.64	хН	(!

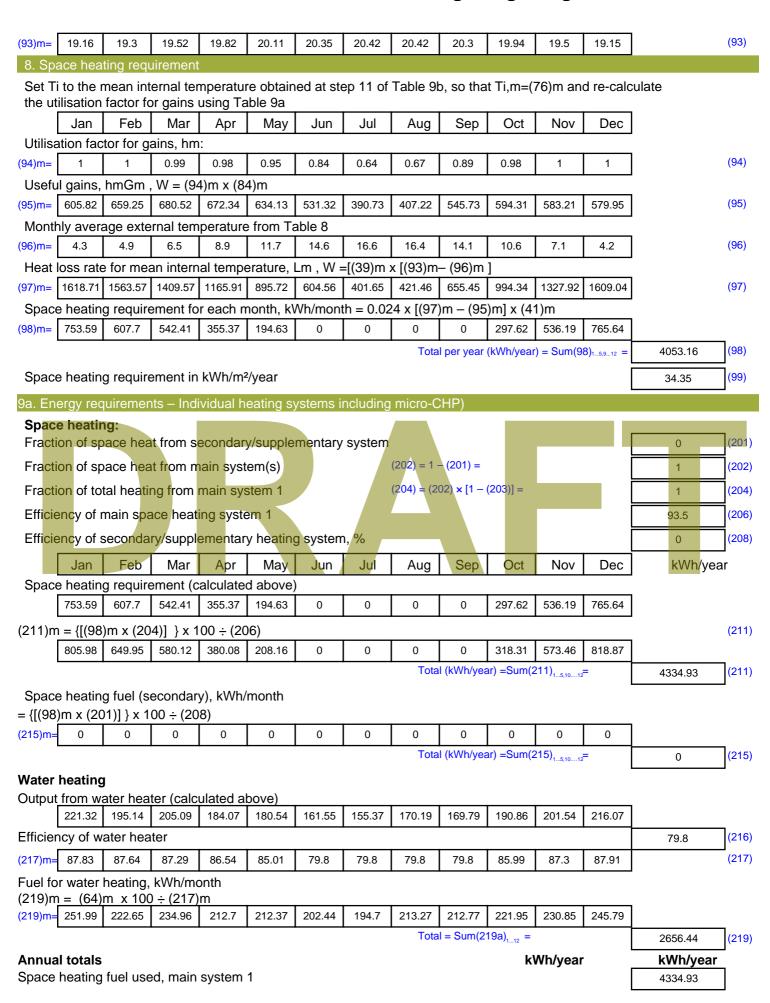


0 111				(0.1)	(00)	o= (44)							
Combi loss c	1	1	1	<del>`</del>	<u> </u>	<u> </u>	<u> </u>	<del> </del>	Γ.	Ι ,		1	(64)
(61)m= 0	0	0			0	0	0	0	0	0	0		(61)
	<del>`</del>		<del></del>				<del>`</del>		<del>` ´                                     </del>	<del>`</del>	<del>`´</del>	(59)m + (61)m	(20)
(62)m= 221.32		205.09	184.07	180.54	161.55	155.37	170.19		190.86	201.54	216.07		(62)
Solar DHW inpu									r contribut	ion to wate	er heating)		
(add addition	1	1	1	r		<del></del>	<del>.                                      </del>	<del></del>				1	(00)
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(63)
Output from v		<b>.</b>				·	l	. 1		T	l	1	
(64)m= 221.32	195.14	205.09	184.07	180.54	161.55	155.37	170.19		190.86	201.54	216.07	0054.50	7(64)
						>		utput from w				2251.53	(64)
Heat gains fr	1	T .	i e	r		T T			T T	1		1] 1	(2-)
(65)m= 99.26		93.86	86.04	85.7	78.56	77.33	82.26		89.13	91.85	97.51		(65)
include (57	)m in cald	culation (	of (65)m	only if c	ylinder i	s in the	dwellin	g or hot w	ater is f	rom com	munity h	neating	
5. Internal of	gains (see	Table 5	and 5a	):									
Metabolic ga	ins (Table	5), Wat	ts					_				•	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep Sep	Oct	Nov	Dec		
(66)m= 142.76	142.76	142.76	142.76	142.76	142.76	142.76	142.7	142.76	142.76	142.76	142.76		(66)
Ligh <mark>ting g</mark> ains	s (calcula	ted in Ap	pendix	L, equ <mark>at</mark>	ion L9 o	r L9a), <mark>a</mark>	lso see	Table 5					
(67)m= 32.28	28.67	23.32	17.65	13.2	11.14	12.04	15.65	21	26.66	31.12	33.18		(67)
App <mark>liance</mark> s g	ains (ca <mark>lc</mark>	<mark>ulat</mark> ed ir	Append	dix L, eq	uation L	13 or L1	3a), al	so see Ta	ble <mark>5</mark>				
(68)m= 282.59	285.52	278.13	262.4	242.54	223.88	211.41	208.48	215.86	231.6	251.45	270.12		(68)
Cooking gain	s (calcula	ited in A	ppendix	L, equat	ion L15	or L15a	), also	see Table	5		-		
(69)m= 37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28		(69)
Pumps and fa	ans gains	(Table 5	 ōa)									-	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)	•		-	•	•	•	•	
(71)m= -114.21	1 -114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.2	1 -114.21	-114.21	-114.21	-114.21	]	(71)
Water heating	g gains (T	able 5)	•	•		•	•	•	•	•	•	•	
(72)m= 133.41	131.05	126.16	119.51	115.19	109.11	103.94	110.56	112.91	119.8	127.57	131.06	]	(72)
Total interna	ıl gains =				(66)	)m + (67)m	n + (68)n	n + (69)m +	(70)m + (7	'1)m + (72)	)m	•	
(73)m= 517.1	514.07	496.43	468.39	439.75	412.95	396.21	403.5	418.61	446.89	478.98	503.19	]	(73)
6. Solar gair	ns:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	ations to	convert to th	ne applicat	ole orienta	tion.		
Orientation:			Area		Flu			g_		FF		Gains	
	Table 6d		m²		Ta	ble 6a		Table 6b	Т	able 6c		(W)	
North 0.9x	0.77	X	0.3	36	X 1	10.63	x [	0.63	х	0.7	=	1.17	(74)
North 0.9x	0.77	X	0.3	36	x 2	20.32	x	0.63	x	0.7	=	2.24	(74)
North 0.9x	0.77	X	0.3	36	x (	34.53	x	0.63	x	0.7	=	3.8	(74)
North 0.9x	0.77	X	0.3	36	X E	55.46	x	0.63	x	0.7	=	6.1	(74)
North 0.9x	0.77	X	0.3	36	x 7	74.72	x	0.63	x [	0.7	=	8.22	(74)

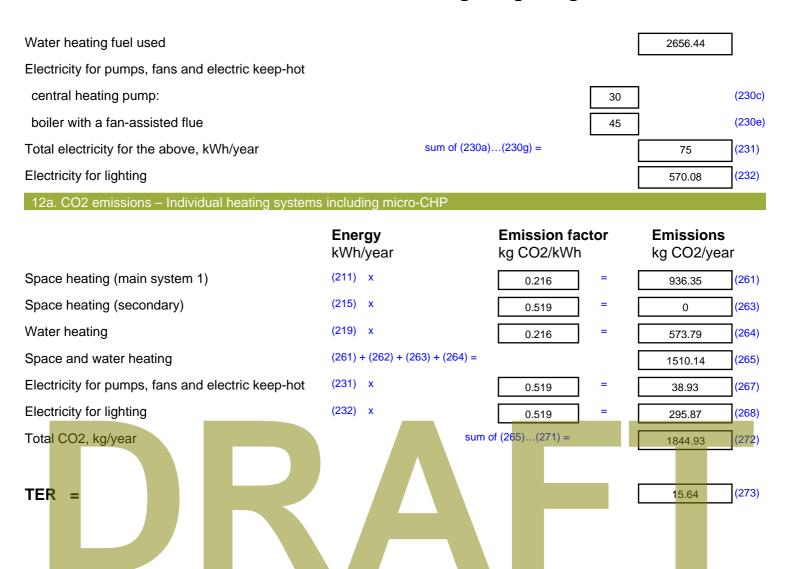














User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 33 - 1B2P -TF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.4 (2a) =(3a) 59.88 143.71 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)59.88 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =143.71 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.14 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.3 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



	0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35		
			-	rate for t	he appli	cable ca	se			!	l	Ţ		
		I ventila											0	(:
If exhaus	t air he	at pump ı	using Appe	endix N, (2	3b) = (23a	a) × Fmv (6	equation (I	N5)) , othe	rwise (23b	o) = (23a)			0	(
If balance	ed with	heat reco	very: effic	eiency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =				0	(
a) If <u>ba</u>	lance	d mecha	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(
b) If <u>ba</u>	lance	d mecha	anical ve	entilation	without	heat red	covery (N	MV) (24b	m = (22)	2b)m + (2	23b)			
b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(
,				ntilation o	•	•								
if (2	22b)m	< 0.5 ×	(23b), t	then (24)	c) = (23b)	o); other	· ` `	c) = (22k	o) m + 0.	.5 × (23b	)	1	1	
c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(
,				ole hous m = (221	•	•				0.5]			_	
d)m= (	).57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(
Effectiv	e air	change	rate - er	nter (24a	) or (24h	o) or (24	c) or (24	d) in box	(25)					
)m= (	).57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(
Heat I	0000	and he	at lose i	paramet	or.					_		_		
EME		Gros		Openin		Net Ar	rea	U-val	IP.	AXU		k-value	2	ΑΧk
	141	area		m		A ,r		W/m2		(W/I	K)	kJ/m²·l		kJ/K
ndows						4.6	<sub>X</sub> 1,	/[1/( 1.4 )+	0.04] =	6.1				(
alls Typ	e1	72.9	9	4.6		68.3	x	0.18	<b>-</b>	12.29	Ħι		7 🖂	(
alls Typ	pe2	26.5	7	0	$=$ \	26.57	X	0.18	7 ]	4.78	F i		<b>i</b>	
of		55		0	╡╹	55	×	0.13		7.15	۲ i		5 <b>-</b>	— ·
tal area	a of el	ements				154.4	=	0.10		7.10				`
			•	effective wi	ndow U-va	<u> </u>		a formula 1	/[(1/U-valı	ue)+0.041 a	as aiven in	paragraph	132	(
				nternal wal			atou uomg	, rommana m	II II Vale	10) 10.04] 0	io givoii iii	paragrapi	7 0.2	
bric he	at los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				30.32	(
at capa	acity (	Cm = S(	Axk)						((28).	(30) + (32	2) + (32a)	(32e) =	7135.62	(
ermal r	mass	parame	ter (TMF	= Cm +	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(
design a	assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	indicative	e values of	TMP in T	able 1f		
			tailed calc											
	_	•	,	culated (	• .	•	K						7.72	(
etails of a tal fabr			are not kn	own (36) =	= 0.05 x (3	11)			(33) +	· (36) =			20.05	<u> </u>
			aloulotos	d monthly	,					$0.33 \times ($	25\m v /5	١	38.05	(
						lun	1	Ι Δα		i		1	1	
-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(
<u> </u>	7.22	27.08	26.95	26.32	26.21	25.66	25.66	25.56	25.87	26.21	26.44	26.69	J	(
at tran		oefficier		ı		1	1			= (37) + (37)			1	
	- 07 I	65.13	65	64.37	64.25	63.71	63.71	63.61	63.92	64.25	64.49	64.74	1	
	5.27					•		•			-	•		$\neg$
)m= 6			HLP), W	/m²K			•	•		Average = = (39)m ÷		12 /12=	64.37	(



Number of days in month (Table 1a)

	Jan	Feb	nth (Tab Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(4
1. Wa	ter heat	ing ener	gy requi	rement:								kWh/ye:	ar:	
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	)013 x ( <sup>-</sup>	ΓFA -13.		98		(4
educe t	the annua	l average	hot water	ge in litre usage by t day (all w	5% if the $a$	lwelling is	designed			se target o		.18		(4
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot wate	r usage ir	litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
4)m=	89.3	86.05	82.81	79.56	76.31	73.06	73.06	76.31	79.56	82.81	86.05	89.3		
nergy c	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	_	974.2	
5)m=	132.43	115.83	119.52	104.2	99.98	86.28	79.95	91.74	92.84	108.2	118.1	128.25		_
nstanta	aneous w	ater heatir	na at point	of use (no	hot water	storage).	enter 0 in	boxes (46		Γotal = Su	m(45) <sub>112</sub> =	ا ا	1277.33	
6)m= [	19.86	17.37	17.93	15.63	15	12.94	11.99	13.76	13.93	16.23	17.72	19.24		(
·	storage		17.50	10.00	10	12.04	11.00	10.70	10.00	10.20	17.72	10.24		
orage	e v <mark>olum</mark>	e (litre <mark>s)</mark>	includin	ng any so	olar or W	WHRS	storage	within sa	me ves	sel		150		(
herw	-	stored		nk in dw er (this in				` '	ers) ente	er '0' in (	47)			
			eclared l	oss facto	or is kno	wn (kWł	n/day):				1.	39		
mpe	rature fa	actor fro	m Table	2b							0.	54		
ergy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=		0.	75		(
t wa	ter stora	age loss		cylinder I com Tabl								0		
	•	from Tal		011 4.3								0		
mpe	rature fa	actor fro	m Table	2b								0		
ergy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (	53) =		0		
nter (	(50) or (	54) in (5	55)								0.	75		
ater s	storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m				
6)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(
vlinde.	r contains	dedicated	d solar sto	rage, (57)r	n = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendix	кН	
ymiac				• , ,										

Primary circuit loss (annual) from Table 3 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 thermostat)

(11100	illica by	iactoi ii	om rab		ilicic is s	olai wat	Ci ricatii	ig and a	Cymnaci	uiciiio	Sidij		_
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi	loss cal	lculated	for each	month (	(61)m =	(60) ÷ 36	65 × (41)	)m					
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

(58)



Total heat	required 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= 17	9.03 157.91	166.12	149.29	146.58	131.37	126.54	138.34	137.93	154.79	163.2	174.85		(62)
Solar DHW i	input calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	y) (enter '(	)' if no sola	r contribu	tion to wate	r heating)		
(add addit	tional 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 fro	m water hea	ter											
(64)m= 17	9.03 157.91	166.12	149.29	146.58	131.37	126.54	138.34	137.93	154.79	163.2	174.85		
	•	•				•	Out	put from wa	ater heate	er (annual) <sub>1</sub>	12	1825.95	(64)
Heat gain	s from water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)r	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	]	
(65)m= 8°	1.31 72.18	77.02	70.72	70.52	64.76	63.86	67.78	66.94	73.25	75.34	79.92		(65)
include	(57)m in cal	culation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	eating	
5. Intern	al gains (see	e Table 5	and 5a	):									
Metabolic	gains (Table	e 5), Wat	ts										
	Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 98	3.91 98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91		(66)
Lighting g	ains (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		_		•	
(67)m= 18	3.72 16.62	13.52	10.24	7.65	6.46	6.98	9.07	12.18	15.46	18.05	19.24		(67)
Appliance	s gains (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), als	see Ta	ble 5				
(68)m= 17	2.64 174.44	169.92	160.31	148.18	136.78	129.16	127.37	131.88	141.49	153.62	165.03		(68)
Cooking g	ains (calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), also s	ee Table	5				
(69)m= 32	2.89 32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89		(69)
Pumps an	nd fans gains	(Table	ōa)										
(70)m=	3 3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.	g. evaporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m= -7	9.13 -79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13		(71)
Water hea	ating gains (1	able 5)							•			•	
(72)m= 10	9.29 107.41	103.52	98.22	94.79	89.95	85.83	91.1	92.98	98.46	104.64	107.42		(72)
Total inte	rnal gains =	•			(66)	)m + (67)m	n + (68)m	+ (69)m + (	(70)m + (	71)m + (72)	m		
(73)m= 35	6.32 354.15	342.63	324.44	306.29	288.85	277.64	283.22	292.71	311.08	331.99	347.36		(73)
6. Solar	gains:												
	_												
•	are calculated	•	r flux from	Table 6a	and assoc	iated equa	itions to c	onvert to th	e applica		ion.		
•	s are calculated n: Access F Table 6d	actor	r flux from Area m²		Flu	•		onvert to th g_ Fable 6b		ble orientat FF able 6c	ion.	Gains (W)	
Orientatio	n: Access F	actor	Area		Flu Tal	ıx		<b>g</b> _		FF	ion. =		7(74)
Orientatio	n: Access F Table 6d	actor	Area m²	6	Flu Tal	lx ble 6a	, ,	g_ Fable 6b	 	FF able 6c		(W)	](74) ](74)
Orientatio	n: Access F Table 6d	actor ×	Area m²	6	Flu Tal × 1	ble 6a	) × [	g_ Fable 6b	 ] × [	FF Table 6c	=	(W) 14.95	╡
Orientatio	n: Access F Table 6d 0.9x 0.77 0.9x 0.77	actor ×	Area m²	6 6	Flu Tal  x 1  x 2  x 3	ble 6a 10.63	x	g_ Fable 6b 0.63 0.63	x [	FF Table 6c 0.7	= =	(W) 14.95 28.57	[74]
Orientatio	n: Access F Table 6d 0.9x 0.77 0.9x 0.77 0.9x 0.77	x x	Area m²  4.  4.  4.	6 6 6	Flu Tal  x 1  x 2  x 3  x 5	ble 6a 10.63 20.32 34.53	x	g_ Fable 6b 0.63 0.63	x [	FF Table 6c 0.7 0.7 0.7	= = =	(W) 14.95 28.57 48.54	(74) (74)
Orientatio  North North North North North North	n: Access F Table 6d 0.9x 0.77 0.9x 0.77 0.9x 0.77 0.9x 0.77	x x x	Area m²  4.  4.  4.  4.	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Flu Tal  x 1  x 2  x 3  x 5  x 7	0.63 0.63 20.32 34.53 55.46	x	g_ Fable 6b 0.63 0.63 0.63	x [	FF Table 6c 0.7 0.7 0.7 0.7	= = = =	(W) 14.95 28.57 48.54 77.97	(74) (74) (74)

74.68

59.25

0.63

0.63

0.7

0.7

4.6

4.6

North

North

0.9x

0.9x

0.77

0.77

(74)

(74)

104.98

83.29







On Engage was increased by the characters and	tomo in alculio municus OLID		
9a. Energy requirements – Individual heating sys Space heating:	tems including micro-CHP)		
Fraction of space heat from secondary/supplem	entary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 - (201)	1) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) ×	[1 - (203)] =	1 (204)
Efficiency of main space heating system 1			93.5 (206)
Efficiency of secondary/supplementary heating s	system, %		0 (208)
Jan Feb Mar Apr May	Jun Jul Aug S	Sep Oct Nov Dec	kWh/year
Space heating requirement (calculated above)			
454.45   379.81   346.81   228.96   123.66	0 0 0 0	0 201.04 332.04 460.88	
$(211)$ m = {[(98)m x (204)] } x 100 ÷ (206)			(211)
486.05   406.21   370.92   244.88   132.25		0 215.01 355.13 492.92	
Occasion of a life control NAMe (consti-	rotai (kvv	/h/year) =Sum(211) <sub>15,1012</sub> =	2703.37 (211)
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$			
(215)m= 0 0 0 0 0 0	0 0 0 0	0 0 0	
	Total (kW	/h/year) =Sum(215) <sub>15,1012</sub> =	0 (215)
Water heating			
Output from water heater (calculated above)  179.03 157.91 166.12 149.29 146.58 1	31.37 126.54 138.34 137	7.93 15 <mark>4.79 163.2 174.85</mark>	
Efficiency of water heater	31.37   126.54   138.34   137	7.93 154.79 163.2 174.65	79.8 (216)
(217)m= 87.2 87.07 86.73 85.95 84.36	79.8 79.8 79.8 79	0.8 85.51 86.67 87.28	(217)
Fuel for water heating, kWh/month			
$(219)$ m = $(64)$ m x $100 \div (217)$ m	Variable of Lands I and		
(219)m= 205.32 181.36 191.52 173.7 173.75 1	Total - St	2.85   181.02   188.29   200.33 um(219a) <sub>1.12</sub> =	2164.68 (219)
Annual totals	rotal = Ot	kWh/year	2164.68 (219) kWh/year
Space heating fuel used, main system 1		RWIII y Cai	2703.37
Water heating fuel used			2164.68
Electricity for pumps, fans and electric keep-hot			
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (2)	30a)(230g) =	<u> </u>
•	3411 01 (24	(2009) =	
Electricity for lighting			330.56 (232)
12a. CO2 emissions – Individual heating system	is including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	583.93 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	467.57 (264)
Space and water heating	(261) + (262) + (263) + (264)		1051.5 (265)
a			(200)

# envision

### TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 171.56 (268) Total CO2, kg/year sum of (265)...(271) = 1261.99 (272)

TER = 21.08 (273)



User Details: **Assessor Name:** Stroma Number: **Software Version: Software Name:** Stroma FSAP 2012 Version: 1.0.4.23 Property Address: Gate House (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) **Basement** 36.22 (1a) x 3.2 (2a) =(3a) 115.9 Ground floor (1b) x (3b) 47.4 3.2 (2b) =151.68 First floor 36.22 (1c) x 3.2 (2c) 115.9 (3c)Second floor (1d) x 37.02 2.76 (2d) 102.18 (3d)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 156.86 (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =Dwelling volume 485.66 (5) 2. Ventilation rate: main secondary other total m³ per hour heating heating x 40 =Number of chimneys 0 n 0 (6a) 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)40 4 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =0 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8)0.08 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)(8) + (10) + (11) + (12) + (13) + (15) =Infiltration rate (16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)(18)0.33 Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1 Shelter factor  $(20) = 1 - [0.075 \times (19)] =$ 0.92 (20)Infiltration rate incorporating shelter factor  $(21) = (18) \times (20) =$ (21)0.31 Infiltration rate modified for monthly wind speed

Mar

Apr

Jun

May

Jul

Sep

Aug

Oct

Nov

Dec

Jan

Feb



Monthly avera	age wind	speed fi	rom Tab	le 7									
(22)m= 5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infilt	ration rat	te (allowi	ina for sl	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36		
Calculate effe		-	rate for t	he appli	cable ca	se				<u> </u>		]	
If mechanic			andiv N. (C	)2h) _ (22d	a) v Emy (4	auation (I	VEVV otho	nuina (22k	a)			0	(23a)
If exhaust air I									0) = (23a)			0	(23b)
a) If balanc		-	-	_					2h)m + (	23h) <b>x</b> [	1 – (23c)	0 ÷ 1001	(23c)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If balanc	ed mech	anical ve	entilation	without	heat red	covery (N	иV) (24k	o)m = (2	2b)m + (2	 23b)	<u> </u>	l	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole I	house ex	tract ver	ntilation o	or positiv	e input	ventilatio	n from o	outside	•	•	•	•	
if (22b)	m < 0.5	× (23b), 1	then (24	c) = (23k	o); other	vise (24	c) = (22l	o) m + 0	.5 × (23b	)		1	
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)	l ventil <mark>ati</mark> m = 1, th								0.5]				
(24d)m = 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(24d)
Effective ai	r change	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in bo	x (25)					
(25)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(25)
3. Heat losse	es and h	eat loss i	paramet	er:									
ELEMENT	Gro	SS	Openin	ıgs	Net Ar		U-val		AXU	<i>^</i>	k-value		A X k
Doors Type 1	area	(m²)	m	)²	A ,r		W/m2		(W/I	<b>⟨</b> )	kJ/m²-l	Λ.	kJ/K
Doors Type 1 Doors Type 2					4.08		1	=		<b>=</b>			(26) (26)
Doors Type 2					2.43	=	1	╡ -	2.43	$\dashv$			(26)
Windows Typ					0.408	〓 .	<u> </u>		0.54	$\dashv$			(27)
Windows Typ					1.84		/[1/( 1.4 )+		2.44	=			(27)
Windows Typ					0.408	<b>=</b>   .	/[1/( 1.4 )+		0.54	=			(27)
Windows Typ					1.84				2.44	╡			(27)
Windows Typ					0.907	<b>=</b>   .	- /[1/( 1.4 )+		1.2	=			(27)
Windows Typ					0.907	ऱ .			1.2	$\dashv$			(27)
Windows Typ					1.34		- /[1/( 1.4 )+		1.78	$\dashv$			(27)
Windows Typ					2.72		- /[1/( 1.4 )+		3.61	$\exists$			(27)
Windows Typ					1.82	〓 .	/[1/( 1.4 )+		2.41	$\exists$			(27)
Windows Typ					2.72	<del>_</del>	/[1/( 1.4 )+		3.61	Ħ			(27)
Windows Typ	e 11				1.45	〓 .	/[1/( 1.4 )+	0.04] =	1.92	Ħ			(27)



Windows Type 12	2.91	x1/[1/( 1.4 )+	0.04] =	3.86				(27)
Windows Type 13	0.58	x1/[1/( 1.4 )+	0.04] =	0.77				(27)
Floor Type 1	36.22	x 0.13	= [	4.7086				(28)
Floor Type 2	47.41	x 0.13	= [	6.1633				(28)
Walls Type1 66.24 4.08	62.16	x 0.18	= [	11.19				(29)
Walls Type2 76.51 11.17	65.34	x 0.18	= [	11.76				(29)
Walls Type3 66.24 8.6	57.64	x 0.18	= [	10.38				(29)
Walls Type4 75.9 4.94	70.96	x 0.18	= [	12.77				(29)
Roof 45 0	45	x 0.13	= [	5.85				(30)
Total area of elements, m <sup>2</sup>	413.52							(31)
Party wall	14.08	<b>x</b> 0		0				(32)
Party wall	14.08	<b>x</b> 0	<u> </u>	0				(32)
Party wall	14.08	<b>x</b> 0	<u> </u>	0				(32)
Party wall	9.91	<b>x</b> 0	<u> </u>	0				(32)
Party floor	36.22							(32a)
Party floor	37.02							(32a)
Party ceiling	36.22							(32b)
Party ceiling	47.4							(32b)
Party ceiling	36.22							(32b)
* for windows and roof windows, use effective window ** include the areas on both sides of internal walls and		sing formula 1	/[(1/U-valu	ıe)+ <mark>0.04] a</mark>	s given in	paragraph	3.2	
Fabric heat loss, W/K = S (A x U)		(26)(30	) + (32) =				98.08	(33)
Heat capacity Cm = S(A x k)			((28)	.(30) + (32	2) + (32a).	(32e) =	37002.6	(34)
Thermal mass parameter (TMP = Cm ÷ TFA	a) in kJ/m²K		Indica	tive Value:	Medium		250	(35)
For design assessments where the details of the const can be used instead of a detailed calculation.	ruction are not known	n precisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridges: S (L x Y) calculated using	Appendix K						20.68	(36)
if details of thermal bridging are not known (36) = 0.05	• •						20.00	
Total fabric heat loss			(33) +	(36) =			118.75	(37)
Ventilation heat loss calculated monthly		·	(38)m	= 0.33 × (	25)m x (5)	)	1	
Jan Feb Mar Apr Ma	<del>-                                     </del>	Ť	Sep	Oct	Nov	Dec		
(38)m= 92.45 91.97 91.5 89.3 88.8	86.97 86.9	7 86.61	87.71	88.89	89.72	90.59		(38)
Heat transfer coefficient, W/K			•	= (37) + (3			1	
(39)m= 211.2 210.72 210.25 208.05 207.	64 205.72 205.7	72 205.37	206.46	207.64	208.47	209.34		7(20)
Heat loss parameter (HLP), W/m²K				Average = = (39)m ÷		12 /12=	208.05	(39)
(40)m= 1.35 1.34 1.34 1.33 1.3	2 1.31 1.31	1 1.31	1.32	1.32	1.33	1.33		
			•	Average =	Sum(40) <sub>1</sub>	12 /12=	1.33	(40)
Number of days in month (Table 1a)	1.1.	.   .					1	
Jan Feb Mar Apr Mar	<del>-                                     </del>	-	Sep	Oct	Nov	Dec		(44)
(41)m= 31 28 31 30 31	30 31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

2.94

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)

Annual average hot water usage in litres per day Vd average =  $(25 \times N) + 36$ 

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(42)



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) 169.86 148.56 153.31 133.66 128.25 110.67 102.55 117.68 119.08 138.78 151.49 164.5 (45)m =Total =  $Sum(45)_{1...12}$  = 1638.38 (45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)25.48 22.28 20.05 19.24 16.6 15.38 20.82 22.72 24.68 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): (48)2.13 Temperature factor from Table 2b 0.54 (49)Energy lost from water storage, kWh/year  $(48) \times (49) =$ (50)1.15 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) (51)0 If community heating see section 4.3 Volume factor from Table 2a 0 (52)Temperature factor from Table 2b 0 (53)Energy lost from water storage, kWh/year  $(47) \times (51) \times (52) \times (53) =$ 0 (54)Enter (50) or (54) in (55) (55)1.15 Water storage loss calculated for each month  $((56)m = (55) \times (41)m$ (56)m =35.73 32.27 35.73 34.57 35.73 34.57 35.73 35.73 34.57 35.73 34.57 35.73 (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 35.73 32.27 35.73 34.57 35.73 34.57 35.73 35.73 34.57 35.73 34.57 35.73 (57)(57)m =(58)Primary circuit loss (annual) from Table 3 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 thermostat) (59)(59)m =23.26 21.01 23.26 23.26 22.51 23.26 22.51 23.26 22.51 23.26 Combi loss calculated for each month (61)m = (60)  $\div$  365 x (41)m 0 0 0 0 0 (61)(61)m =0 0 Total heat required for water heating calculated for each month  $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ 228.85 201.85 212.29 190.74 187.23 167.75 161.54 176.67 176.17 197.77 (62)208.57 223.49 (62)m =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)(63)m =0 0 0 0 0 0 0 Output from water heater 228.85 201.85 212.29 190.74 187.23 167.75 161.54 (64)m =176.67 176.17 197.77 208.57 223.49 (64)Output from water heater (annual) 1...12 2332.93 Heat gains from water heating, kWh/month  $0.25 (0.85 \times (45)) + (61) + 0.8 \times ((46)) + (57) + (59) +$ 86.32 (65)(65)m =103.67 98.17 90.11 89.83 82.47 81.29 85.26 93.33 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



				<u></u>				T	T			(22)
(66)m= 147.2		47.22	147.22 147.		47.22   147.2			147.22	147.22	147.22		(66)
· -	ns (calculated	<del></del>	<del>'                                    </del>		<del></del>				1	ı		(0=)
(67)m= 32.0°		23.16	17.54 13.4	!_	11.07	Ļ	!	26.49	30.92	32.96		(67)
· · · · · ·	gains (calcula		<del></del>						T	1		
(68)m= 327.8	39 331.29 3	322.72	304.46 281.	42 2	59.77 245.	.3 24	.9 250.47	268.73	291.77	313.42		(68)
Cooking gai	ns (calculate	d in Ap	pendix L, eq			5a), als	o see Table	5		,		
(69)m= $37.7$	2 37.72	37.72	37.72 37.7	72 (	37.72	2 37.	72 37.72	37.72	37.72	37.72		(69)
Pumps and	fans gains (T	able 5	a)									
(70)m= 3	3	3	3 3		3 3	3	3	3	3	3		(70)
Losses e.g.	evaporation	(negati	ve values) (	Table	5)							
(71)m= -117.7	78 -117.78 -1	117.78	-117.78 -117.	.78 -1	17.78 -117.	78 -117	.78 -117.78	-117.78	-117.78	-117.78		(71)
Water heating	ng gains (Tab	ole 5)										
(72)m= 139.3	34   136.94   1	31.94	125.15 120.	74 1	14.54 109.2	26 116	.02 118.42	125.45	133.39	136.95		(72)
Total intern	al gains =				(66)m + (6	7)m + (68	3)m + (69)m +	(70)m + (	71)m + (72)	m		
(73)m= 569.4	566.88	547.99	517.32 485.	44 4	55.54 436.6	68 443	.63 459.92	490.83	526.24	553.49		(73)
6. Solar ga												
	e calculated usi	-		6a and		quations		ne applica		ion.		
Orientation:	Access Fac Table 6d	ctor	Area m²		Flux Table 6a		g_ Table 6b	-	FF able 6c		Gains (W)	
Nauth		<u> </u>		4		47				_	` ,	<b>–</b>
North 0.9		×	0.41	X	10.63	×	0.63	× [	0.7	=	1.33	(74)
North 0.9		×	1.84	×	10.63	×	0.63	X	0.7	=	5.98	(74)
North 0.9	0	×	1.34	_ ×	10.63	×	0.63	× [	0.7	=	4.35	(74)
North 0.9		×	2.72	×	10.63	X	0.63	X	0.7	=	8.84	(74)
North 0.9		×	1.45	×	10.63	x	0.63	×	0.7	=	4.71	(74)
North 0.9	• • • • • • • • • • • • • • • • • • • •	×	0.58	×	10.63	×	0.63	x	0.7	=	1.88	(74)
North 0.9		X	0.41	×	20.32	X	0.63	x	0.7	=	2.53	(74)
North 0.9		X	1.84	×	20.32	X	0.63	x	0.7	=	11.43	(74)
North 0.9	× 0.77	×	1.34	×	20.32	X	0.63	x	0.7	=	8.32	(74)
North 0.9	× 0.77	X	2.72	X	20.32	X	0.63	X	0.7	=	16.89	(74)
North 0.9	x 0.77	X	1.45	×	20.32	X	0.63	X	0.7	=	9.01	(74)
North 0.9	x 0.77	X	0.58	X	20.32	X	0.63	x	0.7	=	3.6	(74)
North 0.9	x 0.77	X	0.41	X	34.53	X	0.63	x	0.7	=	4.31	(74)
North 0.9	× 0.77	X	1.84	X	34.53	X	0.63	x	0.7	=	19.42	(74)
North 0.9	× 0.77	X	1.34	x	34.53	X	0.63	x	0.7	=	14.14	(74)
North 0.9	x 0.77	X	2.72	X	34.53	X	0.63	x	0.7	=	28.7	(74)
North 0.9	x 0.77	X	1.45	X	34.53	X	0.63	x	0.7	=	15.3	(74)
North 0.9	x 0.77	X	0.58	X	34.53	X	0.63	x	0.7	=	6.12	(74)
North 0.9	x 0.77	X	0.41	X	55.46	X	0.63	x	0.7	=	6.92	(74)
North 0.9	x 0.77	X	1.84	X	55.46	X	0.63	x	0.7	=	31.19	(74)
North 0.9	x 0.77	х	1.34	X	55.46	X	0.63	x	0.7	=	22.71	(74)



	_		_		_						_		_
North	0.9x	0.77	X	2.72	X	55.46	X	0.63	X	0.7	=	46.11	(74)
North	0.9x	0.77	X	1.45	x	55.46	X	0.63	X	0.7	=	24.58	(74)
North	0.9x	0.77	x	0.58	X	55.46	X	0.63	X	0.7	=	9.83	(74)
North	0.9x	0.77	x	0.41	X	74.72	X	0.63	x	0.7	=	9.32	(74)
North	0.9x	0.77	X	1.84	X	74.72	x	0.63	x	0.7	=	42.01	(74)
North	0.9x	0.77	x	1.34	X	74.72	X	0.63	x	0.7	=	30.6	(74)
North	0.9x	0.77	x	2.72	x	74.72	X	0.63	x	0.7	=	62.11	(74)
North	0.9x	0.77	X	1.45	X	74.72	x	0.63	x	0.7	=	33.11	(74)
North	0.9x	0.77	x	0.58	X	74.72	X	0.63	x	0.7	=	13.24	(74)
North	0.9x	0.77	x	0.41	x	79.99	x	0.63	X	0.7	=	9.97	(74)
North	0.9x	0.77	x	1.84	x	79.99	X	0.63	X	0.7	=	44.98	(74)
North	0.9x	0.77	x	1.34	x	79.99	X	0.63	X	0.7	=	32.76	(74)
North	0.9x	0.77	x	2.72	x	79.99	X	0.63	X	0.7	=	66.49	(74)
North	0.9x	0.77	X	1.45	x	79.99	X	0.63	X	0.7	=	35.44	(74)
North	0.9x	0.77	X	0.58	X	79.99	X	0.63	X	0.7	=	14.18	(74)
North	0.9x	0.77	x	0.41	x	74.68	X	0.63	x	0.7	=	9.31	(74)
North	0.9x	0.77	X	1.84	X	74.68	X	0.63	X	0.7	=	41.99	(74)
North	0.9x	0.77	X	1.34	X	74.68	Х	0.63	X	0.7	-	30.58	(74)
North	0.9x	0.77	x	2.72	х	74.68	x	0.63	x	0.7	=	62.08	(74)
North	0.9x	0.77	X	1.45	х	74.68	x	0.63	x	0.7	] =	33.09	(74)
North	0.9x	0.77	x	0.58	X	74.68	X	0.63	x	0.7	=	13.24	(74)
North	0.9x	0.77	x	0.41	X	59.25	Х	0.63	x	0.7	=	7.39	(74)
North	0.9x	0.77	x	1.84	х	59.25	X	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	X	1.34	х	59.25	X	0.63	X	0.7	=	24.26	(74)
North	0.9x	0.77	X	2.72	X	59.25	X	0.63	X	0.7	=	49.25	(74)
North	0.9x	0.77	X	1.45	X	59.25	X	0.63	X	0.7	=	26.25	(74)
North	0.9x	0.77	X	0.58	X	59.25	X	0.63	X	0.7	=	10.5	(74)
North	0.9x	0.77	X	0.41	X	41.52	X	0.63	X	0.7	=	5.18	(74)
North	0.9x	0.77	x	1.84	x	41.52	X	0.63	X	0.7	=	23.35	(74)
North	0.9x	0.77	X	1.34	x	41.52	X	0.63	X	0.7	=	17	(74)
North	0.9x	0.77	X	2.72	X	41.52	X	0.63	X	0.7	=	34.51	(74)
North	0.9x	0.77	X	1.45	X	41.52	X	0.63	X	0.7	=	18.4	(74)
North	0.9x	0.77	X	0.58	X	41.52	X	0.63	X	0.7	=	7.36	(74)
North	0.9x	0.77	X	0.41	X	24.19	X	0.63	X	0.7	=	3.02	(74)
North	0.9x	0.77	X	1.84	X	24.19	X	0.63	X	0.7	=	13.6	(74)
North	0.9x	0.77	X	1.34	x	24.19	X	0.63	X	0.7	=	9.91	(74)
North	0.9x	0.77	x	2.72	x	24.19	x	0.63	x	0.7	] =	20.11	(74)
North	0.9x	0.77	x	1.45	x	24.19	x	0.63	x	0.7	] =	10.72	(74)
North	0.9x	0.77	x	0.58	x	24.19	x	0.63	x	0.7	] =	4.29	(74)
North	0.9x	0.77	x	0.41	x	13.12	X	0.63	X	0.7	=	1.64	(74)
North	0.9x	0.77	X	1.84	X	13.12	X	0.63	X	0.7	=	7.38	(74)

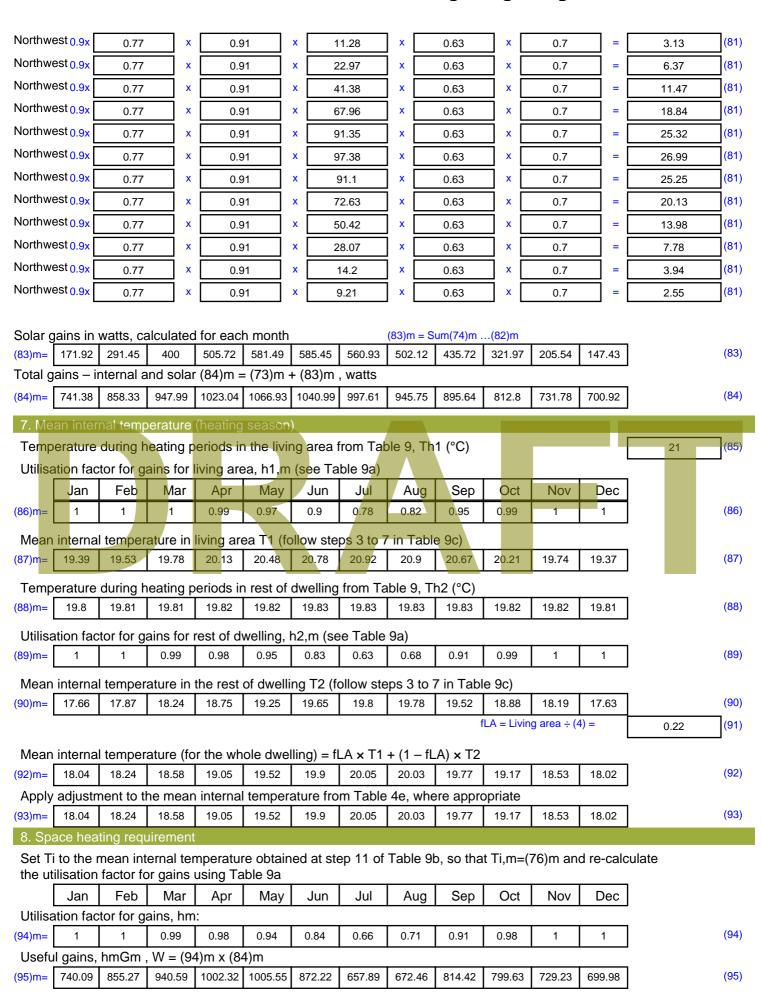


North				1				,				,		_
North	North	0.9x	0.77	X	1.34	X	13.12	X	0.63	X	0.7	=	5.37	(74)
North		0.9x	0.77	X	2.72	X	13.12	X	0.63	X	0.7	=	10.9	(74)
North		0.9x	0.77	X	1.45	X	13.12	X	0.63	X	0.7	=	5.81	<b>(74)</b>
North	North	0.9x	0.77	X	0.58	X	13.12	X	0.63	X	0.7	=	2.33	(74)
North	North	0.9x	0.77	X	0.41	x	8.86	X	0.63	X	0.7	=	1.11	(74)
North	North	0.9x	0.77	X	1.84	X	8.86	X	0.63	X	0.7	=	4.98	(74)
North	North	0.9x	0.77	X	1.34	X	8.86	X	0.63	X	0.7	=	3.63	(74)
North	North	0.9x	0.77	X	2.72	x	8.86	X	0.63	X	0.7	=	7.37	(74)
Northeast 0,9x	North	0.9x	0.77	X	1.45	X	8.86	X	0.63	X	0.7	=	3.93	(74)
Northeast 0.9x				X	0.58	X	8.86	X	0.63	X	0.7	=	1.57	(74)
Northeast 0.9x			• • • • • • • • • • • • • • • • • • • •	X	0.91	X	11.28	X	0.63	X	0.7	=	3.13	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	X	0.91	X	22.97	X	0.63	X	0.7	=	6.37	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	X	0.91	x	41.38	x	0.63	x	0.7	=	11.47	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	X	0.91	x	67.96	x	0.63	X	0.7	=	18.84	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	X	0.91	x	91.35	X	0.63	x	0.7	=	25.32	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	X	0.91	x	97.38	x	0.63	X	0.7	=	26.99	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	X	0.91	x	91.1	x	0.63	X	0.7	=	25.25	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	x	0.91	X	72.63	Х	0.63	X	0.7	-	20.13	(75)
Northeast 0.9x	Northeas	t 0.9x	0.77	x	0.91	х	50.42	] x	0.63	x	0.7	=	13.98	(75)
Northeast 0.9x	Northeas	0.9x	0.77	x	0.91	x	28.07	×	0.63	x	0.7	=	7.78	(75)
South         0.9x         0.77         x         0.41         x         46,75         x         0.63         x         0.7         =         5.83         (78)           South         0.9x         0.77         x         1.84         x         46,75         x         0.63         x         0.7         =         26.29         (78)           South         0.9x         0.77         x         1.82         x         46,75         x         0.63         x         0.7         =         26.29         (78)           South         0.9x         0.77         x         2.72         x         46,75         x         0.63         x         0.7         =         26.29         (78)           South         0.9x         0.77         x         2.91         x         46,75         x         0.63         x         0.7         =         38.86         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.63         x         0.7         =         41.58         (78)           South         0.9x         0.77         x         1.82         x         76.57	Northeas	0.9x	0.77	X	0.91	X	14.2	X	0.63	X	0.7	=	3.94	(75)
South         0.9x         0.77         x         1.84         x         46.75         x         0.63         x         0.7         =         26.29         (78)           South         0.9x         0.77         x         1.82         x         46.75         x         0.63         x         0.7         =         26.29         (78)           South         0.9x         0.77         x         2.72         x         46.75         x         0.63         x         0.7         =         26.29         (78)           South         0.9x         0.77         x         2.91         x         46.75         x         0.63         x         0.7         =         38.86         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.63         x         0.7         =         41.58         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.91         x         76.57	Northeas	0.9x	0.77	] x	0.91	x	9.21	Х	0.63	x	0.7	=	2.55	(75)
South         0.9x         0.77         x         1.82         x         46.75         x         0.63         x         0.7         =         26         (78)           South         0.9x         0.77         x         2.72         x         46.75         x         0.63         x         0.7         =         38.86         (78)           South         0.9x         0.77         x         2.91         x         46.75         x         0.63         x         0.7         =         41.58         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.63         x         0.7         =         41.58         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.63         x         0.7         =         43.06         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.91         x         76.57	South	0.9x	0.77	] x	0.41	x	46.75	X	0.63	x	0.7	=	5.83	(78)
South         0.9x         0.77         x         2.72         x         46.75         x         0.63         x         0.7         =         38.86         (78)           South         0.9x         0.77         x         2.91         x         46.75         x         0.63         x         0.7         =         41.58         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.63         x         0.7         =         9.55         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.63         x         0.7         =         43.06         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.63         x         0.7         =         63.65         (78)           South         0.9x         0.77         x         0.41         x         97.53	South	0.9x	0.77	x	1.84	x	46.75	x	0.63	x	0.7	=	26.29	(78)
South         0.9x         0.77         x         2.91         x         46.75         x         0.63         x         0.7         =         41.58         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.63         x         0.7         =         9.55         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.63         x         0.7         =         43.06         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         43.06         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         1.84         x         97.53	South	0.9x	0.77	X	1.82	X	46.75	x	0.63	X	0.7	=	26	(78)
South         0.9x         0.77         x         0.41         x         76.57         x         0.63         x         0.7         =         9.55         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.63         x         0.7         =         43.06         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.63         x         0.7         =         63.65         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         1.84         x         97.53	South	0.9x	0.77	X	2.72	x	46.75	X	0.63	X	0.7	=	38.86	(78)
South         0.9x         0.77         x         1.84         x         76.57         x         0.63         x         0.7         =         43.06         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.63         x         0.7         =         63.65         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.63         x         0.7         =         63.65         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.63         x         0.7         =         54.85         (78)           South         0.9x         0.77         x         1.82         x         97.53	South	0.9x	0.77	X	2.91	X	46.75	X	0.63	x	0.7	=	41.58	(78)
South         0.9x         0.77         x         1.82         x         76.57         x         0.63         x         0.7         =         42.59         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.63         x         0.7         =         63.65         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.63         x         0.7         =         54.85         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.63         x         0.7         =         54.25         (78)           South         0.9x         0.77         x         2.72         x         97.53	South	0.9x	0.77	X	0.41	X	76.57	x	0.63	X	0.7	=	9.55	(78)
South         0.9x         0.77         x         2.72         x         76.57         x         0.63         x         0.7         =         63.65         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.63         x         0.7         =         54.85         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.63         x         0.7         =         54.25         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.63         x         0.7         =         81.08         (78)           South         0.9x         0.77         x         2.91         x         97.53	South	0.9x	0.77	X	1.84	x	76.57	x	0.63	X	0.7	=	43.06	(78)
South         0.9x         0.77         x         2.91         x         76.57         x         0.63         x         0.7         =         68.09         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         12.16         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.63         x         0.7         =         54.85         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.63         x         0.7         =         54.25         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.63         x         0.7         =         81.08         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.63         x         0.7         =         86.74         (78)           South         0.9x         0.77         x         0.41         x         110.23	South	0.9x	0.77	X	1.82	x	76.57	X	0.63	x	0.7	] =	42.59	(78)
South         0.9x         0.77         x         0.41         x         97.53         x         0.63         x         0.7         =         12.16         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.63         x         0.7         =         54.85         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.63         x         0.7         =         54.25         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.63         x         0.7         =         54.25         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.63         x         0.7         =         81.08         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.63         x         0.7         =         86.74         (78)           South         0.9x         0.77         x         1.84         x         110.23	South	0.9x	0.77	X	2.72	x	76.57	x	0.63	X	0.7	=	63.65	(78)
South       0.9x       0.77       x       1.84       x       97.53       x       0.63       x       0.7       =       54.85       (78)         South       0.9x       0.77       x       1.82       x       97.53       x       0.63       x       0.7       =       54.25       (78)         South       0.9x       0.77       x       2.72       x       97.53       x       0.63       x       0.7       =       81.08       (78)         South       0.9x       0.77       x       2.91       x       97.53       x       0.63       x       0.7       =       81.08       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.63       x       0.7       =       86.74       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.63       x       0.7       =       61.99       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.63       x       0.7       =       61.31       (78)	South	0.9x	0.77	X	2.91	X	76.57	x	0.63	X	0.7	=	68.09	(78)
South       0.9x       0.77       x       1.82       x       97.53       x       0.63       x       0.7       =       54.25       (78)         South       0.9x       0.77       x       2.72       x       97.53       x       0.63       x       0.7       =       81.08       (78)         South       0.9x       0.77       x       2.91       x       97.53       x       0.63       x       0.7       =       86.74       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.63       x       0.7       =       61.99       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.63       x       0.7       =       61.99       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.63       x       0.7       =       61.31       (78)	South	0.9x	0.77	X	0.41	x	97.53	x	0.63	X	0.7	=	12.16	(78)
South       0.9x       0.77       x       2.72       x       97.53       x       0.63       x       0.7       =       81.08       (78)         South       0.9x       0.77       x       2.91       x       97.53       x       0.63       x       0.7       =       86.74       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.63       x       0.7       =       61.99       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.63       x       0.7       =       61.99       (78)	South	0.9x	0.77	X	1.84	X	97.53	X	0.63	X	0.7	=	54.85	(78)
South       0.9x       0.77       x       2.91       x       97.53       x       0.63       x       0.7       =       86.74       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.63       x       0.7       =       13.75       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.63       x       0.7       =       61.99       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.63       x       0.7       =       61.31       (78)	South	0.9x	0.77	X	1.82	X	97.53	X	0.63	X	0.7	=	54.25	(78)
South       0.9x       0.77       x       0.41       x       110.23       x       0.63       x       0.7       =       13.75       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.63       x       0.7       =       61.99       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.63       x       0.7       =       61.31       (78)	South	0.9x	0.77	X	2.72	X	97.53	x	0.63	X	0.7	=	81.08	(78)
South 0.9x 0.77 x 1.84 x 110.23 x 0.63 x 0.7 = 61.99 (78) South 0.9x 0.77 x 1.82 x 110.23 x 0.63 x 0.7 = 61.31 (78)	South	0.9x	0.77	X	2.91	x	97.53	x	0.63	x	0.7	=	86.74	(78)
South 0.9x 0.77 x 1.82 x 110.23 x 0.63 x 0.7 = 61.31 (78)	South	0.9x	0.77	X	0.41	x	110.23	x	0.63	x	0.7	=	13.75	(78)
	South	0.9x	0.77	X	1.84	x	110.23	x	0.63	x	0.7	] =	61.99	(78)
South 0.9x 0.77 x 2.72 x 110.23 x 0.63 x 0.77 = 91.63 (78)	South	0.9x	0.77	X	1.82	x	110.23	x	0.63	X	0.7	=	61.31	(78)
	South	0.9x	0.77	X	2.72	x	110.23	x	0.63	x	0.7	=	91.63	(78)



	_				•								_
South	0.9x	0.77	X	2.91	X	110.23	X	0.63	X	0.7	=	98.04	(78)
South	0.9x	0.77	X	0.41	X	114.87	X	0.63	X	0.7	=	14.32	(78)
South	0.9x	0.77	X	1.84	X	114.87	X	0.63	X	0.7	=	64.6	(78)
South	0.9x	0.77	X	1.82	X	114.87	X	0.63	X	0.7	=	63.89	(78)
South	0.9x	0.77	X	2.72	X	114.87	X	0.63	X	0.7	=	95.49	(78)
South	0.9x	0.77	X	2.91	x	114.87	X	0.63	X	0.7	=	102.16	(78)
South	0.9x	0.77	X	0.41	X	110.55	X	0.63	X	0.7	=	13.78	(78)
South	0.9x	0.77	X	1.84	X	110.55	x	0.63	X	0.7	=	62.16	(78)
South	0.9x	0.77	X	1.82	X	110.55	X	0.63	X	0.7	=	61.49	(78)
South	0.9x	0.77	X	2.72	x	110.55	X	0.63	X	0.7	=	91.89	(78)
South	0.9x	0.77	X	2.91	X	110.55	X	0.63	X	0.7	=	98.31	(78)
South	0.9x	0.77	X	0.41	X	108.01	X	0.63	X	0.7	=	13.47	(78)
South	0.9x	0.77	X	1.84	x	108.01	X	0.63	X	0.7	=	60.74	(78)
South	0.9x	0.77	X	1.82	x	108.01	X	0.63	X	0.7	=	60.08	(78)
South	0.9x	0.77	X	2.72	x	108.01	X	0.63	X	0.7	=	89.79	(78)
South	0.9x	0.77	X	2.91	x	108.01	X	0.63	X	0.7	=	96.06	(78)
South	0.9x	0.77	X	0.41	X	104.89	X	0.63	X	0.7	=	13.08	(78)
South	0.9x	0.77	X	1.84	X	104.89	X	0.63	X	0.7	=	58.99	(78)
South	0.9x	0.77	X	1.82	х	104.89	X	0.63	X	0.7	=	58.34	(78)
South	0.9x	0.77	X	2.72	х	104.89	X	0.63	X	0.7	=	87.2	(78)
South	0.9x	0.77	X	2.91	X	104.89	X	0.63	X	0.7	=	93.29	(78)
South	0.9x	0.77	X	0.41	х	101.89	Х	0.63	X	0.7	=	12.7	(78)
South	0.9x	0.77	X	1.84	х	101.89	X	0.63	X	0.7	=	57.29	(78)
South	0.9x	0.77	X	1.82	х	101.89	X	0.63	X	0.7	=	56.67	(78)
South	0.9x	0.77	X	2.72	X	101.89	X	0.63	X	0.7	=	84.69	(78)
South	0.9x	0.77	X	2.91	X	101.89	X	0.63	X	0.7	=	90.61	(78)
South	0.9x	0.77	X	0.41	x	82.59	X	0.63	X	0.7	=	10.3	(78)
South	0.9x	0.77	X	1.84	x	82.59	X	0.63	X	0.7	=	46.44	(78)
South	0.9x	0.77	X	1.82	x	82.59	X	0.63	X	0.7	=	45.94	(78)
South	0.9x	0.77	X	2.72	X	82.59	X	0.63	X	0.7	=	68.65	(78)
South	0.9x	0.77	X	2.91	x	82.59	X	0.63	X	0.7	=	73.45	(78)
South	0.9x	0.77	X	0.41	X	55.42	X	0.63	X	0.7	=	6.91	(78)
South	0.9x	0.77	X	1.84	X	55.42	X	0.63	X	0.7	=	31.16	(78)
South	0.9x	0.77	X	1.82	x	55.42	X	0.63	X	0.7	=	30.82	(78)
South	0.9x	0.77	X	2.72	x	55.42	X	0.63	X	0.7	=	46.07	(78)
South	0.9x	0.77	X	2.91	x	55.42	X	0.63	X	0.7	=	49.28	(78)
South	0.9x	0.77	X	0.41	x	40.4	X	0.63	X	0.7	=	5.04	(78)
South	0.9x	0.77	X	1.84	x	40.4	X	0.63	X	0.7	=	22.72	(78)
South	0.9x	0.77	X	1.82	x	40.4	X	0.63	X	0.7	=	22.47	(78)
South	0.9x	0.77	X	2.72	x	40.4	X	0.63	X	0.7	=	33.58	(78)
South	0.9x	0.77	X	2.91	X	40.4	X	0.63	X	0.7	=	35.93	(78)







Mon	thly avera	ne exte	arnal tem	nerature	from T	ahle 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)
Heat	loss rate	for me	an intern	al tempe	erature,	Lm , W :	=[(39)m	x [(93)m	– (96)m	]	<u>I</u>	<u> </u>		
(97)m=	2902.75	2811.28	2539.98	2112.33	1624.32	1091.11	709.48	745.88	1171.15	1780.42	2383.44	2893.24		(97)
Spac	ce heating					/Vh/mon	th = 0.02	24 x [(97)	)m – (95	)m] x (4	1)m			
(98)m=	1609.02	1314.44	1189.95	799.21	460.37	0	0	0	0	729.7	1191.03	1631.78		_
0				L-) A / l- / (	2/			Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	8925.5	(98)
	ce heating	•											56.9	(99)
	nergy req		nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	<b>ce heatin</b> tion of sp	•	at from se	econdar	v/supple	mentary	svstem					1	0	(201)
	tion of sp						•	(202) = 1 -	- (201) =				1	(202)
Frac	tion of tot	al heati	ng from ı	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Effic	iency of n	nain spa	ace heati	ing syste	em 1								93.5	(206)
Effic	iency 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/ye	ear
Spac	ce heating													
			1189.95		460.37	0	0	0	0	729.7	1191.03	1631.78		
(211)ı	$n = \{[(98)]$	,		`										(211)
	1720.88	1405.82	1272.67	854.77	492.37	0	0	0	0	780.43		17 <mark>45.22</mark>		
								Toto	I (Id)Mh/you	cum/s	044)			(044)
0				) I \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \				Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	=	9545.99	(211)
	ce heating	`			month			Tota	l (kWh/yea	ar) =Sum(2	2 <b>11)<sub>15,1012</sub></b>	=	9545.99	(211)
	8)m x (20	`			month 0	0	0	Tota	I (kWh/yea	o = Sum(2	0	0	9545.99	(211)
= {[(98	8)m x (20	1)] } x 1	00 ÷ (20	8)		0	0	0	0	0	7	0	9545.99	(211)
= {[(98 (215)m	8)m x (20	1)] } x 1	00 ÷ (20	8)		0	0	0	0	0	0	0		_
= {[(98 (215)m	s)m x (20	1)] } x 1 0	00 ÷ (20 0	8) 0 ulated a	0 bove)		ı °	0 Tota	0 I (kWh/yea	0 ar) =Sum(2	0215) <sub>15,1012</sub>	0		_
= {[(96 (215)m	s)m x (20 0 r heating at from wa 228.85	0 ater hea 201.85	00 ÷ (20 0 tter (calculation)	8)	0	167.75	161.54	0	0	0	0	0	0	(215)
= {[(98 (215)m Water Outpu	r heating 228.85 ency of wa	0 ater hea 201.85 ater hea	00 ÷ (20 0 ter (calculater (calculater)	8) 0 ulated a 190.74	0 bove) 187.23	167.75	161.54	0 Tota 176.67	0 I (kWh/yea	0 ar) =Sum(2 197.77	0 215) <sub>15,1012</sub> 208.57	223.49		(215)
= {[(98 (215)m <b>Wate</b> Outpu Efficie (217)m	B)m x (20 = 0 r heating at from wa 228.85 ency of wa = 89.01	0 ater hea 201.85 ater hea 88.91	00 ÷ (20 0 tter (calc 212.29 ater 88.7	8) 0 ulated a 190.74	0 bove)		ı °	0 Tota	0 I (kWh/yea	0 ar) =Sum(2	0215) <sub>15,1012</sub>	0	0	(215)
= {[(98 (215)m <b>Wate</b> Outpu Efficie (217)m Fuel f	r heating at from wa 228.85 ency of wa 89.01 or water i	0 ater hea 201.85 ater hea 88.91 neating,	00 ÷ (20 0 tter (calc 212.29 ater 88.7	8) 0 ulated a 190.74 88.22	0 bove) 187.23	167.75	161.54	0 Tota 176.67	0 I (kWh/yea	0 ar) =Sum(2 197.77	0 215) <sub>15,1012</sub> 208.57	223.49	0	(215)
= {[(98 (215)m <b>Wate</b> Outpu Efficie (217)m Fuel f	r heating  r heating  228.85  ency of wa  89.01  or water I  m = (64)	0 ater hea 201.85 ater hea 88.91 neating,	00 ÷ (20 0 tter (calc 212.29 ater 88.7	8) 0 ulated a 190.74 88.22	0 bove) 187.23	167.75	161.54	0 Tota 176.67	0 I (kWh/yea	0 ar) =Sum(2 197.77	0 215) <sub>15,1012</sub> 208.57	223.49	0	(215)
= {[(98 (215)m <b>Wate</b> Outpu Efficie (217)m Fuel f (219)m (219)m	8)m x (20 r heating ut from wa 228.85 ency of wa = 89.01 or water I m = (64)r = 257.1	0 ater hear 201.85 ater hear 88.91 heating, m x 100	00 ÷ (20 0 ater (calculus) 212.29 ater 88.7 kWh/mc 0 ÷ (217)	8) 0 ulated a 190.74 88.22 onth m	0 bove) 187.23	167.75 79.8	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17	0 197.77 87.98	0 215) <sub>15,1012</sub> 208.57	223.49 89.06	0	(215)
= {[(98 (215)m Water Output Efficie (217)m Fuel f (219)m (219)m	r heating t from wa 228.85 ency of wa 89.01 or water I m = (64)r = 257.1	0 ater hea 201.85 ater hea 88.91 neating, m x 100 227.01	00 ÷ (20 0 tter (calconduction (calconduction)) 212.29 atter 88.7 kWh/modulum (calconduction) 5 ÷ (217) 239.34	8) 0 ulated a 190.74 88.22 onth m 216.21	0 bove) 187.23 87.12	167.75 79.8	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17 79.8	0 197.77 87.98 224.78	0 215) <sub>15,1012</sub> 208.57	0 = 223.49 89.06	79.8 2720.16 <b>kWh/yea</b>	(215) (216) (217)
= {[(98 (215)m Water Output Efficie (217)m Fuel f (219)m Annu Space	r heating t from wa 228.85 ency of wa = 89.01 or water I m = (64)r = 257.1  al totals e heating	ater hear 201.85 ater hear 88.91 neating, m x 100 227.01	00 ÷ (20 0 tter (calconduction (calconduction)) 212.29 atter 88.7 kWh/modulus (217) 239.34	8) 0 ulated a 190.74 88.22 onth m 216.21	0 bove) 187.23 87.12	167.75 79.8	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17 79.8	0 197.77 87.98 224.78	0 215) <sub>15,1012</sub> 208.57 88.73	0 = 223.49 89.06	79.8	(215) (216) (217)
= {[(98 (215)m Water Output Efficie (217)m Fuel f (219)m Annu Space	r heating t from wa 228.85 ency of wa 89.01 or water I m = (64)r = 257.1	ater hear 201.85 ater hear 88.91 neating, m x 100 227.01	00 ÷ (20 0 tter (calconduction (calconduction)) 212.29 atter 88.7 kWh/modulus (217) 239.34	8) 0 ulated a 190.74 88.22 onth m 216.21	0 bove) 187.23 87.12	167.75 79.8	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17 79.8	0 197.77 87.98 224.78	0 215) <sub>15,1012</sub> 208.57 88.73	0 = 223.49 89.06	79.8 2720.16 <b>kWh/yea</b>	(215) (216) (217)
= {[(98 (215)m Water Outpu Efficie (217)m Fuel f (219)m (219)m Space Water	r heating t from wa 228.85 ency of wa = 89.01 or water I m = (64)r = 257.1  al totals e heating	ater hear 201.85 ater hear 88.91 neating, m x 100 227.01 fuel use	00 ÷ (20 0 ater (calco 212.29 ater 88.7 kWh/mc 0 ÷ (217) 239.34 ed, main	8) 0 ulated a 190.74 88.22 onth m 216.21	0 bove) 187.23 87.12 214.91	79.8 210.22	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17 79.8	0 197.77 87.98 224.78	0 215) <sub>15,1012</sub> 208.57 88.73	0 = 223.49 89.06	79.8 2720.16 <b>kWh/yea</b> 9545.99	(215) (216) (217)
= {[(98 (215)m Water Outpu Efficie (217)m Fuel f (219)m (219)m Space Water Electr	r heating t from wa  228.85 ency of wa  = 89.01 or water I or water I al totals e heating r heating	ater hear 201.85 ater hear 88.91 heating, m x 100 227.01 fuel use tumps, f	00 ÷ (20 0 212.29 ater 88.7 kWh/mc 0 ÷ (217) 239.34 ed, main	8) 0 ulated a 190.74 88.22 onth m 216.21	0 bove) 187.23 87.12 214.91	79.8 210.22	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17 79.8	0 197.77 87.98 224.78	0 215) <sub>15,1012</sub> 208.57 88.73	0 = 223.49 89.06	79.8 2720.16 <b>kWh/yea</b> 9545.99	(215) (216) (217)
= {[(98 (215)m Water Outpu Efficie (217)m Fuel f (219)m (219)m Space Water Electr	r heating t from wa 228.85 ency of wa = 89.01 or water I m = (64)r = 257.1  al totals e heating r heating r heating	ater hear 201.85 ater hear 88.91 heating, m x 100 227.01 fuel use fuel use umps, f	00 ÷ (20 0 212.29 ater 88.7 kWh/mc 0 ÷ (217) 239.34 ed, main ed ans and	8) 0 ulated a 190.74 88.22 onth m 216.21	0 bove) 187.23 87.12 214.91	79.8 210.22	79.8	0 Tota 176.67 79.8	0 I (kWh/yea 176.17 79.8	0 197.77 87.98 224.78	0 215) <sub>15,1012</sub> 208.57 88.73	0 = 223.49 89.06	79.8 2720.16 <b>kWh/yea</b> 9545.99	(215) (216) (217) (219)



Electricity for lighting			566.3 (232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	2061.93 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	587.55 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2649.49 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	293.91 (268)
Total CO2, kg/year	sum	of (265)(271) =	2982.32 (272)

TER = 19.01 (273)





User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Triplex (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) **Basement** 70.32 (1a) x 3.2 (2a) =225.02 (3a) Ground floor (1b) x (2b) (3b) 82.3 3.2 263.36 First floor 115 (1c) x (2c) 310.5 (3c)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 267.62 (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =Dwelling volume (5) 798.88 2. Ventilation rate: other total main secondary m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents 0 0 (7b) x 40 =Number of flueless gas fires 0 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = 0.05 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)O Additional infiltration (10)[(9)-1]x0.1 =0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ (15)0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)(18)0.3 Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.26 Infiltration rate modified for monthly wind speed Jan Feb Mar Jul Sep Oct Nov Apr May Jun Aug Dec Monthly average wind speed from Table 7

4.4

4.3

3.8

3.8

3.7

4.9

(22)m =

5.1

5

4.3

4.5

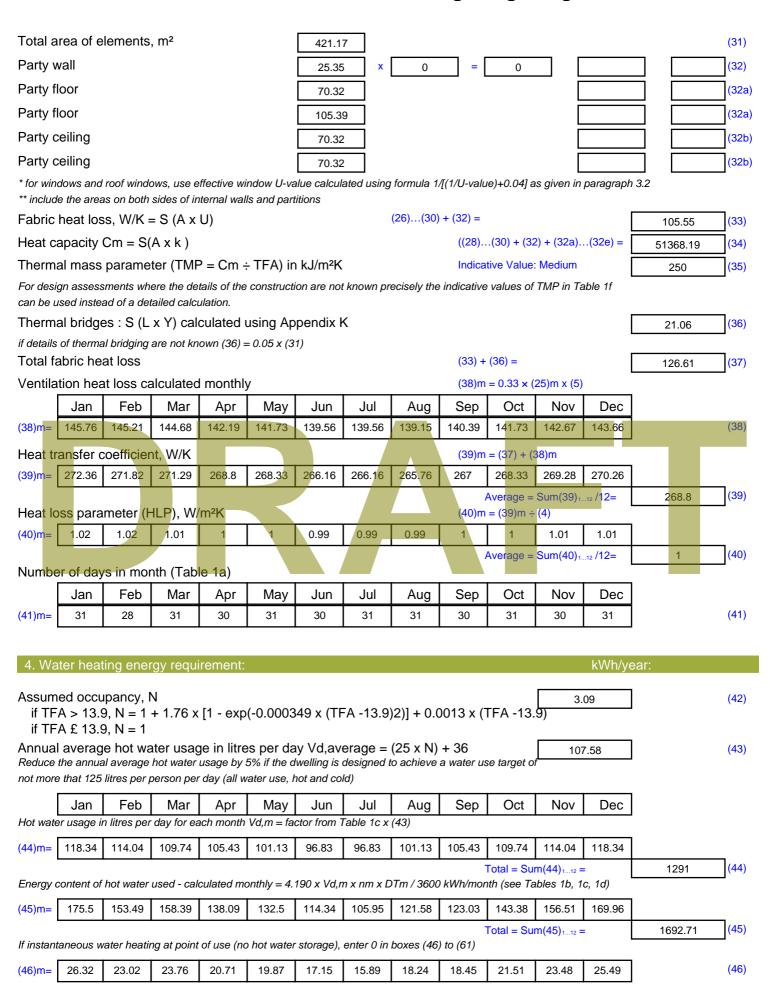
4.7

4



Wind Factor (	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infilt	ration rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.33	0.32	0.31	0.28	0.27	0.24	0.24	0.24	0.26	0.27	0.29	0.3		
Calculate effe		•	rate for t	he appli	cable ca	se							0 (23a)
If exhaust air h			endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)				0 (23a) 0 (23b)
If balanced wit									, , ,				0 (23c)
a) If balance	ed mecha	anical ve	entilation	with he	at recove	ery (MV	HR) (24a	a)m = (2	2b)m + (	23b) <b>×</b> [′	1 – (23c)	<u> </u>	( = 3)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	ed mech	anical ve	entilation	without	heat rec	overy (ľ	MV) (24b	o)m = (2	2b)m + (	23b)		-	
(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	ventilation	n or wh	ole hous	e positiv	/e input	ventilati	on from I	oft			ļ	l	
	m = 1, the								0.5]			_	
(24d)m= 0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.54		(24d)
Effective air	_			` `	<u> </u>	<u> </u>		` '				,	
(25)m= 0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.54		(25)
												ı	
3. Heat losse	es and he	eat loss	paramet	er:									
3. Heat losse	Gros	ss	oaramet Openin m	gs	Net Ar		U-vali W/m2		A X U	<b>(</b> )	k-value		A X k kJ/K
		ss	Openin	gs	Net Ar A ,n				A X U (W/I	<)			
ELEMENT	Gros	ss	Openin	gs	A ,n	n²	W/m2	2K	(W/I	<)			kJ/K
ELEMENT  Doors Type 1	Gros area	ss	Openin	gs	A ,n	m <sup>2</sup> x x	W/m2	= =	3.36	<) 			kJ/K (26)
Doors Type 1 Doors Type 2	Gros area	ss	Openin	gs	A ,n 3.36 2.8	x x x x1	W/m2 1 1.2	= = = = = = = = = = = = = = = = = = =	3.36 3.36	<) 			kJ/K (26) (26)
Doors Type 1 Doors Type 2 Windows Type	Gros área e 1 e 2	ss	Openin	gs	A ,n 3.36 2.8 2.72	x x x 1 x 1	W/m2 1 1.2 /[1/( 1.4 )+	= 0.04] = 0.04] =	3.36 3.36 3.61	<) 			kJ/K (26) (26) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type	Gros area e 1 e 2 e 3	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18	x x x1 x1 x1	W/m2  1  1.2  /[1/( 1.4 )+ /[1/( 1.4 )+	= 0.04] = 0.04] =	3.36 3.36 3.61 8.19	\$) 			kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44	x x x1 x1 x1 x1	W/m2  1  1.2  /[1/( 1.4 )+ /[1/( 1.4 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	3.36 3.36 3.61 8.19 7.21	<) 			kJ/K (26) (26) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81	x x x1 x1 x1 x1 x1	W/m2  1  1.2  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	3.36 3.36 3.61 8.19 7.21 2.4	<)			kJ/K (26) (26) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55	x x x1 x1 x1 x1 x1 x1	W/m2  1  1.2  /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	(W/I 3.36 3.36 3.61 8.19 7.21 2.4 6.03				(26) (26) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Type	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37	x x x 1 x 1 x 1 x 1 x 1 x 1 x 1 x 1 x 1	W/m2  1  1.2  /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79				kJ/K (26) (26) (27) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Floor Type 1	Gros area e 1 e 2 e 3 e 4 e 5	ss (m²)	Openin	gs <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32	x x x1	W/m2  1  1.2  /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	0.04] = 0.04]	(W/I 3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79 9.1416				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Type Floor Type 1 Floor Type 2	e 1 e 2 e 3 e 4 e 5 e 6	es (m²)	Openin m	gs <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98	x x x x x x x x x x x x x x x x x x x	W/m2  1  1.2  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  0.13  0.13	0.04] = 0.04]	3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79 9.1416				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28)
Doors Type 1 Doors Type 2 Windows Type Floor Type 1 Floor Type 2 Walls Type1	Gros area  e 1 e 2 e 3 e 4 e 5 e 6	es (m²)	Openin m	gs <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09	x x x x x x x x x x x x x x x x x x x	W/m2  1  1.2  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  0.13  0.13	0.04] = 0.04]	(W/I 3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79 9.1416 1.5574 11.36				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
Doors Type 1 Doors Type 2 Windows Type Tloor Type 1 Floor Type 2 Walls Type1 Walls Type2	Gros area  e 1 e 2 e 3 e 4 e 5 e 6	25 (m²)	Openin m	gs <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21	x x x x x x x x x x x x x x x x x x x	W/m2  1  1.2  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  0.13  0.13  0.18  0.18	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = =	(W/I 3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79 9.1416 1.5574 11.36 6.88				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
Doors Type 1 Doors Type 2 Windows Type Tloor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3	Gros area  e 1 e 2 e 3 e 4 e 5 e 6 69.2 73.0	25 21 6 32	6.16 0 8.9	gs <sub>2</sub>	A ,n  3.36  2.8  2.72  6.18  5.44  1.81  4.55  4.37  70.32  11.98  63.09  38.21  64.7	x x x x x x x x x x x x x x x x x x x	W/m2  1  1.2  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  0.13  0.13  0.18  0.18	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = =	3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79 9.1416 1.5574 11.36 6.88				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29)
Doors Type 1 Doors Type 2 Windows Type Tloor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3 Walls Type4	Gros area  e 1 e 2 e 3 e 4 e 5 e 6  69.2  73.0  28.3	25 (m²) 21 6 32 99	6.16 0 8.9	gs <sub>2</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32	x x x x x x x x x x x x x x x x x x x	W/m2  1  1.2  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  /[1/( 1.4 )+  0.13  0.13  0.18  0.18  0.18	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = 0.04] = = = = = = = = = = = = = = = = = = =	(W/I 3.36 3.36 3.61 8.19 7.21 2.4 6.03 5.79 9.1416 1.5574 11.36 6.88 11.65 5.1				kJ/K (26) (26) (27) (27) (27) (27) (27) (28) (28) (29) (29)







Water storage loss:	within game vegeel		(47)
Storage volume (litres) including any solar or WWHRS storage		150	(47)
If community heating and no tank in dwelling, enter 110 litres in Otherwise if no stored hot water (this includes instantaneous or Water storage loss:	` '	(47)	
a) If manufacturer's declared loss factor is known (kWh/day):		2.13	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known:	$(48) \times (49) =$	1.15	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b	(17) (74) (75) (75)	0	(53)
Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53) =	0	(54) (55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$	1.15	(33)
(56)m= 35.73 32.27 35.73 34.57 35.73 34.57 35.73	35.73 34.57 35.73	34.57 35.73	(56)
If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50)$ – $(H11)$ ] $\div$ $(56)$ m $\div$			` '
(57)m= 35.73 32.27 35.73 34.57 35.73 34.57 35.73	35.73 34.57 35.73	34.57 35.73	(57)
		0	(58)
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 30	65 × (41)m		(00)
(modified by factor from Table H5 if there is solar water heati		ostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26	23.26 22.51 23.26	22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) $\div$ 365 × (41	)m		
(61)m= 0 0 0 0 0 0	0 0 0	0 0	(61)
Total heat required for water heating calculated for each month	$(62)$ m = $0.85 \times (45)$ m +	(46)m + (57)m + (59	9)m + (61)m
(62)m= 234.49 206.77 217.38 195.17 191.49 171.42 164.94	180.57 180.12 202.37	213.6 228.95	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantit	y) (enter '0' if no solar contribut	ion to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Ap	ppendix G)		
(63)m= 0 0 0 0 0 0	0 0 0	0 0	(63)
Output from water heater	I I I	T T T	
(64)m= 234.49 206.77 217.38 195.17 191.49 171.42 164.94	180.57 180.12 202.37	213.6 228.95	0007.00 (64)
Heat arise for a started by the LWI (see all 0.05 (10.05 (45))	Output from water heate		2387.26 (64)
Heat gains from water heating, kWh/month $0.25 \cdot [0.85 \times (45)m]$ (65)m= 105.54 93.66 99.86 91.58 91.25 83.69 82.42	1 + (61)m] + 0.8 x [(46)m] 87.62   86.58   94.87	<del></del>	(65)
include (57)m in calculation of (65)m only if cylinder is in the	dwelling or not water is ti	rom community nea	ting
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= 154.49 154.49 154.49 154.49 154.49 154.49 154.49	154.49 154.49 154.49	154.49 154.49	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), a	1 1	1 1	(/
(67)m= 44.45 39.48 32.11 24.31 18.17 15.34 16.57	21.54 28.92 36.72	42.85 45.68	(67)
Appliances gains (calculated in Appendix L, equation L13 or L1	<del>                                     </del>		
(68)m= 431.48 435.96 424.68 400.66 370.34 341.84 322.8	318.32 329.61 353.63	383.95 412.44	(68)

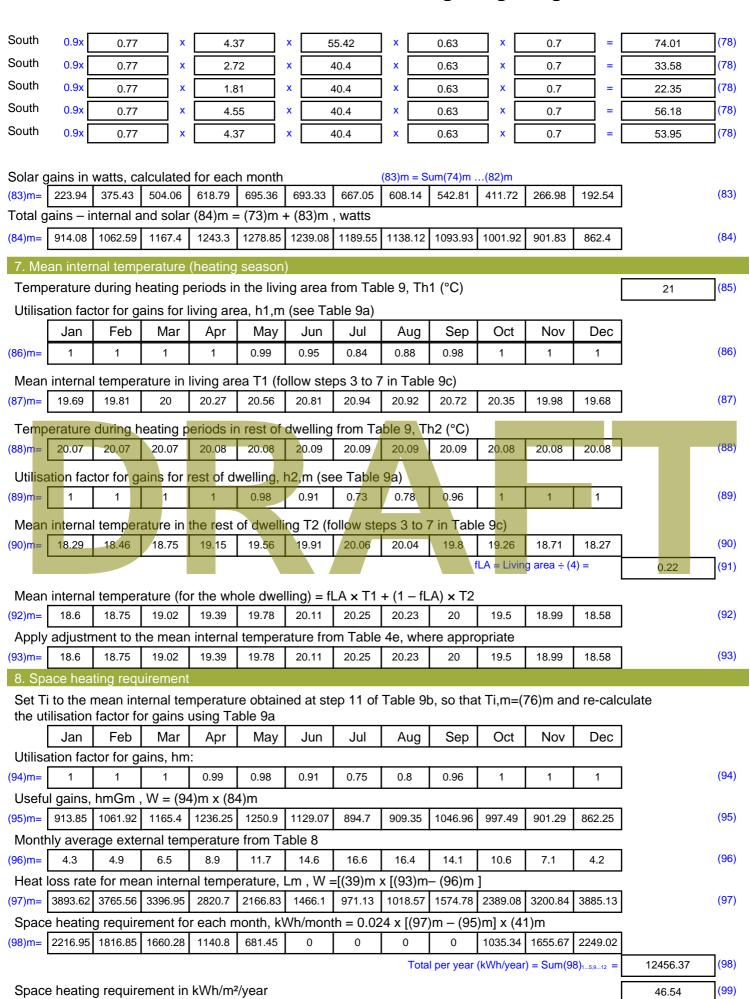


Cookir	na aains	(calcula	ited in A	nnendix	l equa	tior	1 15 o	r I 15a)	واد ۱	റ ടേല	e Tahle	5						
(69)m=	38.45	38.45	38.45	38.45	38.45	т —	88.45	38.45	38.		38.45	38.4	5 1	38.45	38.4	5		(69)
, ,		ns gains	<u> </u>		00.10	`	.0.10	00.10			00.10			00.10	00.1			(==)
(70)m=	3	3	3	3	3	Т	3	3	3	3	3	3		3	3			(70)
Losses	e.g. ev	aporatio	n (nega	tive valu	es) (Tal	ole	5)			•								
(71)m=	-123.59		-123.59	-123.59	-123.59	_		123.59	-123	.59	-123.59	-123.	59	-123.59	-123.	59		(71)
Water	heating	gains (T	able 5)			-												
(72)m=	141.86	139.38	134.21	127.2	122.64	1	16.23	110.78	117	.76	120.25	127.5	51	135.71	139.3	39		(72)
Total i	nternal	gains =		•			(66)m	+ (67)m	+ (68	3)m +	(69)m + (	70)m +	(71	1)m + (72)	m			
(73)m=	690.14	687.16	663.35	624.51	583.5	5	45.76	522.5	529	.98	551.11	590.	2	634.85	669.8	36		(73)
6. So	lar gains	S:		•	•													
Solar	ains are o	calculated	using sola	r flux from	Table 6a	and	associat	ted equa	tions	to cor	overt to the	e appli	cab	le orientati	ion.			
Orienta		Access F		Area			Flux	- 0-			g_ 		т.	FF			Gains	
	<u> </u>	Table 6d		m²			Tabl	e 6a 		l 6	able 6b	_	16	able 6c			(W)	_
North	0.9x	0.54	X	6.	18	X	10.	.63	X		0.63	X	Ļ	0.7		=	14.08	(74)
North	0.9x	0.77	X	5.4	14	X	10.	.63	X		0.63	X	Ļ	0.7	_	=	17.68	<b>(74)</b>
North	0.9x	0.54	X	6.	18	X	20.	.32	X		0.63	X	L	0.7		=	26.92	(74)
North	0.9x	0.77	X	5.4	14	X	20.	.32	Х		0.63	X	Ļ	0.7		=	33.78	(74)
North	0.9x	0.54	×	6.	18	X	34.	.53	X		0.63	X	Ļ	0.7		=	45.74	(74)
North	0.9x	0.77	X	5.4	14	X	34.	.53	X		0.63	X	L	0.7		=	57.41	(74)
North	0.9x	0.54	X	6.	18	X	55.	.46	X		0.63	X	L	0.7		=	73.46	(74)
North	0.9x	0.77	X	5.4	14	x	55.	.46	Х		0.63	X	L	0.7		=	92.21	(74)
North	0.9x	0.54	X	6.	18	Х	74.	.72	X		0.63	X		0.7		=	98.96	(74)
North	0.9x	0.77	X	5.4	14	X	74.	.72	X		0.63	X		0.7		=	124.22	(74)
North	0.9x	0.54	X	6.	18	X	79.	.99	X		0.63	X		0.7		=	105.94	(74)
North	0.9x	0.77	Х	5.4	14	X	79.	.99	X		0.63	X		0.7		=	132.98	(74)
North	0.9x	0.54	X	6.	18	X	74.	.68	X		0.63	X		0.7		=	98.91	(74)
North	0.9x	0.77	X	5.4	14	X	74.	.68	X		0.63	X		0.7		=	124.15	(74)
North	0.9x	0.54	Х	6.	18	X	59.	.25	X		0.63	X		0.7		=	78.47	(74)
North	0.9x	0.77	Х	5.4	14	X	59.	.25	X		0.63	X		0.7		=	98.5	(74)
North	0.9x	0.54	Х	6.	18	X	41.	.52	X		0.63	X		0.7		=	54.99	(74)
North	0.9x	0.77	Х	5.4	14	X	41.	.52	x		0.63	X		0.7		=	69.02	(74)
North	0.9x	0.54	X	6.	18	X	24.	.19	X		0.63	X		0.7		=	32.04	(74)
North	0.9x	0.77	X	5.4	14	X	24.	.19	X		0.63	X		0.7		=	40.22	(74)
North	0.9x	0.54	X	6.	18	X	13.	.12	X		0.63	X		0.7		=	17.37	(74)
North	0.9x	0.77	X	5.4	14	X	13.	.12	X		0.63	X		0.7		=	21.81	(74)
North	0.9x	0.54	X	6.	18	X	8.8	36	x		0.63	X		0.7		=	11.74	(74)
North	0.9x	0.77	X	5.4	14	X	8.8	36	x		0.63	X		0.7		=	14.74	(74)
South	0.9x	0.77	X	2.	72	x	46.	.75	x		0.63	x		0.7		=	38.86	(78)
South	0.9x	0.77	X	1.8	31	X	46.	.75	x		0.63	X		0.7		=	25.86	(78)



South 0,9x 0,77 x 4,55 x 5 46,75 x 0,63 x 0,7 = 65,01 779 South 0,9x 0,77 x 2,437 x 6,657 x 0,63 x 0,7 = 65,01 779 South 0,9x 0,77 x 2,272 x 76,677 x 0,63 x 0,63 x 0,7 = 62,43 (78) South 0,9x 0,77 x 2,272 x 76,677 x 0,63 x 0,63 x 0,7 = 62,43 (78) South 0,9x 0,77 x 4,455 x 76,677 x 0,63 x 0,63 x 0,7 = 10,647 (78) South 0,9x 0,77 x 4,455 x 76,677 x 0,63 x 0,63 x 0,7 = 10,627 (78) South 0,9x 0,77 x 1,41 x 2,72 x 1,41 x 2,73 x 0,63 x 0,7 = 10,627 (78) South 0,9x 0,77 x 1,41 x 2,72 x 1,41 x 2,73 x 0,63 x 0,7 = 10,627 (78) South 0,9x 0,77 x 1,41 x 2,72 x 1,41 x 2,73 x 0,63 x 0,7 = 135,62 (78) South 0,9x 0,77 x 1,41 x 2,72 x 1,41 x 2,73 x 0,63 x 0,7 = 135,62 (78) South 0,9x 0,77 x 1,43		_												_
South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 63.85 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 42.25 (78) South 0.9x 0.77 x 4.55 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 4.437 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 76.57 x 0.83 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.047 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.85 x 1.023 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.455 x 110.23 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.455 x 110.23 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.455 x 110.25 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.455 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.83 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.083 x 0.77 = 10.048 (78) South 0.9x 0.77 x 1.81 x 1.048 x 0.083 x 0.77 = 10.058 (78) South 0.9x 0.77 x 1.85 x 1.048 x 0.083 x 0.77 = 10.058 (78) South 0.9x 0.77	South	0.9x	0.77	X	4.55	X	46.75	X	0.63	X	0.7	=	65.01	(78)
South 0.9% 0.77 x 1.81 x 76.57 x 0.63 x 0.7 = 106.47 (78) South 0.9% 0.77 x 4.455 x 76.57 x 0.63 x 0.7 = 106.47 (78) South 0.9% 0.77 x 4.455 x 76.57 x 0.63 x 0.7 = 102.26 (78) South 0.9% 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 102.26 (78) South 0.9% 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.62 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.26 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.25 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.25 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.25 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.25 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 110.25 x 0.63 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.77 x 4.455 x 100.80 x 0.83 x 0.7 = 103.20 (78) South 0.9% 0.7	South	0.9x	0.77	X	4.37	X	46.75	X	0.63	X	0.7	=	62.44	(78)
South 0.5x 0.77 x 4.55 x 76.57 x 0.63 x 0.7 = 106.47 (78) South 0.5x 0.77 x 4.437 x 76.57 x 0.63 x 0.7 = 102.26 (78) South 0.5x 0.77 x 1.81 x 97.53 x 0.63 x 0.7 = 102.26 (78) South 0.5x 0.77 x 1.81 x 97.53 x 0.63 x 0.7 = 135.52 (78) South 0.5x 0.77 x 1.81 x 97.53 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 97.53 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 1.81 x 102.3 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 102.3 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 102.3 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 102.3 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 102.3 x 0.63 x 0.7 = 135.62 (78) South 0.5x 0.77 x 1.81 x 102.3 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 102.3 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 135.20 (78) South 0.5x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.55 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.65 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.65 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.65 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.65 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.65 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.65 x 10.60 x 0.63 x 0.7 = 135.21 (78) South 0.5x 0.77 x 1.81 x 10.60 x 10.60 x 0.63 x 0.7 = 136.60 (78) South 0.5x 0.77 x 1.81 x 10.80 x 10.60 x 0.63 x	South	0.9x	0.77	X	2.72	X	76.57	X	0.63	X	0.7	=	63.65	(78)
South 0.8x 0.77 x 4.437 x 76.57 x 0.63 x 0.7 = 10.226 (78) South 0.9x 0.77 x 1.81 x 97.53 x 0.63 x 0.7 = 53.95 (78) South 0.9x 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 153.26 (78) South 0.9x 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 153.26 (78) South 0.9x 0.77 x 4.455 x 97.53 x 0.63 x 0.7 = 153.26 (78) South 0.9x 0.77 x 4.455 x 10.23 x 0.63 x 0.7 = 153.26 (78) South 0.9x 0.77 x 1.81 x 10.23 x 0.63 x 0.7 = 153.26 (78) South 0.9x 0.77 x 4.455 x 10.23 x 0.63 x 0.7 = 153.29 (78) South 0.9x 0.77 x 4.455 x 10.23 x 0.63 x 0.7 = 153.29 (78) South 0.9x 0.77 x 4.455 x 10.23 x 0.63 x 0.7 = 153.29 (78) South 0.9x 0.77 x 4.455 x 10.23 x 0.63 x 0.7 = 153.29 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 147.22 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.24 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.24 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.24 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.84 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.84 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.84 x 110.84 x 110.85 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.84 x 110.85 x 0.63 x 0.7 = 153.44 (78) South 0.9x 0.77 x 1.84 x 110.84 x	South	0.9x	0.77	X	1.81	X	76.57	X	0.63	X	0.7	=	42.35	(78)
South 0.9x 0.77 x 2.72 x 97.53 x 0.63 x 0.77 = \$13.60 78 78 78 78 78 78 78 78 78 78 78 78 78	South	0.9x	0.77	X	4.55	x	76.57	X	0.63	X	0.7	=	106.47	(78)
South	South	0.9x	0.77	X	4.37	x	76.57	X	0.63	x	0.7	=	102.26	(78)
South 0.9x 0.77 x 4.55 x 97.53 x 0.63 x 0.7 = 113.62 (78) South 0.9x 0.77 x 4.37 x 110.23 x 0.63 x 0.7 = 113.62 (78) South 0.9x 0.77 x 4.437 x 110.23 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 4.455 x 110.23 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 160.98 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 110.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 10.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 10.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 10.88 x 0.63 x 0.7 = 180.73 (78) South 0.9x 0.77 x 1.81 x 1.81	South	0.9x	0.77	x	2.72	x	97.53	X	0.63	x	0.7	=	81.08	(78)
South	South	0.9x	0.77	X	1.81	x	97.53	X	0.63	X	0.7	=	53.95	(78)
South         0.9k         0.77         x         2.72         x         110.23         x         0.63         x         0.7         =         91.63         78           South         0.9k         0.77         x         1.81         x         110.23         x         0.63         x         0.7         =         60.98         78           South         0.9k         0.77         x         4.55         x         110.23         x         0.63         x         0.7         =         60.98         78           South         0.9k         0.77         x         4.37         x         110.23         x         0.63         x         0.7         =         147.22         78           South         0.9k         0.77         x         1.81         x         114.87         x         0.63         x         0.7         =         65.49         78           South         0.9k         0.77         x         4.455         x         114.87         x         0.63         x         0.7         =         155.41         78           South         0.9k         0.77         x         4.37         x         110.55	South	0.9x	0.77	X	4.55	x	97.53	x	0.63	X	0.7	=	135.62	(78)
South 0.9x 0.77 x 1.81 x 110.23 x 0.63 x 0.7 = 60.9e (78) South 0.9x 0.77 x 4.55 x 110.23 x 0.63 x 0.7 = 147.22 (78) South 0.9x 0.77 x 4.37 x 114.87 x 0.63 x 0.7 = 147.22 (78) South 0.9x 0.77 x 2.72 x 114.87 x 0.63 x 0.7 = 147.22 (78) South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 63.54 (78) South 0.9x 0.77 x 4.55 x 114.87 x 0.63 x 0.7 = 63.54 (78) South 0.9x 0.77 x 4.55 x 114.87 x 0.63 x 0.7 = 63.54 (78) South 0.9x 0.77 x 4.55 x 114.87 x 0.63 x 0.7 = 63.54 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 63.54 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 10.891 x 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77 x 1.81 x 8.25 y 0.63 x 0.7 = 61.76 (78) South 0.9x 0.77	South	0.9x	0.77	X	4.37	x	97.53	x	0.63	X	0.7	=	130.26	(78)
South 0.9x 0.77 x 4.55 x 110.23 x 0.63 x 0.7 = 147.22 (78)  South 0.9x 0.77 x 4.37 x 110.23 x 0.63 x 0.7 = 147.22 (78)  South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 95.49 (78)  South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 95.49 (78)  South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 63.54 (78)  South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 159.73 (78)  South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 159.73 (78)  South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 91.89 (78)  South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 91.89 (78)  South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 147.64 (78)  South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 147.64 (78)  South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 147.64 (78)  South 0.9x 0.77 x 1.81 x 10.55 x 0.63 x 0.7 = 147.64 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 159.75 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 159.75 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 159.75 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 159.75 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 147.64 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 144.25 (78)  South 0.9x 0.77 x 1.81 x 10.801 x 0.63 x 0.7 = 144.25 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.25 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.65 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.69 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.69 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.69 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.69 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.69 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)  South 0.9x 0.77 x 1.81 x 10.889 x 0.63 x 0.7 = 144.66 (78)	South	0.9x	0.77	x	2.72	X	110.23	x	0.63	X	0.7	=	91.63	(78)
South 0.9x 0.77	South	0.9x	0.77	X	1.81	X	110.23	x	0.63	X	0.7	=	60.98	(78)
South 0.9x 0.77	South	0.9x	0.77	X	4.55	x	110.23	x	0.63	x	0.7	=	153.29	(78)
South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 63.54 78)  South 0.9x 0.77 x 4.55 x 114.87 x 0.63 x 0.7 = 159.73 78)  South 0.9x 0.77 x 4.55 x 114.87 x 0.63 x 0.7 = 159.73 78)  South 0.9x 0.77 x 1.81 x 114.87 x 0.63 x 0.7 = 91.89 78)  South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 91.89 78)  South 0.9x 0.77 x 4.55 x 110.55 x 0.63 x 0.7 = 155.72 78)  South 0.9x 0.77 x 4.55 x 110.55 x 0.63 x 0.7 = 155.72 78)  South 0.9x 0.77 x 4.37 x 110.55 x 0.63 x 0.7 = 147.64 78)  South 0.9x 0.77 x 4.37 x 108.01 x 0.63 x 0.7 = 159.75 78)  South 0.9x 0.77 x 4.455 x 108.01 x 0.63 x 0.7 = 150.19 78)  South 0.9x 0.77 x 4.455 x 108.01 x 0.63 x 0.7 = 154.25 78)  South 0.9x 0.77 x 4.55 x 108.01 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.55 x 108.01 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.55 x 108.01 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.55 x 108.01 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.437 x 108.81 x 104.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.55 x 108.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.55 x 108.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.437 x 108.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.437 x 108.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.437 x 108.89 x 0.63 x 0.7 = 144.25 78)  South 0.9x 0.77 x 4.437 x 104.89 x 0.63 x 0.7 = 144.60 78)  South 0.9x 0.77 x 4.437 x 104.89 x 0.63 x 0.7 = 144.60 78)  South 0.9x 0.77 x 4.437 x 104.89 x 0.63 x 0.7 = 144.60 78)  South 0.9x 0.77 x 4.455 x 104.89 x 0.63 x 0.7 = 144.66 78)  South 0.9x 0.77 x 4.455 x 104.89 x 0.63 x 0.7 = 144.60 78)  South 0.9x 0.77 x 4.455 x 104.89 x 0.63 x 0.7 = 144.60 78)  South 0.9x 0.77 x 4.455 x 104.89 x 0.63 x 0.7 = 144.60 78)  South 0.9x 0.77 x 4.455 x 104.89 x 0.63 x 0.7 = 144.60 78)	South	0.9x	0.77	x	4.37	x	110.23	X	0.63	X	0.7	=	147.22	(78)
South 0.9x 0.77	South	0.9x	0.77	X	2.72	x	114.87	x	0.63	X	0.7	=	95.49	(78)
South 0.9x 0.77	South	0.9x	0.77	X	1.81	x	114.87	X	0.63	X	0.7	=	63.54	(78)
South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 91.89 (78) South 0.9x 0.77 x 4.55 x 110.55 x 0.63 x 0.7 = 61.15 (78) South 0.9x 0.77 x 4.37 x 11.81 x 104.89 x 0.63 x 0.7 = 144.25 (78) South 0.9x 0.77 x 4.37 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78)	South	0.9x	0.77	x	4.55	X	114.87	x	0.63	X	0.7	=	159.73	(78)
South 0.9x 0.77 x 4.55 x 108.01 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 110.55 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 153.72 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 150.19 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 150.19 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 150.19 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 144.25 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.25 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.69 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.69 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.69 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.69 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.69 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.69 (78)	South	0.9x	0.77	X	4.37	×	114.87	Х	0.63	X	0.7	=	153.41	(78)
South 0.9x 0.77 x 4.55 x 110.56 x 0.63 x 0.7 = 153.72 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 56.36 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 147.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x	South	0.9x	0.77	x	2.72	х	110.55	x	0.63	x	0.7	=	91.89	(78)
South 0.9x 0.77 x 4.37 x 108.01 x 0.63 x 0.7 = 147.64 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 59.75 (78) South 0.9x 0.77 x 1.81 x 108.01 x 0.63 x 0.7 = 150.19 (78) South 0.9x 0.77 x 4.37 x 108.01 x 0.63 x 0.7 = 150.19 (78) South 0.9x 0.77 x 4.37 x 108.01 x 0.63 x 0.7 = 144.25 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 87.2 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 58.02 (78) South 0.9x 0.77 x 4.37 x 108.01 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 145.86 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 140.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 140.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 140.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 140.09 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 141.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 141.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 141.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 141.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.68 (78) South 0.9x 0.77 x 1.81 x 104.89 x 0.63 x 0.7 = 144.60 (78)	South	0.9x	0.77	x	1.81	x	110.55	×	0.63	x	0.7	=	61.15	(78)
South 0.9x 0.77	South	0.9x	0.77	x	4.55	X	110.55	X	0.63	x	0.7	=	153.72	(78)
South 0.9x 0.77	South	0.9x	0.77	x	4.37	x	110.55	Х	0.63	x	0.7	=	147.64	(78)
South         0.9x         0.77         x         4.55         x         108.01         x         0.63         x         0.7         =         150.19         (78)           South         0.9x         0.77         x         4.37         x         108.01         x         0.63         x         0.7         =         144.25         (78)           South         0.9x         0.77         x         2.72         x         104.89         x         0.63         x         0.7         =         87.2         (78)           South         0.9x         0.77         x         1.81         x         104.89         x         0.63         x         0.7         =         87.2         (78)           South         0.9x         0.77         x         4.55         x         104.89         x         0.63         x         0.7         =         145.86         (78)           South         0.9x         0.77         x         4.37         x         104.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         4.55         x         101.	South	0.9x	0.77	x	2.72	x	108.01	X	0.63	x	0.7	=	89.79	(78)
South         0.9x         0.77         x         4.37         x         108.01         x         0.63         x         0.7         =         144.25         (78)           South         0.9x         0.77         x         2.72         x         104.89         x         0.63         x         0.7         =         87.2         (78)           South         0.9x         0.77         x         1.81         x         104.89         x         0.63         x         0.7         =         58.02         (78)           South         0.9x         0.77         x         4.55         x         104.89         x         0.63         x         0.7         =         145.86         (78)           South         0.9x         0.77         x         4.37         x         104.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         4.55         x         101	South	0.9x	0.77	x	1.81	x	108.01	x	0.63	x	0.7	=	59.75	(78)
South         0.9x         0.77         x         2.72         x         104.89         x         0.63         x         0.7         =         87.2         (78)           South         0.9x         0.77         x         1.81         x         104.89         x         0.63         x         0.7         =         58.02         (78)           South         0.9x         0.77         x         4.55         x         104.89         x         0.63         x         0.7         =         145.86         (78)           South         0.9x         0.77         x         4.37         x         104.89         x         0.63         x         0.7         =         145.86         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         101	South	0.9x	0.77	x	4.55	X	108.01	X	0.63	X	0.7	=	150.19	(78)
South         0.9x         0.77         x         1.81         x         104.89         x         0.63         x         0.7         =         58.02         (78)           South         0.9x         0.77         x         4.55         x         104.89         x         0.63         x         0.7         =         145.86         (78)           South         0.9x         0.77         x         4.37         x         104.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         2.72         x         101.89         x         0.63         x         0.7         =         84.69         (78)           South         0.9x         0.77         x         1.81         x         101.89         x         0.63         x         0.7         =         84.69         (78)           South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         82.	South	0.9x	0.77	X	4.37	X	108.01	x	0.63	X	0.7	=	144.25	(78)
South         0.9x         0.77         x         4.55         x         104.89         x         0.63         x         0.7         =         145.86         (78)           South         0.9x         0.77         x         4.37         x         104.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         2.72         x         101.89         x         0.63         x         0.7         =         84.69         (78)           South         0.9x         0.77         x         1.81         x         101.89         x         0.63         x         0.7         =         84.69         (78)           South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         56.36         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         2.72         x         82.	South	0.9x	0.77	X	2.72	X	104.89	X	0.63	X	0.7	=	87.2	(78)
South         0.9x         0.77         x         4.37         x         104.89         x         0.63         x         0.7         =         140.09         (78)           South         0.9x         0.77         x         2.72         x         101.89         x         0.63         x         0.7         =         84.69         (78)           South         0.9x         0.77         x         1.81         x         101.89         x         0.63         x         0.7         =         56.36         (78)           South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         136.07         (78)           South         0.9x         0.77         x         1.81         x         82	South	0.9x	0.77	x	1.81	x	104.89	X	0.63	X	0.7	=	58.02	(78)
South         0.9x         0.77         x         2.72         x         101.89         x         0.63         x         0.7         =         84.69         (78)           South         0.9x         0.77         x         1.81         x         101.89         x         0.63         x         0.7         =         56.36         (78)           South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         82.59         x         0.63         x         0.7         =         136.07         (78)           South         0.9x         0.77         x         1.81         x         82.59         x         0.63         x         0.7         =         45.68         (78)           South         0.9x         0.77         x         4.37         x         82.59	South	0.9x	0.77	X	4.55	X	104.89	x	0.63	X	0.7	=	145.86	(78)
South         0.9x         0.77         x         1.81         x         101.89         x         0.63         x         0.7         =         56.36         (78)           South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         2.72         x         82.59         x         0.63         x         0.7         =         68.65         (78)           South         0.9x         0.77         x         4.55         x         82.59         x         0.63         x         0.7         =         45.68         (78)           South         0.9x         0.77         x         4.37         x         82.59         x         0.63         x         0.7         =         114.84         (78)           South         0.9x         0.77         x         4.37         x         82.59<	South	0.9x	0.77	X	4.37	x	104.89	X	0.63	X	0.7	=	140.09	(78)
South         0.9x         0.77         x         4.55         x         101.89         x         0.63         x         0.7         =         141.68         (78)           South         0.9x         0.77         x         4.37         x         101.89         x         0.63         x         0.7         =         136.07         (78)           South         0.9x         0.77         x         2.72         x         82.59         x         0.63         x         0.7         =         68.65         (78)           South         0.9x         0.77         x         1.81         x         82.59         x         0.63         x         0.7         =         45.68         (78)           South         0.9x         0.77         x         4.55         x         82.59         x         0.63         x         0.7         =         114.84         (78)           South         0.9x         0.77         x         4.37         x         82.59         x         0.63         x         0.7         =         110.3         (78)           South         0.9x         0.77         x         1.81         x         55.42 </td <td>South</td> <td>0.9x</td> <td>0.77</td> <td>x</td> <td>2.72</td> <td>X</td> <td>101.89</td> <td>x</td> <td>0.63</td> <td>X</td> <td>0.7</td> <td>=</td> <td>84.69</td> <td>(78)</td>	South	0.9x	0.77	x	2.72	X	101.89	x	0.63	X	0.7	=	84.69	(78)
South       0.9x       0.77       x       4.37       x       101.89       x       0.63       x       0.7       =       136.07       (78)         South       0.9x       0.77       x       2.72       x       82.59       x       0.63       x       0.7       =       68.65       (78)         South       0.9x       0.77       x       4.55       x       82.59       x       0.63       x       0.7       =       45.68       (78)         South       0.9x       0.77       x       4.37       x       82.59       x       0.63       x       0.7       =       114.84       (78)         South       0.9x       0.77       x       4.37       x       82.59       x       0.63       x       0.7       =       110.3       (78)         South       0.9x       0.77       x       2.72       x       55.42       x       0.63       x       0.7       =       46.07       (78)         South       0.9x       0.77       x       1.81       x       55.42       x       0.63       x       0.7       =       30.65       (78)	South	0.9x	0.77	X	1.81	X	101.89	X	0.63	X	0.7	=	56.36	(78)
South         0.9x         0.77         x         2.72         x         82.59         x         0.63         x         0.7         =         68.65         (78)           South         0.9x         0.77         x         1.81         x         82.59         x         0.63         x         0.7         =         45.68         (78)           South         0.9x         0.77         x         4.55         x         82.59         x         0.63         x         0.7         =         114.84         (78)           South         0.9x         0.77         x         4.37         x         82.59         x         0.63         x         0.7         =         110.3         (78)           South         0.9x         0.77         x         2.72         x         55.42         x         0.63         x         0.7         =         46.07         (78)           South         0.9x         0.77         x         1.81         x         55.42         x         0.63         x         0.7         =         46.07         (78)	South	0.9x	0.77	X	4.55	X	101.89	X	0.63	X	0.7	=	141.68	(78)
South       0.9x       0.77       x       1.81       x       82.59       x       0.63       x       0.7       =       45.68       (78)         South       0.9x       0.77       x       4.55       x       82.59       x       0.63       x       0.7       =       114.84       (78)         South       0.9x       0.77       x       4.37       x       82.59       x       0.63       x       0.7       =       110.3       (78)         South       0.9x       0.77       x       2.72       x       55.42       x       0.63       x       0.7       =       46.07       (78)         South       0.9x       0.77       x       1.81       x       55.42       x       0.63       x       0.7       =       30.65       (78)	South	0.9x	0.77	x	4.37	X	101.89	x	0.63	X	0.7	=	136.07	(78)
South       0.9x       0.77       x       4.55       x       82.59       x       0.63       x       0.7       =       114.84       (78)         South       0.9x       0.77       x       4.37       x       82.59       x       0.63       x       0.7       =       110.3       (78)         South       0.9x       0.77       x       2.72       x       55.42       x       0.63       x       0.7       =       46.07       (78)         South       0.9x       0.77       x       1.81       x       55.42       x       0.63       x       0.7       =       30.65       (78)		0.9x	0.77	x	2.72	x	82.59	x	0.63	x	0.7	=	68.65	(78)
South       0.9x       0.77       x       4.37       x       82.59       x       0.63       x       0.7       =       110.3       (78)         South       0.9x       0.77       x       2.72       x       55.42       x       0.63       x       0.7       =       46.07       (78)         South       0.9x       0.77       x       1.81       x       55.42       x       0.63       x       0.7       =       30.65       (78)		0.9x	0.77	x	1.81	x	82.59	x	0.63	x	0.7	=	45.68	(78)
South 0.9x 0.77 x 2.72 x 55.42 x 0.63 x 0.7 = 46.07 (78) South 0.9x 0.77 x 1.81 x 55.42 x 0.63 x 0.7 = 30.65 (78)		0.9x	0.77	x	4.55	x	82.59	x	0.63	x	0.7	=	114.84	(78)
South 0.9x 0.77 x 1.81 x 55.42 x 0.63 x 0.7 = 30.65 (78)	South	0.9x	0.77	x	4.37	x	82.59	x	0.63	x	0.7	=	110.3	(78)
	South	0.9x	0.77	x	2.72	x	55.42	x	0.63	x	0.7	=	46.07	(78)
South $0.9x$ 0.77  x 4.55  x 55.42  x 0.63  x 0.7 = 77.06 (78)	South	0.9x	0.77	x	1.81	x	55.42	x	0.63	x	0.7	=	30.65	(78)
	South	0.9x	0.77	X	4.55	X	55.42	X	0.63	X	0.7	=	77.06	(78)







On Engraviraguiramente, la dividual hanti-	tomo in alcelia a aciene. Ol	ID)	
9a. Energy requirements – Individual heating sys Space heating:	tems including micro-CH	1P)"	
Fraction of space heat from secondary/supplem	entary 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	2) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1			93.5 (206)
Efficiency of secondary/supplementary heating s	system, %		0 (208)
Jan Feb Mar Apr May	Jun Jul Aug	Sep Oct Nov Dec	kWh/year
Space heating requirement (calculated above)			_
2216.95 1816.85 1660.28 1140.8 681.45	0 0 0	0 1035.34 1655.67 2249.02	2
$(211)$ m = {[(98)m x (204)] } x 100 ÷ (206)			(211)
2371.07 1943.15 1775.7 1220.11 728.83	0 0 0	0 1107.32 1770.77 2405.3	
	l otal (	(kWh/year) =Sum(211) <sub>15,1012</sub> =	13322.32 (211)
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$			
(215)m =	0 0 0	0 0 0 0	7
	Total (	(kWh/year) =Sum(215) <sub>15,1012</sub> =	0 (215)
Water heating			
Output from water heater (calculated above)	74 40 404 04 400 57	400 40 000 07 040 0 000 05	
234.49 206.77 217.38 195.17 191.49 1 Efficiency of water heater	71.42 164.94 180.57	180.12 202.37 213.6 228.95	79.8 (216)
(217)m= 89.35 89.28 89.12 88.76 87.91	79.8 79.8 79.8	79.8 88.56 89.13 89.39	(217)
Fuel for water heating, kWh/month			
$(219)$ m = $(64)$ m x $100 \div (217)$ m			, III
(219)m= 262.42 231.61 243.93 219.89 217.81 2		225.71   228.51   239.63   256.12 = Sum(219a) <sub>1.12</sub> =	<del>-</del>
Annual totals	Total =	** <b>kWh/year</b>	2773.41 (219) kWh/year
Space heating fuel used, main system 1		KWII/yeai	13322.32
Water heating fuel used			2773.41
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	f (230a)(230g) =	75 (231)
Electricity for lighting			784.96 (232)
12a. CO2 emissions – Individual heating system	s including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	2877.62 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	599.06 (264)
Space and water heating	(261) + (262) + (263) + (26	0.210	
Space and water nearing	(===) (===) (===) (====)	- ,	3476.68 (265)

# envision

## TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot (231) x 0.519 = 38.93 (267) Electricity for lighting (232) x 0.519 = 407.4 (268) Total CO2, kg/year sum of (265)...(271) = 3923 (272)

TER = 14.66 (273)



# APPENDIX VII – BE-LEAN DER WORKSHEETS (NEW-BUILD)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 3 - 2B4P - GF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 140.3 (1a) x 2.7 (2a) =(3a) 378.81 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)140.3 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =378.81 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.14 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) :	= (21a) x (22a)m
0.18 0.17 0.17 0.15 0.15 0.13 0.13	0.13 0.14 0.15 0.16 0.16
Calculate effective air change rate for the applicable case	
If mechanical ventilation:	(A)(F)) athorning (22h) (22a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation	Table 4b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (fro	(200)
a) If balanced mechanical ventilation with heat recovery (MV (24a)m= 0.31 0.3 0.3 0.28 0.28 0.26 0.26	$(7HR) (24a)M = (22b)M + (23b) \times [1 - (23c) \div 100]$ 0.26  0.27  0.28  0.29  0.29 (24a)
b) If balanced mechanical ventilation without heat recovery (	
(24b)m= 0 0 0 0 0 0 0 0	
c) If whole house extract ventilation or positive input ventilation	
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (24b)$	
(24c)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilat	ion from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m =	0.5 + [(22b)m <sup>2</sup> x 0.5]
(24d)m= 0 0 0 0 0 0 0	0 0 0 0 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (2	
(25)m= 0.31 0.3 0.3 0.28 0.28 0.26 0.26	0.26 0.27 0.28 0.29 0.29 (25)
3. Heat losses and heat loss parameter:	
<b>ELEMENT</b> Gross Openings Net Area area (m²)	U-value A X U k-value A X k W/m2K (W/K) kJ/m²·K kJ/K
	4//4// 4 4 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
W. I. T. T. O	
vvindows Type 4 2.67 x	
Windows Type F	1/[1/(1.1) + 0.04] = 2.81   (27)
	1/[1/(1.1) + 0.04] = 1.88  (27)
Floor 139.42 x	1/[1/(1.1) + 0.04] = 1.88 $0.11 = 15.3362$ (28)
Floor 139.42 x Walls Type1 99.06 27.4 71.66 x	1/[1/(1.1) + 0.04] = 1.88 $0.11 = 15.3362$ $0.12 = 8.6$ $(29)$
Floor 139.42 x Walls Type1 99.06 27.4 71.66 x Walls Type2 30.1 0 30.1 x	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29)
Floor 139.42 x  Walls Type1 99.06 27.4 71.66 x  Walls Type2 30.1 0 30.1 x  Total area of elements, m <sup>2</sup> 268.59	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
Floor 139.42 x  Walls Type1 99.06 27.4 71.66 x  Walls Type2 30.1 0 30.1 x  Total area of elements, m² 268.59  Party wall 25.35 x	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
Floor	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) (31) 0 = 0 (32)
Floor 139.42 x  Walls Type1 99.06 27.4 71.66 x  Walls Type2 30.1 0 30.1 x  Total area of elements, m² 268.59  Party wall 25.35 x  Party ceiling 139.42  * for windows and roof windows, use effective window U-value calculated using the control of t	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) (31) 0 = 0 (32)
Floor	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) (31) 0 = 0 (32)
Floor 139.42 x  Walls Type1 99.06 27.4 71.66 x  Walls Type2 30.1 0 30.1 x  Total area of elements, m² 268.59  Party wall 25.35 x  Party ceiling 139.42  * for windows and roof windows, use effective window U-value calculated using the sinclude the areas on both sides of internal walls and partitions	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) (31) 0 = 0 (32) 0 = 0 (32) 0 = 0 (32)
Floor  Walls Type1  99.06  27.4  71.66  Walls Type2  30.1  Total area of elements, m²  Party wall  Party ceiling  * for windows and roof windows, use effective window U-value calculated using the include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) (31) 0 = 0 (32) 0 = 0 (32b) 0 = 0 (32b) 0 = 0 (32b) 0 = 0 (32b)
Floor	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) 0.14 = 0 (31) 0 = 0 (32) 0 = 0 (33) 0 = 0 (32) 0 = 0 (33) 0 = 0 (35)
Floor	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) 0.14 = 0 (29) 0.14 = 0 (31) 0 = 0 (32) 0 = 0 (33) 0 = 0 (33) 0 = 0 (34) 0 = 0 (35) 0 = 0 (35) 0 = 0 (35) 0 = 0 (35) 0 = 0 (35)
Floor	1/[1/(1.1) + 0.04] = 1.88 (27) 0.11 = 15.3362 (28) 0.12 = 8.6 (29) 0.14 = 4.26 (29) 0.14 = 0 (31) 0 = 0 (32) 0 = 0 (33) 0 = 0 (32) 0 = 0 (33) 0 = 0 (35)



Ventilation heat loss calculated monthly $(38)m = 0.33 \times (20)$	25\m v (5\			
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov	Dec		
(38)m= 38.4 37.96 37.53 35.36 34.93 32.76 32.33 33.63 34.93	35.8	36.66		(38)
Heat transfer coefficient, W/K $(39)m = (37) + (37)m = (37)m $			I	, ,
(39)m= 135.75 135.32 134.88 132.72 132.28 130.11 130.11 129.68 130.98 132.28	133.15	134.02		
Average =	Sum(39) <sub>1.</sub>	12 /12=	132.61	(39)
Heat loss parameter (HLP), W/m <sup>2</sup> K $ (40)m = (39)m \div $	(4)			
(40)m= 0.97 0.96 0.96 0.95 0.94 0.93 0.93 0.92 0.93 0.94	0.95	0.96		<b>—</b> (40)
Average = Number of days in month (Table 1a)	Sum(40) <sub>1.</sub>	12 /12=	0.95	(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/ye	ear:	
Assumed occupancy, N		92		(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)	9)			
if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	101	3.49		(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of		J.+J		(10)
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)			1	
(44)m= 113.84 109.7 105.56 101.42 97.28 93.14 93.14 97.28 101.42 105.56	109.7	113.84	4044.00	7(44)
Total = Sur Energy content of hot water used - calculated monthly = $4.190 \times Vd$ , $m \times nm \times DTm / 3600 \times Wh/month$ (see Table 2)			1241.93	(44)
(45)m= 168.83 147.66 152.37 132.84 127.46 109.99 101.92 116.96 118.35 137.93	150.56	163.5		
Total = Sur If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	m(45) <sub>112</sub> =	=	1628.37	(45)
(46)m= 25.32 22.15 22.86 19.93 19.12 16.5 15.29 17.54 17.75 20.69	22.58	24.52		(46)
Water storage loss:	22.00	24.02		(.0)
Storage volume (litres) including any solar or WWHRS storage within same vessel		250		(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 (4	47)			
Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day):	1	49		(48)
Temperature factor from Table 2b		54		(49)
Energy lost from water storage, kWh/year (48) x (49) =		.8		(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  Volume factor from Table 2a			1	(52)
Temperature factor from Table 2b		0		(52) (53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$		0		(54)
Enter (50) or (54) in (55)		.8		(55)
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$				
(56)m= 24.94 22.53 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94	24.14	24.94		(56)



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 24.94 22.53 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94 (55)m= 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94	57)
Primary circuit loss (annual) from Table 3	58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (55)m= 23.26 23.26 23.26 23.26 23.26 23.26 23.26	59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0	61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 217.03 191.2 200.57 179.49 175.67 156.64 150.13 165.16 165 186.13 197.21 211.7	62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (6	63)
Output from water heater	
(64)m= 217.03 191.2 200.57 179.49 175.67 156.64 150.13 165.16 165 186.13 197.21 211.7	
Output from water heater (annual) <sub>112</sub> 2195.94	64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]	
(65)m= 94.7 83.93 89.23 81.49 80.95 73.89 72.45 77.45 76.67 84.43 87.38 92.93	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	
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)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	36)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         165.88	66) 67)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         145.88         165.88	,
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 (66)m= 29.16 25.9 21.06 15.94 11.92 10.06 10.87 14.13 18.97 24.08 28.11 29.97 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	,
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 (66)m= 29.16 25.9 21.06 15.94 11.92 10.06 10.87 14.13 18.97 24.08 28.11 29.97 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 145.88 (66)m= 29.16 25.9 21.06 15.94 11.92 10.06 10.87 14.13 18.97 24.08 28.11 29.97 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 309.75 312.97 304.87 287.62 265.86 245.4 231.73 228.52 236.62 253.86 275.63 296.09 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 166)m= 29.16 25.9 21.06 15.94 11.92 10.06 10.87 14.13 18.97 24.08 28.11 29.97 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 309.75 312.97 304.87 287.62 265.86 245.4 231.73 228.52 236.62 253.86 275.63 296.09 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 37.59 37.	67) 68)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 (66)m= 29.16 25.9 21.06 15.94 11.92 10.06 10.87 14.13 18.97 24.08 28.11 29.97 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 309.75 312.97 304.87 287.62 265.86 245.4 231.73 228.52 236.62 253.86 275.63 296.09 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 37.59 37.	67) 68)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 (66)m= 29.16 25.9 21.06 15.94 11.92 10.06 10.87 14.13 18.97 24.08 28.11 29.97 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 309.75 312.97 304.87 287.62 265.86 245.4 231.73 228.52 236.62 253.86 275.63 296.09 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 37.59 37.	67) 68) 69)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 14	67) 68) 69)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 14	68) 69)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 145	68) 69)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 145.88 145	668) 669)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 14	668) 669)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	668) 669) 770)

Flux

Table 6a

Area

m²

Orientation: Access Factor

Table 6d

Gains

(W)

FF

Table 6c

Table 6b

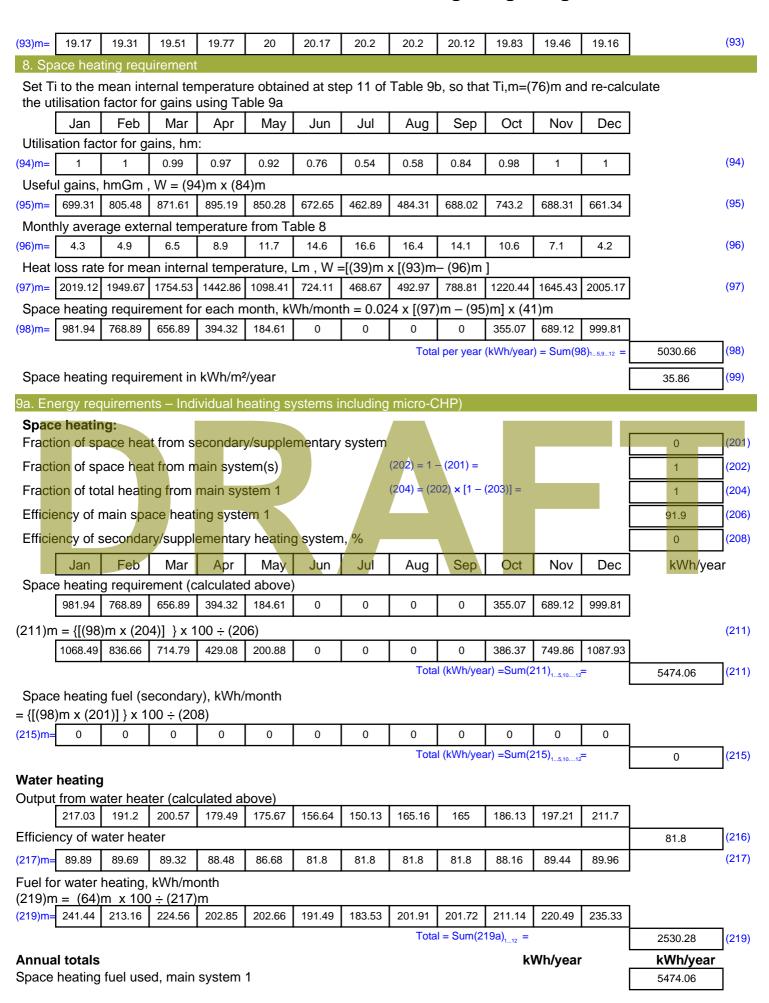


Southeast 0.0x													
Southeast 0 s	Southeast 0.9x	0.54	x	8.88	x	36.79	X	0.45	x	0.67	=	47.88	(77)
Southeast 0.5%	Southeast 0.9x	0.54	x	1.78	x	36.79	x	0.45	x	0.67	=	9.6	(77)
Southeast 0.5x	Southeast 0.9x	0.54	x	8.88	x	62.67	X	0.45	x	0.67	=	81.55	(77)
Southeast 0.5%	Southeast 0.9x	0.54	X	1.78	x	62.67	x	0.45	x	0.67	=	16.35	(77)
Southeast 0 sk	Southeast 0.9x	0.54	x	8.88	x	85.75	x	0.45	x	0.67	=	111.58	(77)
Southeast 0, 9x	Southeast 0.9x	0.54	x	1.78	x	85.75	x	0.45	x	0.67	=	22.37	(77)
Southeast 0, 9x	Southeast 0.9x	0.54	X	8.88	x	106.25	X	0.45	x	0.67	=	138.25	(77)
Southeast 0.9%	Southeast 0.9x	0.54	x	1.78	x	106.25	X	0.45	x	0.67	=	27.71	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	x	119.01	X	0.45	x	0.67	=	154.85	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	119.01	X	0.45	x	0.67	=	31.04	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	x	118.15	X	0.45	x	0.67	=	153.73	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	118.15	X	0.45	x	0.67	=	30.82	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	x	113.91	X	0.45	x	0.67	=	148.22	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	113.91	X	0.45	x	0.67	=	29.71	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	x	104.39	X	0.45	x	0.67	=	135.83	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	104.39	X	0.45	x	0.67	=	27.23	(77)
Southeast 0.9x	Southeast 0.9x	0.54	X	8.88	x	92.85	X	0.45	x	0.67	=	120.82	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	X	92.85	X	0.45	X	0.67	=	24.22	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	х	69.27	X	0.45	x	0.67	=	90.13	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	69.27	×	0.45	x	0.67	=	18.07	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	X	44.07	X	0.45	x	0.67	=	57.34	(77)
Southeast 0.9x         0.54         x         1.78         x         31.49         x         0.45         x         0.67         =         8.21         (77)           South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23	Southeast 0.9x	0.54	x	1.78	x	44.07	Х	0.45	x	0.67	=	11.49	(77)
South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23	Southeast 0.9x	0.54	x	8.88	x	31.49	X	0.45	x	0.67	=	40.97	(77)
South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.2	Southeast 0.9x	0.54	x	1.78	х	31.49	X	0.45	x	0.67	=	8.21	(77)
South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.	South 0.9x	0.54	x	2.85	x	46.75	X	0.45	x	0.67	=	39.05	(78)
South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110	South <sub>0.9x</sub>	0.54	X	2.85	X	46.75	X	0.45	X	0.67	=	39.05	(78)
South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         11	South 0.9x	0.54	X	2.85	X	76.57	X	0.45	X	0.67	=	63.95	(78)
South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         1	South 0.9x	0.54	X	2.85	X	76.57	x	0.45	X	0.67	=	63.95	(78)
South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x	South <sub>0.9x</sub>	0.54	X	2.85	X	97.53	X	0.45	X	0.67	=	81.46	(78)
South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x	South 0.9x	0.54	X	2.85	X	97.53	X	0.45	X	0.67	=	81.46	(78)
South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x	South <sub>0.9x</sub>	0.54	X	2.85	X	110.23	X	0.45	X	0.67	=	92.07	(78)
South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         87.61         (78)           South         0.9x         0.54         x         2.85         x	South <sub>0.9x</sub>	0.54	X	2.85	X	110.23	X	0.45	X	0.67	=	92.07	(78)
South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         87.61         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         87.61         (78)	South 0.9x	0.54	X	2.85	X	114.87	X	0.45	X	0.67	=	95.94	(78)
South       0.9x       0.54       x       2.85       x       110.55       x       0.45       x       0.67       =       92.33       (78)         South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	South 0.9x	0.54	X	2.85	X	114.87	X	0.45	X	0.67	=	95.94	(78)
South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	South 0.9x	0.54	x	2.85	x	110.55	X	0.45	x	0.67	=	92.33	(78)
South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	South 0.9x	0.54	x	2.85	x	110.55	X	0.45	x	0.67	=	92.33	(78)
South     0.9x     0.54     x     2.85     x     104.89     x     0.45     x     0.67     =     87.61     (78)       South     0.9x     0.54     x     2.85     x     104.89     x     0.45     x     0.67     =     87.61     (78)	<u>l</u>	0.54	x	2.85	x	108.01	X	0.45	x	0.67	=	90.21	(78)
South 0.9x 0.54 x 2.85 x 104.89 x 0.45 x 0.67 = 87.61 (78)	<u>l</u>	0.54	x	2.85	x	108.01	X	0.45	x	0.67	=	90.21	(78)
	<u>l</u>	0.54	x	2.85	x	104.89	X	0.45	x	0.67	=	87.61	(78)
South 0.9x 0.54 x 2.85 x 101.89 x 0.45 x 0.67 = 85.1 (78)	<u>l</u>	0.54	x	2.85	x	104.89	X	0.45	x	0.67	=	87.61	(78)
	South 0.9x	0.54	X	2.85	X	101.89	X	0.45	X	0.67	=	85.1	(78)



South 0.9x 0.54	X	2.85	5	X	10	1.89	x	0.45	x	0.67	=	85.1	(78)
South 0.9x 0.54	X	2.85	5	X	8:	2.59	x	0.45	X	0.67	=	68.98	(78)
South 0.9x 0.54	X	2.8	5	X	8:	2.59	x	0.45	X	0.67	=	68.98	(78)
South 0.9x 0.54	X	2.8	5	X	5	5.42	x	0.45	X	0.67	=	46.29	(78)
South 0.9x 0.54	X	2.85	5	X	5	5.42	x	0.45	x	0.67	=	46.29	(78)
South 0.9x 0.54	X	2.85	5	X	4	10.4	x	0.45	X	0.67	=	33.74	(78)
South 0.9x 0.54	X	2.85	5	X	4	10.4	x	0.45	X	0.67	=	33.74	(78)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	3	6.79		0.45	X	0.67	=	28.79	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	6	2.67		0.45	X	0.67	=	49.04	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	8	5.75		0.45	X	0.67	=	67.1	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	10	06.25		0.45	X	0.67	=	83.14	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	11	19.01		0.45	X	0.67	=	93.12	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	11	18.15		0.45	X	0.67	=	92.45	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	11	13.91		0.45	X	0.67	=	89.13	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	10	04.39		0.45	X	0.67	=	81.68	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	9:	2.85		0.45	x	0.67	=	72.65	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	6	9.27		0.45	X	0.67	=	54.2	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	X	4	4.07		0.45	X	0.67	=	34.48	(79)
Southwest <sub>0.9x</sub> 0.54	X	2.67	7	х	3	1.49		0.45	x	0.67	=	24.64	(79)
Solar gains in watts, calc	ulated	for each	month	1			(83)m	= Sum(74)m .	(82)m				
	ulated 63.97	for each	470.9		61.66	447.48	<mark>(83)m</mark> 419		(82)m 300.3	195.89	141.3		(83)
	63.97	433.24	470.9	4		447.48			, ,	195.89	141.3		(83)
(83)m= 164.36 274.84 3 Total gains – internal and	63.97	433.24	470.9	+ (8		447.48		.96 387.88	, ,		141.3	]	(83) (84)
(83)m= 164.36 274.84 3 Total gains – internal and	63.97 d solar 379.59	433.24 (84)m = 919.75	470.9 (73)m 927.24	4 (8	83)m ,	447.48 watts	419	.96 387.88	300.3		I	]	, ,
(83)m= 164.36 274.84 3  Total gains – internal and (84)m= 700.31 808.36 8	63.97 d solar 79.59	433.24 (84)m = 919.75 (heating	470.9 (73)m 927.24 seasor	4 (8	83)m , 89.51	447.48 watts 857.23	419 836	.96 387.88	300.3		I	21	, ,
(83)m= 164.36 274.84 3  Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper	solar 79.59 ature (	433.24 (84)m = 919.75 (heating eriods in	470.9 (73)m 927.24 seasor the livi	44 + (8 8)	83)m , 89.51 area f	447.48 watts 857.23	419 836	.96 387.88	300.3		I	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8 7. Mean internal temper Temperature during hear	solar 79.59 ature (	433.24 (84)m = 919.75 (heating eriods in	470.9 (73)m 927.24 seasor the livi	4(1) (s) (s)	83)m , 89.51 area f	447.48 watts 857.23	836 ole 9	.96 387.88	300.3	690.76	I	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb	solar d solar d solar areature ( ating pens for li	433.24 (84)m = 919.75 (heating eriods in ving are	470.9 (73)m 927.24 seasor the livi a, h1,m	4(1) (1) (1) (1) (1)	83)m , 89.51 area f ee Ta	447.48 watts 857.23 rom Tab	836 ole 9	.48 819.72 .Th1 (°C)	300.35 761.53	690.76	662.02	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb	solar solar streeting per ating per as for li	433.24 (84)m = 919.75 (heating eriods in ving are Apr 0.98	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95	4 + (8 8 8 1 ) ) ing in (s	83)m , 89.51 area f ee Ta Jun 0.83	447.48 watts 857.23 from Tab ble 9a) Jul 0.65	836 ole 9	.48 819.72 .Th1 (°C) ug Sep .88 0.89	300.38 761.50	8 690.76 Nov	662.02 Dec	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature temperature during heat Internal te	solar solar streeting per ating per as for li	433.24 (84)m = 919.75 (heating eriods in ving are Apr 0.98	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95	4 + (()   8   1)   (s)	83)m , 89.51 area f ee Ta Jun 0.83	447.48 watts 857.23 from Tab ble 9a) Jul 0.65	836 ole 9	.48 819.72 Th1 (°C) ug Sep 88 0.89 Table 9c)	300.38 761.50	Nov 1	662.02 Dec	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature (87)m= 20.14 20.24 3	ature (ating pens for limited	433.24 (84)m = 919.75 (heating eriods in ving are 0.98 iving are 20.59	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (f	4 + (((((((((((((((((((((((((((((((((((	83)m , 89.51 area f ee Ta Jun 0.83 w ster 20.9	447.48 watts 857.23 rom Tabble 9a) Jul 0.65 os 3 to 7 20.95	8366 ble 9 A 0.66	.48 819.72  .Th1 (°C)  .ug Sep .88 0.89  .able 9c)  .94 20.87	300.35 761.53 Oct 0.99	Nov 1	662.02  Dec 1	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature (87)m= 20.14 20.24 2	ature (ating pens for limited	433.24 (84)m = 919.75 (heating eriods in ving are 0.98 iving are 20.59	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (f	4 + (5 8 8 1 ) sing (s ollows) distributed to the collows of the c	83)m , 89.51 area f ee Ta Jun 0.83 w ster 20.9	447.48 watts 857.23 rom Tabble 9a) Jul 0.65 os 3 to 7 20.95	8366 ble 9 A 0.66	.48 819.72  Th1 (°C)  ug Sep  88 0.89  Table 9c)  94 20.87  9, Th2 (°C)	300.35 761.53 Oct 0.99	Nov 1 20.35	662.02  Dec 1	21	(84)
(83)m= 164.36 274.84 3 Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature (87)m= 20.14 20.24 2	solar street (ating pens for limited Mar 0.99 ating pens for limited Mar 0.99 ating pens for limited Mar 120.39 ating pens for limited Mar 120.30 ating pens for limited Mar 120	433.24 (84)m = 919.75 (heating eriods in Apr 0.98 iving are 20.59 eriods in 20.13	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (frace 20.77 rest of 20.13	4+(() 8: (s)	area f ee Ta Jun 0.83 w step 20.9 velling	447.48 watts 857.23 from Tab ble 9a) Jul 0.65 os 3 to 7 20.95 from Ta	419 836 836 A 0.6 7 in T 20.	.48 819.72  .Th1 (°C)  ug Sep .88 0.89  .able 9c) .94 20.87  .Th2 (°C)	300.38 761.50 Oct 0.99	Nov 1 20.35	Dec 1 20.13	21	(84)
Total gains — internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature (87)m= 20.14 20.24 20.24 20.14 20.24 20.11	solar street (ating pens for limited Mar 0.99 ating pens for limited Mar 0.99 ating pens for limited Mar 120.39 ating pens for limited Mar 120.30 ating pens for limited Mar 120	433.24 (84)m = 919.75 (heating eriods in Apr 0.98 iving are 20.59 eriods in 20.13	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (frace 20.77 rest of 20.13	4	area f ee Ta Jun 0.83 w step 20.9 velling	447.48 watts 857.23 from Tab ble 9a) Jul 0.65 os 3 to 7 20.95 from Ta	419 836 836 A 0.6 7 in T 20.	387.88  48 819.72  Th1 (°C)  ug Sep 88 0.89  Table 9c) 94 20.87  9, Th2 (°C) 15 20.14	300.38 761.50 Oct 0.99	Nov 1 20.35	Dec 1 20.13	21	(84)
(83)m= 164.36 274.84 3  Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature (87)m= 20.14 20.24 3  Temperature during heat (88)m= 20.11 20.11 3  Utilisation factor for gain (89)m= 1 1	solar rature (ating pens for limited pen	433.24 (84)m = 919.75 (heating eriods in 20.59 eriods in 20.13 est of dw 0.98	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (fr 20.77 rest of 20.13 velling, 0.92	4+ ((((((((((((((((((((((((((((((((((((	83)m , 89.51 area f ee Ta Jun 0.83 w step 20.9 velling 20.14 ,m (se	447.48  watts  857.23  rom Table 9a)  Jul  0.65  os 3 to 7  20.95  from Ta  20.14  e Table  0.53	419 8366 ble 9 A 0.6 ' in T 20. ble 9 20. 9a)	387.88  48 819.72  Th1 (°C)  ug Sep 88 0.89  Table 9c) 94 20.87  9, Th2 (°C) 15 20.14	Oct 0.99 20.63 0.98	Nov 1 20.35	Dec 1 20.13	21	(84) (85) (86) (87) (88)
Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during head Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature during head (87)m= 20.14 20.24 20.14 20.11	solar rature (ating pens for limited pen	433.24 (84)m = 919.75 (heating eriods in 20.59 eriods in 20.13 est of dw 0.98	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (fr 20.77 rest of 20.13 velling, 0.92	4	83)m , 89.51 area f ee Ta Jun 0.83 w step 20.9 velling 20.14 ,m (se	447.48  watts  857.23  rom Table 9a)  Jul  0.65  os 3 to 7  20.95  from Ta  20.14  e Table  0.53	419 8366 ble 9 A 0.6 ' in T 20. ble 9 20. 9a)	.96 387.88  .48 819.72  .Th1 (°C)  ug Sep .88 0.89  .able 9c) .94 20.87  .9, Th2 (°C) .15 20.14  .77 0.84  to 7 in Tabl	Oct 0.99 20.63 0.98	Nov 1 20.35	Dec 1 20.13	21	(84) (85) (86) (87) (88)
Total gains — internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during head Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature during head (87)m= 20.14 20.24 20.11	solar rature (ating points for limiting points for limiting points for limiting points for limiting points for roughly limiting points for rou	(84)m = 919.75 (heating eriods in ving are 20.59 eriods in 20.13 est of dw 0.98 the rest of the state of the	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (frace 20.77 rest of 20.13 velling, 0.92 of dwell	4	area f ee Ta Jun 0.83 w step 20.9 velling 0.14 ,m (se 0.75	447.48 watts 857.23 from Table 9a) Jul 0.65 0s 3 to 7 20.95 from Ta 20.14 e Table 0.53 bllow ste	419 836 836  A 0.6 7 in T 20. ble 9 20. 9a) 0.5	387.88  48 819.72  Th1 (°C)  ug Sep 88 0.89  fable 9c) 94 20.87  9, Th2 (°C) 15 20.14  to 7 in Table 07 19.99	300.38 761.53 Oct 0.99 20.63 20.13 0.98 e 9c) 19.67	Nov 1 20.35 20.13	Dec 1 20.13 20.12 1 18.93	21	(84) (85) (86) (87) (88) (89)
(83)m= 164.36 274.84 3  Total gains — internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during heat Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature (87)m= 20.14 20.24 3  Temperature during heat (88)m= 20.11 20.11 3  Utilisation factor for gain (89)m= 1 1  Mean internal temperature (90)m= 18.94 19.09	solar rature (ating pens for limited pens for rature) at the solar rature (ating pens for rature) at the solar rature (ating pens for rature) at the solar rature in the solar rature (at the solar rature) at the solar rature in the solar rat	433.24 (84)m = 919.75 (heating eriods in ving are 20.59 eriods in 20.13 est of dw 0.98 he rest of 19.61	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (fr 20.77 rest of 20.13 velling, 0.92 of dwell 19.86	4+ (() 8/10) ling (s) (c) (d) (d) (d) (d) (d) (d) (d) (d) (d) (d	83)m , 89.51 area f ee Ta Jun 0.83 w step 20.9 velling 20.14 ,m (se 0.75 T2 (fo	447.48 watts 857.23 from Table 9a) Jul 0.65 0s 3 to 7 20.95 from Ta 20.14 e Table 0.53 ollow ste 20.07	419 836 ble 9 0.6 7 in T 20. ble 9 20. 9a) 0.5 3 20.	387.88  48 819.72  Th1 (°C)  ug Sep 88 0.89  Table 9c) 94 20.87  9, Th2 (°C) 15 20.14  to 7 in Table 07 19.99	300.38 761.53 Oct 0.99 20.63 20.13 0.98 e 9c) 19.67	Nov 1 20.35 20.13	Dec 1 20.13 20.12 1 18.93		(84) (85) (86) (87) (88) (89)
Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during head Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature during head (87)m= 20.14 20.24 20.11	solar rature (ating pens for limited pens for rature) at the solar rature (ating pens for rature) at the solar rature (ating pens for rature) at the solar rature in the solar rature (at the solar rature) at the solar rature in the solar rat	433.24 (84)m = 919.75 (heating eriods in ving are 20.59 eriods in 20.13 est of dw 0.98 he rest of 19.61	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (fr 20.77 rest of 20.13 velling, 0.92 of dwell 19.86	44	83)m , 89.51 area f ee Ta Jun 0.83 w step 20.9 velling 20.14 ,m (se 0.75 T2 (fo	447.48 watts 857.23 from Table 9a) Jul 0.65 0s 3 to 7 20.95 from Ta 20.14 e Table 0.53 ollow ste 20.07	419 836 ble 9 0.6 7 in T 20. ble 9 20. 9a) 0.5 3 20.	387.88  48 819.72  Th1 (°C)  ug Sep 8 0.89  Table 9c) 94 20.87  9, Th2 (°C) 15 20.14  to 7 in Tabl 07 19.99  f  fLA) × T2	300.38 761.53 Oct 0.99 20.63 20.13 0.98 e 9c) 19.67	Nov 1 20.35 20.13	Dec 1 20.13 20.12 1 18.93		(84) (85) (86) (87) (88) (89)
Total gains – internal and (84)m= 700.31 808.36 8  7. Mean internal temper Temperature during head Utilisation factor for gain Jan Feb (86)m= 1 1  Mean internal temperature during head (87)m= 20.14 20.24 20.11	ature (for 19.66	433.24 (84)m = 919.75 (heating eriods in 20.59 eriods in 20.13 est of dw 0.98 he rest of 19.61 er the who	470.9 (73)m 927.24 seasor the livi a, h1,m May 0.95 ea T1 (fr 20.77 rest of 20.13 velling, 0.92 of dwell 19.86  colle dwe 20.15	44   (1   8   8   1   1   1   1   1   1   1	83)m , 89.51  area f ee Ta Jun 0.83  w step 20.9  velling 0.75  T2 (fc 20.04	447.48 watts 857.23 from Table 9a) Jul 0.65 0s 3 to 7 20.95 from Ta 20.14 e Table 0.53 ollow ste 20.07  A × T1 20.35	419  836  836  0.6  7 in T  20.  ble 9  0.5  20.  + (1  20.	387.88  48 819.72  Th1 (°C)  ug Sep 88 0.89  Table 9c) 94 20.87  9, Th2 (°C) 15 20.14  to 7 in Table 07 19.99  f  fLA) x T2 35 20.27	300.38 761.50 Oct 0.99 20.63 20.13 0.98 e 9c) 19.67 LA = Liv	Nov 1 20.35 20.13 1 19.26 ing area ÷ (4	Dec 1 20.13 20.12 1 18.93		(84) (85) (86) (87) (88) (89) (90) (91)







Water heating fuel used 2530.28 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 392.83 central heating pump: (230c)30 sum of (230a)...(230g) = Total electricity for the above, kWh/year 422.83 (231)Electricity for lighting (232)514.89 12a. CO2 emissions – Individual heating systems including micro-CHP **Energy Emission factor Emissions** kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261)0.216 1182.4 (215) x Space heating (secondary) (263)0.519 0 (219) x Water heating (264)0.216 546.54 (261) + (262) + (263) + (264) =Space and water heating 1728.94 (265)(231) x Electricity for pumps, fans and electric keep-hot 0.519 (267)219.45 (232) x Electricity for lighting (268)0.519 267.23 sum of (265)...(271) = Total CO2, kg/year (272)2215.61  $(272) \div (4) =$ **Dwelling CO2 Emission Rate** 15.79 (273)El rating (section 14) (274)84



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 8 - 4B8P - GF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 220 (1a) x 2.7 (2a) =(3a) 594 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)220 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =594 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
0.16	
Calculate effective air change rate for the applicable case	
If outpout his host numbrusing Appendix N. (22h). (22h). (22h). (22h). (22h). (22h). (22h).	).5 (23a)
If helenged with heat recovery efficiency in 0/ ellewing for in use factor (from Table 4b)	).5 (23b)
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) $\div$ 100]	(23c)
(24a)m= $0.29$ $0.28$ $0.27$ $0.26$ $0.25$ $0.25$ $0.24$ $0.25$ $0.26$ $0.27$ $0.28$	(24a)
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	(24b)
c) If whole house extract ventilation or positive input ventilation from outside	
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (22b)m + 0.5 \times (23b)$	
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0	(24c)
d) If natural ventilation or whole house positive input ventilation from loft if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$	
(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
(25)m= 0.29 0.29 0.28 0.27 0.26 0.25 0.25 0.24 0.25 0.26 0.27 0.28	(25)
3. Heat losses and heat loss parameter:	
ELEMENT       Gross area (m²)       Openings m²       Net Area A ,m²       U-value W/m2K       A X U k-value (W/K)       k-value kJ/m²·K	A X k kJ/K
Windows Type 1 $6.74$ $x1/[1/(1.1) + 0.04] = 7.1$	(27)
Windows Type 2 $0.88$ $x^{1/[1/(1.1) + 0.04]} = 0.93$	(27)
Windows Type 3 $0.88$ $x1/[1/(1.1) + 0.04] = 0.93$	(27)
Windows Type 4	(27)
Windows Type 5 $0.88$ $x^{1/[1/(1.1) + 0.04]} = 0.93$	(27)
Windows Type 6 $4.1$ $x^{1/[1/(1.1) + 0.04]} = 4.32$	(27)
Windows Type 7	(27)
Windows Type 8 $2.68$ $x^{1/[1/(1.1) + 0.04]} = 2.82$	(27)
Floor 220 x 0.11 = 24.2	(28)
Walls Type1 115.69 49.54 66.16 x 0.12 = 7.94	(29)
Walls Type2 57.78 0 57.78 x 0.14 = 8.18	(29)
Total area of elements, m <sup>2</sup> 393.47	(31)
Party wall 35.24 × 0 = 0	(32)
Party ceiling 220	(32b)
* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2  ** include the areas on both sides of internal walls and partitions	
Fabric heat loss, W/K = S (A x U) $(26)(30) + (32) = 9$	2.51 (33)
Heat capacity Cm = $S(A \times k)$ ((28)(30) + (32) + (32a)(32e) = 410	61.02 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K Indicative Value: Medium	

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)59.02 if details of thermal bridging are not known (36) =  $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)151.53 Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)$ m x (5)Feb Mar Jul Sep Dec .lan Apr May Jun Aug Oct Nov (38)m =56.56 55.94 55.31 52.19 51.57 48.44 48.44 47.82 49.69 51.57 52.82 54.06 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =208.1 207.47 206.85 203.72 203.1 199.98 199.98 199.35 201.22 203.1 204.35 205.6 Average = Sum(39)<sub>1...12</sub> /12= (39)203.57 Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m  $\div$  (4)0.92 (40)m =0.95 0.94 0.94 0.93 0.91 0.91 0.91 0.91 0.92 0.93 0.93 (40)Average =  $Sum(40)_{1...12}/12=$ 0.93 Number of days in month (Table 1a) Jan Feb Mar Jun Apr May Jul Aug Sep Oct Nov Dec (41)31 28 31 30 31 30 31 31 30 31 30 31 (41)m =4. Water heating energy requirement: Assumed occupancy, N (42)3.03 if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)106.11 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) 116.72 112.48 108.24 103.99 95.5 99.75 103.99 108.24 112.48 116.72 (44)m =99.75 95.5 (44)Total =  $Sum(44)_{1...12}$  = 1273.36 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 =173.1 151.39 156.22 136.2 130.69 112.77 104.5 119.92 121.35 141.42 154.37 167.64 (45)Total =  $Sum(45)_{1...12}$  = 1669.58 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.96 22.71 23.43 20.43 16.92 21.21 23.16 25.15 (46)19.6 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 305 (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): 1.63 (48)Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year  $(48) \times (49) =$ 0.88 (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 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)



Energy lost from water storage, kWh/year $ (47) \times (51) \times (52) \times (53) = 0 $ Enter (50) or (54) in (55) $ 0.88 $	(54)
Enter (50) or (54) in (55)  Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	(55)
	(56)
(56)m= 27.29 24.65 27.29 26.41	(30)
(57)m= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m + (61)m + (62)m + (63)m + (64)m	)m
(62)m= 223.65 197.05 206.77 185.12 181.24 161.69 155.05 170.47 170.27 191.97 203.29 218.19	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 223.65 197.05 206.77 185.12 181.24 161.69 155.05 170.47 170.27 191.97 203.29 218.19	
Output from water heater (annual) <sub>112</sub> 2264.74	(64)
Heat gains from water heating, kWh/month 0.25 / [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 97.99 86.86 92.38 84.42 83.89 76.63 75.19 80.31 79.48 87.46 90.46 96.18	(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= 151.4 151.4 151.4 151.4 151.4 151.4 151.4 151.4 151.4 151.4 151.4 151.4 151.4	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 34.92 31.01 25.22 19.09 14.27 12.05 13.02 16.92 22.72 28.84 33.66 35.89	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
	(00)
(68)m= 389.68 393.72 383.53 361.84 334.46 308.72 291.52 287.48 297.67 319.36 346.75 372.48	(68)
	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 3	(69)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14 38.14	(69)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 3	(69) (70)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 3	(69) (70)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 3	(69) (70) (71)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 38.14 3	(69) (70) (71)

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



Orientation	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9	9x 0.77	X	6.74	x	10.63	x	0.45	x	0.67	=	14.97	(74)
North 0.	0.77	x	11.41	x	10.63	X	0.45	x	0.67	=	50.7	(74)
North 0.	0.77	x	2.68	x	10.63	x	0.45	x	0.67	=	5.95	(74)
North 0.	9x 0.77	x	6.74	х	20.32	х	0.45	x	0.67	=	28.62	(74)
North 0.9	9x 0.77	X	11.41	х	20.32	X	0.45	x	0.67	=	96.89	(74)
North 0.	0.77	x	2.68	x	20.32	x	0.45	x	0.67	=	11.38	(74)
North 0.9	9x 0.77	X	6.74	x	34.53	x	0.45	X	0.67	=	48.63	(74)
North 0.	0.77	x	11.41	x	34.53	x	0.45	x	0.67	=	164.64	(74)
North 0.	9x 0.77	x	2.68	x	34.53	x	0.45	x	0.67	=	19.34	(74)
North 0.	0.77	x	6.74	x	55.46	x	0.45	x	0.67	=	78.11	(74)
North 0.9	9x 0.77	X	11.41	X	55.46	X	0.45	X	0.67	=	264.45	(74)
North 0.	0.77	X	2.68	x	55.46	x	0.45	x	0.67	=	31.06	(74)
North 0.9	9x 0.77	X	6.74	X	74.72	X	0.45	x	0.67	=	105.22	(74)
North 0.	0.77	X	11.41	X	74.72	X	0.45	X	0.67	=	356.24	(74)
North 0.	9x 0.77	X	2.68	x	74.72	X	0.45	X	0.67	=	41.84	(74)
North 0.	0.77	X	6.74	X	79.99	Х	0.45	X	0.67	=	112.64	(74)
North 0.	0.77	x	11.41	x	79.99	x	0.45	x	0.67	=	381.37	(74)
North 0.9	9x 0.77	x	2.68	х	79.99	x	0.45	x	0.67	=	44.79	(74)
North 0.9	9x 0.77	x	6.74	X	74.68	x	0.45	x	0.67	=	105.16	(74)
North 0.9	9x 0.77	x	11.41	x	74.68	Х	0.45	x	0.67	=	356.06	(74)
North 0.	9x 0.77	x	2.68	x	74.68	X	0.45	X	0.67	=	41.82	(74)
North 0.	9x 0.77	×	6.74	х	59.25	x	0.45	x	0.67	=	83.43	(74)
North 0.	9x 0.77	X	11.41	x	59.25	x	0.45	x	0.67	=	282.49	(74)
North 0.	9x 0.77	X	2.68	X	59.25	x	0.45	x	0.67	=	33.18	(74)
North 0.	9x 0.77	X	6.74	X	41.52	X	0.45	X	0.67	=	58.47	(74)
North 0.	0.77	X	11.41	X	41.52	X	0.45	X	0.67	=	197.95	(74)
	0.77	X	2.68	X	41.52	X	0.45	X	0.67	=	23.25	(74)
North 0.	0.77	X	6.74	X	24.19	X	0.45	X	0.67	=	34.06	(74)
North 0.	0.77	X	11.41	X	24.19	X	0.45	X	0.67	=	115.34	(74)
	0.77	X	2.68	X	24.19	X	0.45	X	0.67	=	13.55	(74)
North 0.	0.77	X	6.74	X	13.12	X	0.45	X	0.67	=	18.47	(74)
	0.77	X	11.41	X	13.12	x	0.45	X	0.67	=	62.54	(74)
North 0.	0.77	X	2.68	X	13.12	X	0.45	X	0.67	=	7.35	(74)
North 0.	0.77	X	6.74	X	8.86	X	0.45	X	0.67	=	12.48	(74)
North 0.	0.77	X	11.41	X	8.86	X	0.45	X	0.67	=	42.27	(74)
North 0.		X	2.68	x	8.86	x	0.45	X	0.67	=	4.96	(74)
Northeast 0.		X	0.88	X	11.28	x	0.45	x	0.67	=	4.15	(75)
Northeast 0.		x	0.88	X	22.97	X	0.45	X	0.67	=	8.45	(75)
Northeast 0.	0.77	X	0.88	X	41.38	X	0.45	X	0.67	=	15.22	(75)



Northeast 0.9x	0.77	١.,	0.00	۱.,	07.00	۱.,	0.45	١.,	0.07	1	0.1.00	7(75)
Northeast 0.9x	0.77	X	0.88	X	67.96	X	0.45	X	0.67	= 1	24.99	(75)
Northeast 0.9x	0.77	X	0.88	X	91.35	X	0.45	X	0.67	= 	33.59	<b></b> (75) <b></b> (75)
Northeast 0.9x	0.77	X	0.88	X	97.38	X	0.45	X	0.67	= i	35.81	」(75) □(75)
Northeast 0.9x	0.77	X	0.88	X	91.1	X	0.45	X	0.67	= 	33.5	」(75) □ (75)
Northeast 0.9x	0.77	X	0.88	X	72.63	X	0.45	X	0.67	= 	26.71	<b></b> (75) <b></b> (75)
Northeast 0.9x	0.77	X	0.88	X	50.42	X	0.45	X	0.67	= 	18.54	<b></b> (75) <b></b> (75)
Northeast 0.9x	0.77	X	0.88	X	28.07	X	0.45	X	0.67	= 	10.32	(75) □(75)
Northeast 0.9x	0.77	X	0.88	X	14.2	X	0.45	X	0.67	= 	5.22	](75)
	0.77	X	0.88	X	9.21	X	0.45	X	0.67	= 	3.39	<b>」</b> (75)
South 0.9x	0.54	X	0.88	X	46.75	X	0.45	X	0.67	= 	24.11	<u></u> (78)
South 0.9x	0.54	X	4.1	X	46.75	X	0.45	X	0.67	=	28.09	<b> 1</b> (78)
South 0.9x	0.54	X	1.54	X	46.75	X	0.45	X	0.67	= 	42.2	<b> 1</b> (78)
South 0.9x	0.54	X	0.88	X	76.57	X	0.45	X	0.67	=	39.49	<b></b>
South 0.9x	0.54	X	4.1	X	76.57	X	0.45	X	0.67	=	46	<u> </u> (78)
South 0.9x	0.54	X	1.54	Х	76.57	X	0.45	X	0.67	=	69.11	<u> </u> (78)
South 0.9x	0.54	X	0.88	Х	97.53	X	0.45	X	0.67	=	50.31	<u> </u> (78)
South 0.9x	0.54	X	4.1	Х	97.53	X	0.45	X	0.67	=	58.6	(78)
South 0.9x	0.54	X	1.54	X	97.53	Х	0.45	X	0.67	=	88.04	<u> </u> (78)
South 0.9x	0.54	X	0.88	Х	110.23	X	0.45	X	0.67	<u></u> = ¯	56.86	(78)
South 0.9x	0.54	X	4.1	Х	110.23	X	0.45	X	0.67	=	66.23	[78]
South 0.9x	0.54	X	1.54	X	110.23	X	0.45	X	0.67	=	99.5	<u> </u> (78)
South 0.9x	0.54	X	0.88	X	114.87	Х	0.45	X	0.67	=	59.25	(78)
South 0.9x	0.54	X	4.1	х	114.87	Х	0.45	X	0.67	=	69.01	(78)
South 0.9x	0.54	X	1.54	X	114.87	X	0.45	X	0.67	=	1 <mark>03.68</mark>	(78)
South 0.9x	0.54	X	0.88	X	110.55	X	0.45	X	0.67	=	57.02	(78)
South 0.9x	0.54	X	4.1	X	110.55	X	0.45	X	0.67	=	66.41	(78)
South 0.9x	0.54	X	1.54	X	110.55	X	0.45	X	0.67	=	99.78	(78)
South 0.9x	0.54	X	0.88	X	108.01	X	0.45	X	0.67	=	55.71	(78)
South 0.9x	0.54	X	4.1	X	108.01	X	0.45	X	0.67	=	64.89	(78)
South 0.9x	0.54	X	1.54	X	108.01	X	0.45	X	0.67	=	97.49	(78)
South 0.9x	0.54	X	0.88	X	104.89	X	0.45	X	0.67	=	54.1	(78)
South 0.9x	0.54	X	4.1	X	104.89	X	0.45	X	0.67	=	63.02	(78)
South 0.9x	0.54	X	1.54	X	104.89	X	0.45	X	0.67	=	94.68	(78)
South 0.9x	0.54	X	0.88	X	101.89	X	0.45	X	0.67	=	52.55	(78)
South 0.9x	0.54	x	4.1	x	101.89	x	0.45	x	0.67	=	61.21	(78)
South 0.9x	0.54	x	1.54	x	101.89	x	0.45	x	0.67	] =	91.96	(78)
South 0.9x	0.54	x	0.88	x	82.59	x	0.45	x	0.67	=	42.6	(78)
South 0.9x	0.54	x	4.1	x	82.59	x	0.45	x	0.67	=	49.61	(78)
South 0.9x	0.54	x	1.54	x	82.59	x	0.45	x	0.67	=	74.54	(78)
South 0.9x	0.54	x	0.88	x	55.42	x	0.45	x	0.67	=	28.58	(78)
South 0.9x	0.54	x	4.1	X	55.42	x	0.45	x	0.67	=	33.29	(78)



South 0.9x	0.54	X	1.5	54	X	55.42	X		0.45	x [	0.67	=	50.0	)2 (78)
South 0.9x	0.54	X	0.8	8	X	40.4	x		0.45	_ x [	0.67	_ =	20.8	(78)
South 0.9x	0.54	X	4.1	1	X	40.4	x		0.45	x	0.67		24.2	27 (78)
South 0.9x	0.54	X	1.5	54	X	40.4	x		0.45	x	0.67	_ =	36.4	16 (78)
Northwest <sub>0.9x</sub>	0.77	X	0.8	8	X	11.28	×		0.45	_ x [	0.67	╗ -	4.1	5 (81)
Northwest <sub>0.9x</sub>	0.77	х	0.8	8	X	22.97	x		0.45	x	0.67	_ =	8.4	5 (81)
Northwest 0.9x	0.77	X	0.8	8	X	41.38	×		0.45	- x	0.67	╡ =	15.2	(81)
Northwest <sub>0.9x</sub>	0.77	x	0.8	8	X	67.96	x		0.45	<b>a</b> x	0.67	╡ -	24.9	99 (81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	8	X	91.35	x		0.45	×	0.67	_ =	33.5	(81)
Northwest 0.9x	0.77	X	0.8	8	X	97.38	x		0.45	x	0.67	_ =	35.8	(81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	8	X	91.1	×		0.45	_ x [	0.67	╗ -	33.	5 (81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	8	X	72.63	x		0.45	_ x [	0.67	╡ =	26.7	71 (81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	8	X	50.42	x		0.45	_ x [	0.67	_ =	18.5	54 (81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	88	X	28.07	x		0.45	x	0.67	=	10.3	32 (81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	88	X	14.2	x		0.45	x	0.67	_ =	5.2	2 (81)
Northwest <sub>0.9x</sub>	0.77	X	0.8	8	X	9.21	x		0.45	x	0.67		3.3	9 (81)
Solar gains in	watts, calc	culated	for each	n montr	1		(83)	m = Sur	m(74)m	.( <mark>8</mark> 2)m				
(83)m= 174.33	308.38	459.97	646.18	802.43	8	33.64 788	3.13 66	4.31	522.47	350.34	210.7	148.06		(83)
Tota <mark>l gain</mark> s – i	nternal and	d solar	(84)m =	= (73)m	+ (8	33)m , wa	tts						_	
(0.4) = 002.05	933.8 1	064 32	1215 78	1335.33	13	32.26 126	5 15 11	18.08 1	1024.67	887.52	788.18	<b>75</b> 7.12		(84)
(84)m= 802.05	355.0	004.52	1210.70				9.15	10.00	1024.07	007.52	7 00.10	707.12		(0.)
` /	_					.20	9.13 111	10.00	1024.07	007.02	700.10	737.12		(6.1)
7. Mean inter	nal tempe	rature (	(heating	seasor	1)					007.32	700.10	737.12	21	
7. Mean inter Temperature	nal tempel during hea	rature ( ating p	heating eriods in	seasor	n) ing	area from	Table			007.32	766.10	707.12		
7. Mean inter	nal tempel during hea	rature ( ating p	heating eriods in	seasor	n) ing n (s	area from	Table (	), Th1	(°C)	Oct	Nov	_	21	
7. Mean inter Temperature Utilisation fac	nal tempe during hea	rature ( ating pe	heating eriods in	seasor the livi ea, h1,n	n) ing n (s	area from ee Table 9 Jun J	Table (					Dec	21	
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1	nal tempe during hea ctor for gain Feb	rature ( ating po ns for li Mar	heating eriods in ving are Apr 0.99	season the livi ea, h1,n May	ing n (s	area from ee Table 9 Jun Ju 0.84 0.6	Table 9a) ul /	O, Th1	(°C) Sep 0.95	Oct	Nov	Dec	21	(85)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna	nal tempe during hea tor for gain Feb 1	rature ( ating poins for li Mar 1	heating eriods in ving are Apr 0.99	season the living ea, h1,n May 0.96	ing n (s	area from ee Table 9 Jun Jun 30.84 0.6 w steps 3	Table 9a) ul / 67 0 to 7 in	O, Th1	(°C) Sep 0.95 9c)	Oct	Nov	Dec	21	(85)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna  (87)m= 20.06	nal tempe during hea etor for gain Feb 1 1 temperat 20.15	ating points for line Mar 1 ure in 1 20.31	heating are Apr 0.99 iving are 20.53	season the livi ea, h1,n May 0.96 ea T1 (f	n) ing n (s	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20.	Table 9 9a) ul	Aug 75 Table 9.94	(°C) Sep 0.95 9c) 20.82	Oct 1	Nov 1	Dec	21	(85)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna (87)m= 20.06  Temperature	nal tempe during hea stor for gain Feb 1 I temperat 20.15	rature ( ating points for li Mar  1  ure in l 20.31  ating points	heating eriods in Apr 0.99 iving are 20.53 eriods in	seasor the living the hand the	n (s	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20.9	Table 99a) ul	Aug 75 Table 9, Th2	(°C)  Sep 0.95  9c) 20.82 2 (°C)	Oct 1 20.54	Nov 1	Dec 1 20.06	21	(86)
7. Mean inter Temperature Utilisation fac  Jan (86)m= 1  Mean interna (87)m= 20.06  Temperature (88)m= 20.13	real temperate during heat temperate 20.15 during heat 20.13	rature ( ating points for li Mar  1 ure in l 20.31 ating points 20.13	heating eriods in 0.99 iving are 20.53 eriods in 20.15	season the living the hand the	ing (sollo	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20.	Table (9a)  ul	Aug 75 Table 9, Th2	(°C) Sep 0.95 9c) 20.82	Oct 1	Nov 1	Dec	21	(85)
7. Mean inter Temperature Utilisation fact  Jan (86)m= 1  Mean interna (87)m= 20.06  Temperature (88)m= 20.13  Utilisation fact	tor for gain Feb 1 I temperat 20.15 during hea 20.13	ating points for line Mar 1 20.31 ating points for responding to the second sec	heating are Apr 0.99 iving are 20.53 eriods in 20.15 est of dv	season the living, have a, h1,n May 0.96 ea T1 (for 20.75) or rest of 20.15 welling,	follo h2,	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20.6 relling from 0.16 20.6 m (see Ta	Table 99a) ul	75 Table 9, Th2	(°C)  Sep 0.95  9c) 20.82 2 (°C) 20.16	Oct 1 20.54 20.15	Nov 1 20.27	Dec 1 20.06 20.14	21	(85) (86) (87) (88)
7. Mean inter Temperature Utilisation fac  Jan (86)m= 1  Mean interna (87)m= 20.06  Temperature (88)m= 20.13	real temperate during heat temperate 20.15 during heat 20.13	rature ( ating points for li Mar  1 ure in l 20.31 ating points 20.13	heating eriods in 0.99 iving are 20.53 eriods in 20.15	season the living the hand the	follo h2,	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20.	Table 99a) ul	Aug 75 Table 9, Th2	(°C)  Sep 0.95  9c) 20.82 2 (°C)	Oct 1 20.54	Nov 1	Dec 1 20.06	21	(86)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna  (87)m= 20.06  Temperature  (88)m= 20.13  Utilisation fac  (89)m= 1  Mean interna	real temperate during heat temperate 20.15 during heat 20.13 eter for gain	ating points for line Mar 1 20.31 ating points for ring 1 1 20.13 are for ring 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	cheating are Apr 0.99 iving are 20.53 eriods in 20.15 est of do	season the living the	h2,	area from ee Table 9 Jun Ju 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20. m (see Ta 0.77 0.6	Table 9 9a) ul  / 67	75 Table 9, Th2	(°C)  Sep 0.95  9c) 20.82 2 (°C) 20.16	Oct 1 20.54 20.15	Nov 1 20.27	Dec 1 20.06 20.14	21	(85) (86) (87) (88) (89)
7. Mean inter Temperature Utilisation fact  Jan  (86)m= 1  Mean interna  (87)m= 20.06  Temperature  (88)m= 20.13  Utilisation fact  (89)m= 1	real temper during heat temperate 20.15 during heat 20.13 etor for gain 1 temperate 1 temp	ating points for line Mar 1 20.31 ating points for ring 1 1 20.13 are for ring 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	cheating are Apr 0.99 iving are 20.53 eriods in 20.15 est of do	season the living the	h2,	area from ee Table 9 Jun Ju 0.84 0.6 w steps 3 20.9 20. eelling from 0.16 20. m (see Ta 0.77 0.6	Table (9a)  ul	75 Table 9, Th2	(°C)  Sep 0.95  9c) 20.82 2 (°C) 20.16  0.92 in Table 19.95	Oct 1 20.54 20.15 1 29c) 19.57	Nov 1 20.27 20.14	Dec 1 20.06 20.14 1 18.84	21	(85) (86) (87) (88) (89) (90)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna (87)m= 20.06  Temperature (88)m= 20.13  Utilisation fac (89)m= 1  Mean interna	real temper during heat temperate 20.15 during heat 20.13 etor for gain 1 temperate 1 temp	rature ( ating points for li Mar  1 ure in l 20.31 ating points 20.13 ns for r 1 ure in t	heating eriods in 0.99 iving are 20.53 eriods in 20.15 est of do 0.99 he rest	season the living the things of the things of the living season to the l	h2,	area from ee Table 9 Jun Ju 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20. m (see Ta 0.77 0.6	Table (9a)  ul	Aug 75 Table 9, Th2 9, Th2 64	(°C)  Sep 0.95  9c) 20.82 2 (°C) 20.16  0.92 in Table 19.95	Oct 1 20.54 20.15 1 29c) 19.57	Nov 1 20.27 20.14	Dec 1 20.06 20.14 1 18.84	21	(85) (86) (87) (88) (89)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna (87)m= 20.06  Temperature (88)m= 20.13  Utilisation fac (89)m= 1  Mean interna	tor for gain feb 1 1 1 temperat 20.15 20.13 etor for gain 1 1 temperat 18.98	ating points for line ating points for record ating points for record at 19.21	heating are Apr 0.99 iving are 20.53 eriods in 20.15 est of dv 0.99 he rest of 19.55	season the living the living the living the living of the living t	n) ing ing in (s ing) ing	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20. m (see Ta 0.77 0.6 T2 (follow 0.05 20.	Table 9a) ul	9, Th1 Aug 75 Table 9, Th2 0.16 64 3 to 7	(°C)  Sep 0.95  9c) 20.82  2 (°C) 20.16  0.92  in Table 19.95	Oct 1 20.54 20.15 1 29c) 19.57	Nov 1 20.27 20.14	Dec 1 20.06 20.14 1 18.84		(85) (86) (87) (88) (89) (90)
7. Mean inter Temperature Utilisation fact Jan (86)m= 1  Mean interna (87)m= 20.06  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean interna (90)m= 18.85	report of the period of the pe	ating points for line ating points for record ating points for record at 19.21	heating are Apr 0.99 iving are 20.53 eriods in 20.15 est of dv 0.99 he rest of 19.55	season the living the	h2,	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20. m (see Ta 0.77 0.6 T2 (follow 0.05 20.	Table 9 9a) ul  / 67	9, Th1 Aug 75 Table 9, Th2 0.16 64 3 to 7	(°C)  Sep 0.95  9c) 20.82  2 (°C) 20.16  0.92  in Table 19.95	Oct 1 20.54 20.15 1 29c) 19.57	Nov 1 20.27 20.14	Dec 1 20.06 20.14 1 18.84		(85) (86) (87) (88) (89) (90)
7. Mean interrection for Temperature  Utilisation factors  Jan  (86)m= 1  Mean internation factors  (87)m= 20.06  Temperature (88)m= 20.13  Utilisation factors (89)m= 1  Mean internation factors (90)m= 18.85	temperat 20.15 during heat 20.15 during heat 20.13 etor for gain 1 ltemperat 18.98 ltemperat 19.15	ating points for line ating points for received at 19.21 ating points for received ating points for received at 19.21 ating points for received ating points for received at 19.21 ating points for received at 19.21 ating points for received ating points for received at 19.21 ating points for received at 19.21 ating points for received at 19.21 ating points for received ating points f	heating are Apr 0.99 iving are 20.53 eriods in 20.15 est of dv 0.99 he rest of 19.55 er the wholes in 19.69	season the living the living the living the living of the	n) ing ing follo  follo  follo  general descriptions  h2,  h2,  belling  2	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20. m (see Ta 0.77 0.6 T2 (follow 0.05 20. g) = fLA × 0.18 20.	Table 9 9a) ul	9, Th1 Table 9, Th2 9, Th2 10,16 64 3 to 7 10,09	(°C)  Sep 0.95  9c) 20.82  2 (°C) 20.16  0.92  in Table 19.95  ft A) × T2 20.08	Oct 1 20.54 20.15 1 9c) 19.57 A = Liv	Nov 1 20.27 20.14 1 19.16 ng area ÷ (4	Dec 1 20.06 20.14 1 18.84		(85) (86) (87) (88) (89) (90) 5 (91)
7. Mean interrection factors (86)m= 1  Mean internal (87)m= 20.06  Temperature (88)m= 20.13  Utilisation factors (89)m= 1  Mean internal (90)m= 18.85  Mean internal (92)m= 19.03	real temper during heat temperate 20.15 during heat 20.13 etor for gain 1 l temperate 18.98 l temperate 19.15 ment to the	ating points for line ating points for received at 19.21 ating points for received ating points for received at 19.21 ating points for received ating points for received at 19.21 ating points for received at 19.21 ating points for received ating points for received at 19.21 ating points for received at 19.21 ating points for received at 19.21 ating points for received ating points f	heating are Apr 0.99 iving are 20.53 eriods in 20.15 est of dv 0.99 he rest of 19.55 er the wholes in 19.69	season the living the living the living the living of the	h2, (selling 2	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. relling from 0.16 20. m (see Ta 0.77 0.6 T2 (follow 0.05 20. g) = fLA × 0.18 20.	Table 9 9a) ul  / 67	9, Th1 Table 9, Th2 9, Th2 10,16 64 3 to 7 10,09	(°C)  Sep 0.95  9c) 20.82  2 (°C) 20.16  0.92  in Table 19.95  ft A) × T2 20.08	Oct 1 20.54 20.15 1 9c) 19.57 A = Liv	Nov 1 20.27 20.14 1 19.16 ng area ÷ (4	Dec 1 20.06 20.14 1 18.84		(85) (86) (87) (88) (89) (90) 5 (91)
7. Mean interrection for Temperature Utilisation factors  Wean internation (86)m= 1  Mean internation factors  (88)m= 20.06  Temperature (88)m= 20.13  Utilisation factors (89)m= 1  Mean internation factors (90)m= 18.85  Mean internation factors (92)m= 19.03  Apply adjustr	during heater for gain Feb 1 1 1 1 temperat 20.15 20.13 2 tor for gain 1 1 temperat 18.98 1 temperat 19.15 ment to the 19	ating points for line ating points for received at the second sec	heating eriods in ving are 20.53 eriods in 20.15 est of du 19.55 er the whom 19.69 internal	season the living a, h1,m May 0.96 ea T1 (f 20.75 n rest of 20.15 welling, 0.94 of dwell 19.86	h2, (selling 2	area from  ee Table 9  Jun Jun  0.84 0.6  w steps 3  20.9 20.0  elling from  0.16 20.0  m (see Ta  0.77 0.6  T2 (follow  0.05 20.0  g) = fLA ×  0.18 20.0  re from Ta	Table 9 9a) ul  / 67	9, Th1  75  Table 9, Th2 9, Th2 16  3 to 7	(°C)  Sep 0.95  9c) 20.82  2 (°C) 20.16  0.92  in Table 19.95  ft A) x T2 20.08 e appro	Oct 1 20.54 20.15 1 29c) 19.57 A = Livi	Nov 1 20.27 20.14 1 19.16 ng area ÷ (4	Dec 1 20.06 20.14 1 18.84 4) =		(85) (86) (87) (88) (89) (90) 5 (91)
7. Mean internal (86)m= 1  Mean internal (87)m= 20.06  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85  Mean internal (92)m= 19.03  Apply adjustre (93)m= 18.88	real temper during heat tor for gain and temperat 20.15 during heat 20.13 etor for gain 1 l temperat 18.98 l temperat 19.15 ment to the 19 tring requiremean inter	mature (ating points for it is in the content of th	heating are Apr 0.99 iving are 20.53 eriods in 20.15 est of dv 0.99 he rest of 19.55 er the whole 19.69 internal 19.54	season the living the living a, h1,n May 0.96 ea T1 (ff 20.75 for rest of 20.15 for welling, 0.94 for dwelling, 0.94 for dwelling, 19.86 for dwell	h2, (selling 2	area from ee Table 9 Jun Jun 0.84 0.6 w steps 3 20.9 20. elling from 0.16 20. m (see Ta 0.77 0.6 T2 (follow 0.05 20. g) = fLA × 0.18 20. re from Ta 0.03 20.	Table 9 9a) ul  / 67	9, Th1  Aug  75  Table  9, Th2  9, Th2  164  3 to 7  1.09  — fLA  1.21  where	(°C)  Sep 0.95  9c) 20.82  2 (°C) 20.16  0.92  in Table 19.95  fL  A) × T2 20.08  e appro 19.93	Oct 1 20.54 20.15 1 29c) 19.57 A = Livi 19.71 priate 19.56	Nov 1 20.27 20.14 1 19.16 ng area ÷ (4 19.32	Dec 1 20.06 20.14 1 18.84 1) =	0.1	(85) (86) (87) (88) (89) (90) 5 (91)

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

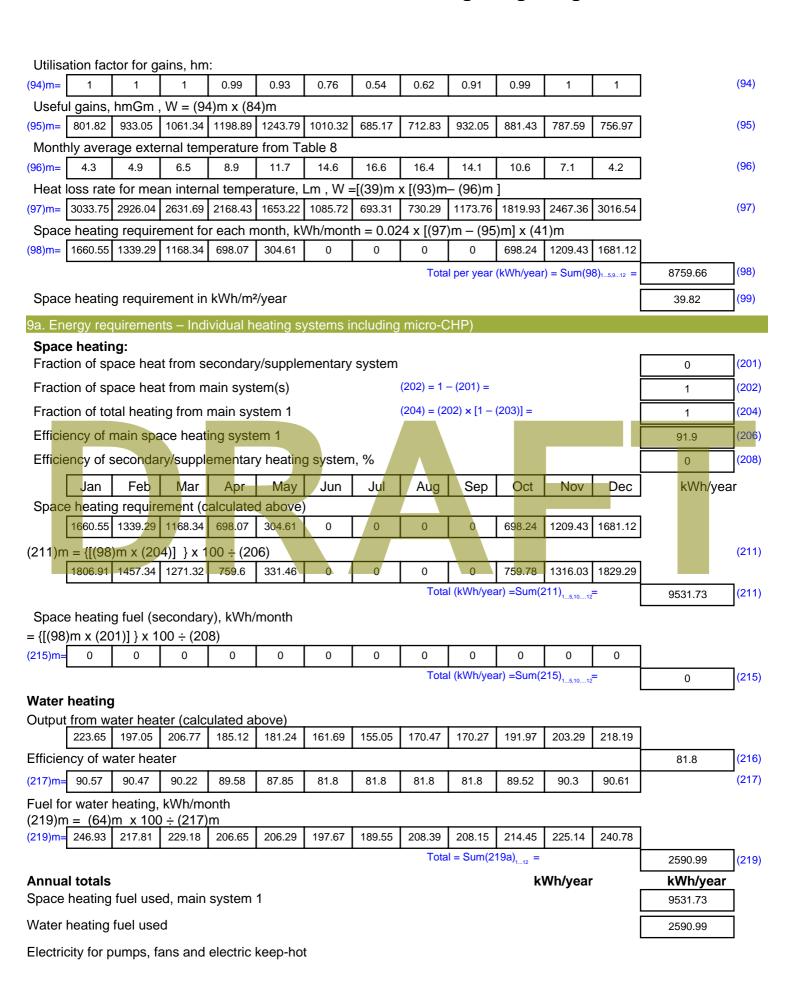
Dec

Mar

Jan

Feb







mechanical ventilation - balanced, extract or positive input from outside 679.39 (230a) central heating pump: (230c)30 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 709.39 (232) Electricity for lighting 616.65 12a. CO2 emissions - Individual heating systems including micro-CHP **Emission factor Emissions** Energy kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261) 0.216 2058.85 Space heating (secondary) (215) x (263)0.519 (219) x Water heating (264)0.216 559.65 (261) + (262) + (263) + (264) =Space and water heating (265)2618.51 (231) x Electricity for pumps, fans and electric keep-hot (267)0.519 368.17 (232) x Electricity for lighting 0.519 320.04 (268)sum of (265)...(271) = Total CO2, kg/year 3306.72 (272)**Dwelling CO2 Emission Rate**  $(272) \div (4) =$ (273) 15.03 El rating (section 14) (274)83



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 10 - 1B2P - MF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.7 (2a) =(3a) 53 143.1 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)53 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =143.1 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18



Adjusted infiltr	ration rate	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	]	
Calculate effe		•	rate for t	he appli	cable ca	ise						-	
If mechanic			o dia N. 70	10l-) (00-		(' /I	\(\f\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		) (00-)			0.5	(23a)
If exhaust air h		0		, ,	,	. `	,, .	,	) = (23a)			0.5	(23b)
If balanced wit		•	•	ŭ		,		,				73.1	(23c)
a) If balance	_	ı —		<b>.</b>		<del>- ` ` </del>	<del>- ^ `</del>	ŕ	<del></del>	<del>`                                    </del>	<del>- ` '</del>	) ÷ 100] 1	(0.4-)
(24a)m= 0.3	0.29	0.29	0.27	0.27	0.26	0.26	0.25	0.26	0.27	0.28	0.28	]	(24a)
b) If balance	1	ı —		ı —		<del>,                                    </del>	<del>- ´ `                                  </del>	ŕ	<del>,                                    </del>	<del>' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' </del>	1 .	1	(O.4F.)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole h if (22b)r	nouse ext m < 0.5 ×			•	•				.5 × (23k	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
d) If natural	ventilation	on or wh	ole hous	e positiv	ve input	ventilation	on from	oft	!	!	ļ.	J	
,	m = 1, the			•					0.5]			_	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	r change	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.3	0.29	0.29	0.27	0.27	0.26	0.26	0.25	0.26	0.27	0.28	0.28		(25)
3. Heat losse	es and he	eat loss	paramete	er:						_	_		_
ELEMENT	Gros area	SS	Openin	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-		A X k kJ/K
Windows Type		(111)			1.68		/[1/( 1.1 )+		1.77	,	110/111	,	(27)
Windows Type					1.00		,	7	1.77				( )
11	~ <b>_</b>				1 68	v1	/[1/( 1.1 )+	0.041 -	1 77				(27)
Windows Type	A 3				1.68	<del>-</del> <b>-</b> 7.	/[1/( 1.1 )+ /[1/( 1 1 )+		1.77				(27)
Windows Type					6.66	x1	/[1/( 1.1 )+	0.04] =	7.02				(27)
Windows Type	e 4				3.36	x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+	0.04] =	7.02				(27) (27)
Windows Type	e 4 e 5				6.66 3.36 2.6	x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] =	7.02 3.54 2.74				(27) (27) (27)
Windows Type Windows Type Walls Type1	e 4	55	15.96	8	3.36	x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] =	7.02				(27) (27) (27) (29)
Windows Type Windows Type Walls Type1 Walls Type2	e 4 e 5 47.5 3.78	8	15.90	8	6.66 3.36 2.6	x1 x1 x1 7 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04] = 0.04] =	7.02 3.54 2.74				(27) (27) (27)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.55	x1 x1 x1 7 x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] =	7.02 3.54 2.74 3.79				(27) (27) (27) (29)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.57 3.78	x1 x1 x1 7 x x x 3	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] =	7.02 3.54 2.74 3.79				(27) (27) (27) (29) (29)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.57 3.78 51.33	x1 x1 x1 7 x x x 3 x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = 0.04] = 0.04] = = = = =	7.02 3.54 2.74 3.79 0.53				(27) (27) (27) (29) (29) (31) (32)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.57 3.78 51.33 39.56	x1 x1 x1 x x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = 0.04] = 0.04] = = = = =	7.02 3.54 2.74 3.79 0.53				(27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor	e 4 e 5 47.5 3.78 elements	B, m²	0	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calcul	x1 x1 x1 x x x x x x x x x x x 3 3 3 3	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] = = = = = =	7.02 3.54 2.74 3.79 0.53	as given in	paragrapl	h 3.2	(27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and	e 4 e 5 47.5 3.78 elements d roof winders on both	, m²	0 effective winternal wall	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calcul	x1 x1 x1 x x x x x x x x x x x 3 3 3 3	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53	as given in	paragrapl	1	(27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are	e 4 e 5  47.5  3.78 elements  d roof windows on both ss, W/K =	sows, use esides of ir	0 effective winternal wall	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calcul	x1 x1 x1 x x x x x x x x x x x 3 3 3 3	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	as given in (2) + (32a).			(27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat los	e 4 e 5  47.5  3.78 elements  d roof winders on both ss, W/K = Cm = S(	ows, use esides of in S (A x k)	0 effective wi nternal wall	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calculatitions	x1 x1 x1 x1 x x1 x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12 0.14	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a).		21.16	(27) (27) (27) (29) (29) (31) (32) (32a) (32b)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat los Heat capacity	e 4 e 5  47.5  3.78 elements  d roof winders on both ss, W/K = Cm = S( s parame	ows, use esides of ir = S (A x k) ter (TMF)	offective winternal walk U)  P = Cm : tails of the	indow U-va Is and pan	6.66  3.36  2.6  31.5;  3.78  51.3;  39.56  53.9;  53.9;  h kJ/m²K	x1 x1 x1 x1 x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a). :: Medium	(32e) =	21.16	(27) (27) (27) (29) (31) (32) (32a) (32b)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat look Heat capacity Thermal mass For design assess	e 4 e 5  47.5  3.78 elements  d roof winder as on both ss, W/K = Cm = S( s parame as ments where ad of a determine a determine where ad of a determine	ows, use esides of interest (TMF) ere the detailed calculary	offective winternal walk  U)  P = Cm -  tails of the ulation.	indow U-va ls and pan - TFA) ir construct	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  alue calculatitions  n kJ/m²K	x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a). :: Medium	(32e) =	21.16	(27) (27) (27) (29) (29) (31) (32) (32a) (32b)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat los Heat capacity Thermal mass For design asses can be used inste	e 4 e 5  47.5  3.78 elements  d roof winder as on both ss, W/K = Cm = S( es parame essments where ad of a determine the set of a determine the determine the set of a determine the set of a determine the set	ows, use esides of ir = S (A x k) ter (TMF) ere the detailed calco	offective winternal walk  O  = Cm ÷ tails of the ulation. culated to	Tridow U-ve ls and pan TFA) ir construct using Ap	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calculatitions  h kJ/m²K	x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a). :: Medium	(32e) =	21.16 8029.37 250	(27) (27) (29) (29) (31) (32) (32a) (32b) (33) (34) (35)



Vantilation boo	et loop or	aloulotod	l monthly	,				(28)m	_ 0 22 % /	(25)m v (5)			
Ventilation hea	Feb	Mar			Jun	Jul	Aug	Sep	Oct	(25)m x (5) Nov	Dec		
(38)m= 14.03	13.88	13.73	Apr 12.97	May 12.82	12.07	12.07	Aug 11.92	12.37	12.82	13.13	13.43		(38)
Heat transfer of			12.01	12.02	12.01	12.01	11.02		= (37) + (	<u> </u>	10.10		(==)
(39)m= 42.89	42.74	42.59	41.83	41.68	40.93	40.93	40.78	41.23	41.68	41.98	42.29		
(39)111= 42.09	42.74	42.09	41.00	41.00	40.93	40.93	40.76			Sum(39) <sub>1</sub>	<u> </u>	41.8	(39)
Heat loss para	meter (H	HLP), W/	m²K						= (39)m ÷				(::/
(40)m= 0.81	0.81	0.8	0.79	0.79	0.77	0.77	0.77	0.78	0.79	0.79	0.8		
Number of day	s in moi	nth (Tab	le 1a)						Average =	Sum(40) <sub>1</sub>	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. Water heat	ting ener	rgy requi	rement:								kWh/ye	ear:	
Assumed occu	ıpancv. I	N								1	78		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	A -13.9	)2)] + 0.0	0013 x (	ΓFA -13.				( /
if TFA £ 13.9 Annual average	•	otor upoc	no in litro	o por de	,, \/d o,,	orogo –	(25 v NI)	. 26				1	(40)
Reduce the annua									se target o		5.44		(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 T	Table 1 <mark>c x</mark>	(43)						
(44)m= 84.08	81.03	77.97	74.91	71.85	68.8	68.8	71.85	74.91	77.97	81.03	84.08		
Ener <mark>gy cont</mark> ent of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	917.29	(44)
(45)m= 124.7	109.06	112.54	98.11	94.14	81.24	75.28	86.38	87.42	101.88	111.2	120.76		
			. ,						Total = Su	m(45) <sub>112</sub> =	-	1202.71	(45)
If instantaneous w		·	,		· · ·	1	, ,	, ,	î	i	1	l	
(46)m= 18.7 Water storage	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.11		(46)
Storage volum		includin	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	` ,		•			•					100		( )
Otherwise if no Water storage	stored			•			` '	ers) ente	er '0' in (	(47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/day):				0.	99		(48)
Temperature fa					,	• ,					54		(49)
Energy lost fro				ear			(48) x (49)	) =			53		(50)
b) If manufact	urer's de	eclared o	ylinder l	oss fact									, ,
Hot water stora	-			e 2 (kW	h/litre/da	ıy)					0		(51)
If community h Volume factor	•		on 4.3								1	1	(50)
Temperature fa			2h								0		(52) (53)
·				oor			(47) x (51)	v (52) v (	53) -				
Energy lost fro Enter (50) or (		-	, KVVII/YE	zai			( <del>+1)</del> X (31,	, A (JZ) X (	00 <i>)</i> =		0 53		(54) (55)
Water storage	, , ,	,	or each	month			((56)m = (	55) × (41):	m				(30)
(56)m= 16.57	14.97	16.57	16.04	16.57	16.04	16.57	16.57	16.04	16.57	16.04	16.57		(56)
(00)	,	. 0.07	.0.04	1 .0.07	1 .0.04	1 .0.07	1 . 0.07	1 .0.0-	1 .0.07	1 .0.0-			(-3)



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= 16.57 14.97 16.57 16.04 16.57 16.04 16.57 16.04 16.57 16.04 16.57 16.04 16.57	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m	n
(62)m= 164.53 145.04 152.37 136.66 133.98 119.79 115.11 126.22 125.97 141.71 149.75 160.6	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 164.53 145.04 152.37 136.66 133.98 119.79 115.11 126.22 125.97 141.71 149.75 160.6	_
Output from water heater (annual) <sub>112</sub> 1671.74	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m ]	
(65)m= 73.33 65.05 69.29 63.46 63.17 57.85 56.9 60.59 59.91 65.74 67.82 72.02	(65)
in <mark>clude</mark> (57)m in c <mark>alcula</mark> tion of (65)m only i <mark>f cylin</mark> der is in the dwelling or hot water is from community heating	
E Internal gains (and Table F and Fa)	
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Metabolic gains (Table 5), Watts	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>(66) (67)</td>	(66) (67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	, ,
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>, ,</td>	, ,
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67) (68)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93       11.42       13.32       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       <	(67) (68)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>(67) (68) (69)</td>	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93       11.42       13.32       14.2       14.2       14.2       14.2       13.32       14.2       14.2       14.2       14.2       15.05	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93       11.42       13.32       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       <	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         11.42         13.32         14.2         14.2         14.2         15.02         15.02	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         14.2         14.2         14.2         14.2	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67) (68) (69) (70) (71)

Flux

Table 6a Table 6b Table 6c

Orientation: Access Factor Area Table 6d m²

Gains

(W)

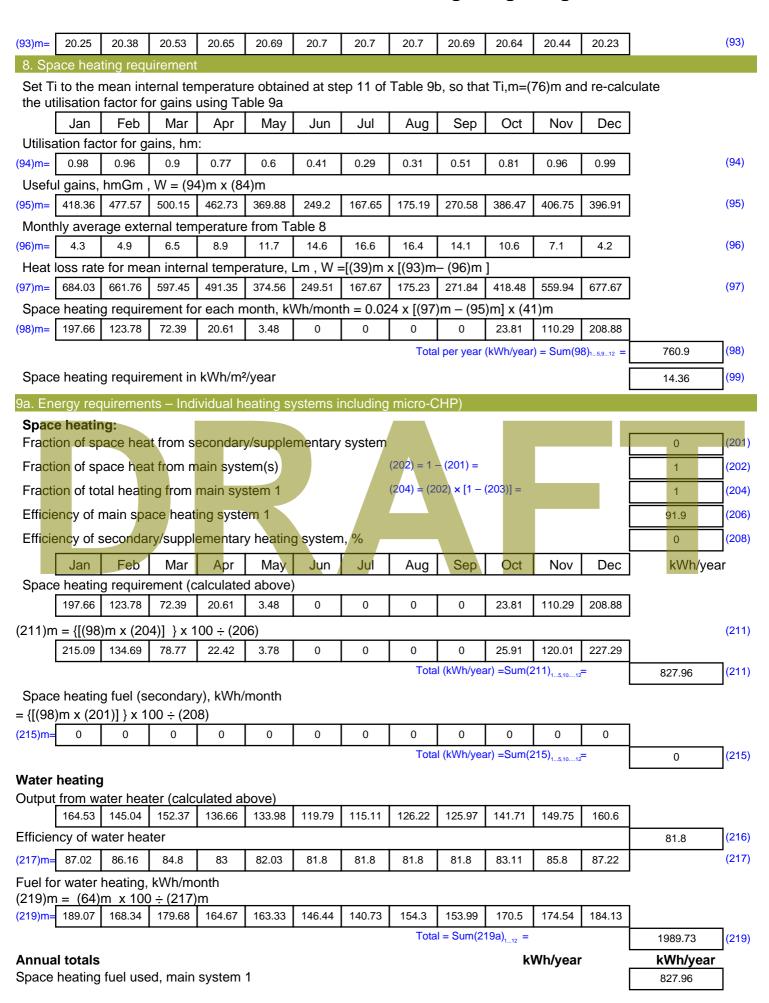


Southeast 0.9x	0.54	X	6.66	x	36.79	x	0.45	X	0.67	=	35.91	(77)
Southeast 0.9x	0.77	X	2.6	x	36.79	x	0.45	x	0.67	=	19.99	(77)
Southeast 0.9x	0.54	X	6.66	X	62.67	x	0.45	x	0.67	=	61.16	(77)
Southeast 0.9x	0.77	X	2.6	x	62.67	X	0.45	x	0.67	=	34.05	(77)
Southeast 0.9x	0.54	X	6.66	x	85.75	x	0.45	x	0.67	=	83.68	(77)
Southeast 0.9x	0.77	X	2.6	x	85.75	x	0.45	x	0.67	=	46.58	(77)
Southeast 0.9x	0.54	X	6.66	x	106.25	x	0.45	X	0.67	=	103.69	(77)
Southeast 0.9x	0.77	X	2.6	x	106.25	x	0.45	X	0.67	=	57.72	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	x	119.01	x	0.45	X	0.67	=	116.14	(77)
Southeast 0.9x	0.77	X	2.6	x	119.01	x	0.45	x	0.67	=	64.65	(77)
Southeast 0.9x	0.54	X	6.66	x	118.15	x	0.45	X	0.67	=	115.3	(77)
Southeast <sub>0.9x</sub>	0.77	X	2.6	x	118.15	x	0.45	X	0.67	=	64.18	(77)
Southeast 0.9x	0.54	X	6.66	x	113.91	x	0.45	x	0.67	=	111.16	(77)
Southeast <sub>0.9x</sub>	0.77	X	2.6	x	113.91	x	0.45	X	0.67	=	61.88	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	x	104.39	x	0.45	X	0.67	=	101.87	(77)
Southeast 0.9x	0.77	X	2.6	x	104.39	x	0.45	x	0.67	=	56.71	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	x	92.85	x	0.45	X	0.67	=	90.61	(77)
Southeast 0.9x	0.77	X	2.6	X	92.85	X	0.45	X	0.67	=	50.44	(77)
Southeast 0.9x	0.54	x	6.66	х	69.27	] x	0.45	X	0.67	=	67.6	(77)
Southeast 0.9x	0.77	] x	2.6	x	69.27		0.45	x	0.67	=	37.63	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	X	44.07	x	0.45	x	0.67	] =	43.01	(77)
Southeast 0.9x	0.77	] x	2.6	x	44.07	Х	0.45	x	0.67	=	23.94	(77)
Southeast 0.9x	0.54	] x	6.66	x	31.49	X	0.45	x	0.67	=	30.73	(77)
Southeast <sub>0.9x</sub>	0.77	X	2.6	х	31.49	X	0.45	x	0.67	=	17.11	(77)
South 0.9x	0.77	X	1.68	x	46.75	x	0.45	X	0.67	=	16.41	(78)
South 0.9x	0.77	X	1.68	X	76.57	x	0.45	X	0.67	=	26.88	(78)
South 0.9x	0.77	X	1.68	X	97.53	X	0.45	x	0.67	] =	34.24	(78)
South 0.9x	0.77	X	1.68	X	110.23	x	0.45	X	0.67	=	38.69	(78)
South 0.9x	0.77	X	1.68	X	114.87	X	0.45	X	0.67	=	40.32	(78)
South 0.9x	0.77	X	1.68	X	110.55	X	0.45	X	0.67	=	38.8	(78)
South 0.9x	0.77	X	1.68	X	108.01	X	0.45	X	0.67	=	37.91	(78)
South 0.9x	0.77	X	1.68	X	104.89	X	0.45	X	0.67	=	36.82	(78)
South 0.9x	0.77	X	1.68	X	101.89	X	0.45	X	0.67	=	35.76	(78)
South 0.9x	0.77	X	1.68	X	82.59	x	0.45	x	0.67	=	28.99	(78)
South 0.9x	0.77	x	1.68	x	55.42	x	0.45	x	0.67	=	19.45	(78)
South 0.9x	0.77	X	1.68	x	40.4	x	0.45	x	0.67	=	14.18	(78)
Southwest <sub>0.9x</sub>	0.77	x	3.36	x	36.79	]	0.45	x	0.67	=	25.83	(79)
Southwest <sub>0.9x</sub>	0.77	×	3.36	x	62.67	]	0.45	x	0.67	] =	44	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.36	x	85.75	]	0.45	x	0.67	] =	60.2	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.36	x	106.25	]	0.45	x	0.67	] =	74.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.36	X	119.01		0.45	X	0.67	=	83.55	(79)

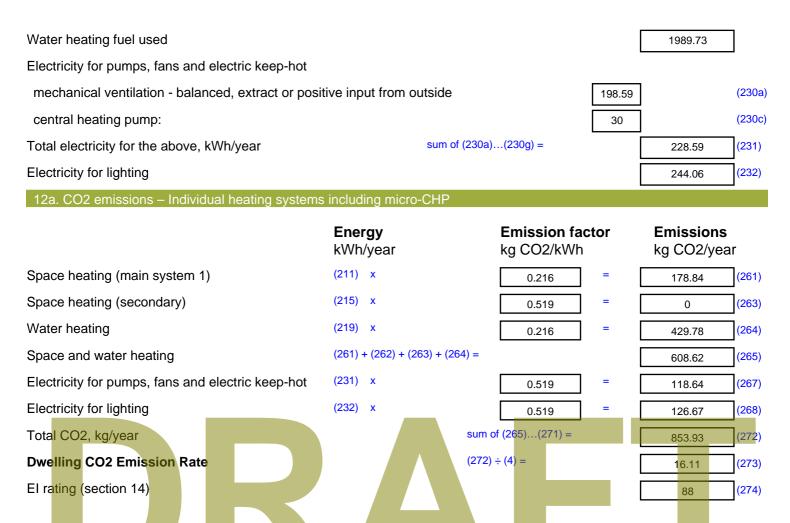


Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	1′	18.15	]	0.45	X	0.67	=	82.95	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	11	13.91	]	0.45	x	0.67	=	79.97	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	X	10	04.39		0.45	X	0.67	=	73.29	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	9	2.85		0.45	X	0.67	=	65.19	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	6	9.27		0.45	X	0.67	=	48.63	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	4	4.07		0.45	X	0.67	=	30.94	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	X	3	1.49		0.45	X	0.67	=	22.11	(79)
West 0.9x	0.77	X	1.6	8	X	1	9.64	X	0.45	X	0.67	=	6.89	(80)
West 0.9x	0.77	X	1.6	8	X	3	8.42	X	0.45	X	0.67	=	13.49	(80)
West 0.9x	0.77	X	1.6	8	X	6	3.27	X	0.45	X	0.67	=	22.21	(80)
West 0.9x	0.77	X	1.6	8	X	9	2.28	X	0.45	X	0.67	=	32.39	(80)
West 0.9x	0.77	X	1.6	8	X	11	13.09	X	0.45	X	0.67	=	39.7	(80)
West 0.9x	0.77	X	1.6	8	X	1′	15.77	X	0.45	X	0.67	=	40.64	(80)
West 0.9x	0.77	X	1.6	8	X	11	10.22	X	0.45	X	0.67	=	38.69	(80)
West 0.9x	0.77	X	1.6	8	X	9	4.68	X	0.45	X	0.67	=	33.23	(80)
West 0.9x	0.77	X	1.6	8	x	7	3.59	X	0.45	X	0.67	=	25.83	(80)
West 0.9x	0.77	X	1.6	8	X	4	5.59	X	0.45	X	0.67	=	16	(80)
West 0.9x	0.77	X	1.6	8	X	2	4.49	X	0.45	X	0.67	=	8.6	(80)
West 0.9x	0.77	x	1.6	8	Х	1	6.15	X	0.45	x	0.67	=	5.67	(80)
Solar gains in	watte calcu		C	- 41			/							
								(83)m	= Sum(74)m .	(82)m			7	
(83)m= 105.03	179.57 24	46.92	307.09	344.36	34	41.87	329.61	( <mark>83</mark> )m 301		(82)m 198.8	5 125.94	89.79		(83)
(83)m= 105.03 Total gains – i	179.57 24 internal and	46.92 solar	307.09 (84)m =	344.36 (73)m	3 <sup>2</sup>	33)m	329.61 watts	301	.92 267.83	198.8			]	
(83)m= 105.03	179.57 24 internal and	46.92	307.09	344.36	3 <sup>2</sup>		329.61	7	.92 267.83	. ,		89.79 401.65	]	(83) (84)
(83)m= 105.03 Total gains – i	179.57 24 internal and 497.95 55	46.92 solar 55.28	307.09 (84)m = 599.41	344.36 (73)m 620.65	+ (8 60	33)m	329.61 watts	301	.92 267.83	198.8			]	
(83)m= 105.03 Total gains – i (84)m= 425.11	179.57 24 internal and 497.95 55 rnal tempera	46.92 solar 55.28 ature (	307.09 (84)m = 599.41 (heating	344.36 (73)m 620.65 seasor	34 + (8	33)m 02.48	329.61 watts 579.89	301 557	.1 531.12	198.8			21	
(83)m= 105.03 Total gains – i (84)m= 425.11 7. Mean inter	179.57 24 internal and 497.95 55 rnal temperal during hea	solar 55.28 ature (	307.09 (84)m = 599.41 (heating eriods in	344.36 (73)m 620.65 seasor the livi	34 + (8 60 n)	33)m 02.48 area f	329.61 watts 579.89	301 557	.1 531.12	198.8			21	(84)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean inte	179.57 24 internal and 497.95 55 rnal tempera e during hea ctor for gain	solar 55.28 ature (	307.09 (84)m = 599.41 (heating eriods in Apr	344.36 (73)m 620.65 seasor the livi	34 + (8 60 n) ing (se	33)m 02.48 area f	329.61 watts 579.89	557 ole 9	92 267.83 3.1 531.12 Th1 (°C)	198.8	5 424.07		21	(84)
(83)m= 105.03 Total gains – (84)m= 425.11  7. Mean inter Temperature Utilisation face	179.57 24 internal and 497.95 55 rnal temperate during heatetor for gain Feb	solar 55.28 ature ( ting po	307.09 (84)m = 599.41 (heating eriods in twing are	344.36 (73)m 620.65 seasor the livi	34 + (8 60 n) ing (so	33)m 02.48 area f ee Ta	329.61 watts 579.89 rom Tab	557 ole 9	92 267.83 3.1 531.12 Th1 (°C)	198.85	5 424.07	401.65	21	(84)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean inte Temperature Utilisation fac	179.57 24 internal and 497.95 55 rnal tempera during hea ctor for gain Feb 0.97 0	solar solar 55.28 ature ( ting po s for li Mar	307.09 (84)m = 599.41 (heating eriods in Apr 0.79	344.36 : (73)m 620.65 seasor the living a, h1,m May 0.62	34+ (86 60 60 60 60 60 60 60 60 60 60 60 60 60	area fee Ta Jun 0.43	329.61 watts 579.89 from Tab ble 9a) Jul 0.31	301 557 ole 9 A 0.3	7.1   531.12   Th1 (°C)   Sep   4   0.53	198.85 478.35	5 424.07 Nov	401.65 Dec	21	(84)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean inte Temperature Utilisation fac  Jan (86)m= 0.99	179.57 24 Internal and 497.95 55 Internal temperate during heat actor for gain Feb 0.97 (c) Internal and temperate during heat actor for gain actor for g	solar solar 55.28 ature ( ting po s for li Mar	307.09 (84)m = 599.41 (heating eriods in Apr 0.79	344.36 : (73)m 620.65 seasor a the living a, h1,m May 0.62	34+ (8 60 1) 1) 11 11 11 11 11 11 11 11 11 11 11	area fee Ta Jun 0.43	329.61 watts 579.89 from Tab ble 9a) Jul 0.31	301 557 ole 9 A 0.3	267.83  7.1 531.12  Th1 (°C)  ug Sep  4 0.53  Table 9c)	198.85 478.35	Nov 0.97	401.65 Dec	21	(84)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean interpreture Utilisation fact  Jan (86)m= 0.99  Mean internal	179.57 24 internal and 497.95 55 rnal temperate during heat ctor for gain Feb 0.97 0 al temperatu 20.67 2	solar 55.28 ature ( ting pos s for li Mar 0.91 ure in l	307.09 (84)m = 599.41 (heating eriods in aving are 0.79 iving are 20.91	344.36 (73)m 620.65 seasor the living a, h1,m May 0.62 ea T1 (f	$3^{2}$ $+ (8 - 60)$ $+ (8 - 6$	33)m 02.48 area f ee Ta Jun 0.43 w ste	329.61 watts 579.89 rom Tak ble 9a) Jul 0.31 os 3 to 7 20.96	301 557 ole 9 A 0.3 7 in T 20.	267.83  7.1   531.12  Th1 (°C)  ug   Sep   44   0.53  Table 9c)  96   20.96	198.85 478.35 Oct 0.83	Nov 0.97	401.65  Dec 0.99	21	(84)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean interpreture Utilisation fact  Jan (86)m= 0.99  Mean internation internat	179.57 24 internal and 497.95 55 rnal temperate during hea ctor for gain Feb 0.97 0 al temperatu 20.67 2	solar 55.28 ature ( ting pos s for li Mar 0.91 ure in l	307.09 (84)m = 599.41 (heating eriods in aving are 0.79 iving are 20.91	344.36 (73)m 620.65 seasor the living a, h1,m May 0.62 ea T1 (f	34+ (8 66 66 66 66 66 66 66 66 66 66 66 66 66	33)m 02.48 area f ee Ta Jun 0.43 w ste	329.61 watts 579.89 rom Tak ble 9a) Jul 0.31 os 3 to 7 20.96	301 557 ole 9 A 0.3 7 in T 20.	7.1   531.12   Th1 (°C)   Sep   4   0.53   Table 9c)   96   20.96   20.96   20.76   20	198.85 478.35 Oct 0.83	Nov 0.97	401.65  Dec 0.99	21	(84)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean inte Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna (87)m= 20.54  Temperature (88)m= 20.25	179.57 24 internal and 497.95 55 rnal temperate during hea ctor for gain Feb 0.97 0 al temperatu 20.67 2 during hea 20.25 2	solar solar solar sting possion limits store in l 20.8 ting possion limits ting possion limits ting possion limits solar	307.09 (84)m = 599.41 (heating eriods in Apr 0.79 iving are 20.91 eriods in 20.26	344.36 (73)m 620.65 seasor the living a, h1,m May 0.62 ea T1 (f 20.95 rest of 20.27	34+ (8 60 60 60 60 60 60 60 60 60 60 60 60 60	area fee Ta Jun 0.43 w ste 0.96 relling	329.61 watts 579.89 from Tab ble 9a) Jul 0.31 os 3 to 7 20.96 from Ta	301 5557 Al 0.3 7 in T 20. able §	7.1   531.12   Th1 (°C)   Sep   4   0.53   Table 9c)   96   20.96   20.96   20.76   20	198.85 478.35 Oct 0.83	Nov 0.97	Dec 0.99	21	(84) (85) (86) (87)
(83)m= 105.03 Total gains – (84)m= 425.11  7. Mean interpreture Utilisation factors (86)m= 0.99 Mean internations (87)m= 20.54 Temperature	179.57 24 internal and 497.95 55 mal temperate during hea ctor for gain Feb 0.97 0 al temperatu 20.67 2 during hea 20.25 2 ctor for gain	solar solar solar sting possion limits store in l 20.8 ting possion limits ting possion limits ting possion limits solar	307.09 (84)m = 599.41 (heating eriods in Apr 0.79 iving are 20.91 eriods in 20.26	344.36 (73)m 620.65 seasor the living a, h1,m May 0.62 ea T1 (f 20.95 rest of 20.27	34+ (8 60 11) ing : (0 00 10 00 12 12 14 14 14 14 14 14 14 14 14 14 14 14 14	area fee Ta Jun 0.43 w ste 0.96 relling	329.61 watts 579.89 from Tab ble 9a) Jul 0.31 os 3 to 7 20.96 from Ta	301 5557 Al 0.3 7 in T 20. able §	267.83  Th1 (°C)  Ug Sep  4 0.53  Table 9c)  96 20.96  9, Th2 (°C)  28 20.27	198.85 478.35 Oct 0.83	Nov 0.97	Dec 0.99	21 ]	(84) (85) (86) (87)
(83)m = 105.03  Total gains - i (84)m = 425.11  7. Mean intermodule Temperature Utilisation fact  (86)m = 0.99  Mean intermation (87)m = 20.54  Temperature (88)m = 20.25  Utilisation fact (89)m = 0.98	internal and 497.95 55 rnal temperate during heat ctor for gain Feb 0.97 cal temperatu 20.67 2 during heat 20.25 2 ctor for gain 0.96 c	solar solar sture ( ting po s for li Mar 0.91  ure in l 20.8 ting po 0.25 s for r	307.09 (84)m = 599.41 (heating eriods in 0.79 iving are 20.91 eriods in 20.26 est of dv 0.75	344.36 (73)m 620.65 seasor the livities, h1,m May 0.62 ea T1 (ff 20.95 rest of 20.27 welling, 0.57	3-4 (8 60 60 60 60 60 60 60 60 60 60 60 60 60	area f ee Ta Jun 0.43 w ste 0.96 elling 0.28 m (se	329.61 watts 579.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26	301 5577 ble 9 0.3 ' in T 20. 9a) 0.2	267.83  Th1 (°C)  ug Sep 4 0.53  Table 9c) 96 20.96  0, Th2 (°C) 28 20.27	Oct 0.83 20.91 20.27	Nov 0.97 20.71	Dec 0.99 20.52 20.26	21	(84) (85) (86) (87) (88)
(83)m= 105.03 Total gains – (84)m= 425.11  7. Mean interpreture Utilisation fact (86)m= 0.99  Mean internation (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fact	179.57 24 internal and 497.95 55 rnal temperate during hea ctor for gain Feb 0.97 0 al temperatu 20.67 2 ctor for gain 0.96 0 al temperatu 0.96 0 al temperatu	solar solar sture ( ting po s for li Mar 0.91  ure in l 20.8 ting po 0.25 s for r	307.09 (84)m = 599.41 (heating eriods in ving are 20.79 eriods in 20.26 est of dv 0.75	344.36 (73)m 620.65 seasor the livities, h1,m May 0.62 ea T1 (ff 20.95 rest of 20.27 welling, 0.57	3-4 (8-60) ing : (so ollo ollo 22) h2, (co ollo ollo ollo ollo ollo ollo ollo	area f ee Ta Jun 0.43 w ste 0.96 elling 0.28 m (se	329.61 watts 579.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26	301 5577 ble 9 0.3 ' in T 20. 9a) 0.2	Th1 (°C)  Sep 4 0.53  Table 9c) 96 20.96  0, Th2 (°C) 28 20.27	Oct 0.83 20.91 20.27	Nov 0.97 20.71 20.26	Dec 0.99 20.52 20.26	21 ]	(84) (85) (86) (87) (88)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean interpreture Utilisation fact  Jan (86)m= 0.99  Mean internation (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fact (89)m= 0.98  Mean internation	179.57 24 internal and 497.95 55 rnal temperate during hea ctor for gain Feb 0.97 0 al temperatu 20.67 2 ctor for gain 0.96 0 al temperatu 0.96 0 al temperatu	solar solar solar sting possion of the solar solar of the	307.09 (84)m = 599.41 (heating eriods in 7.79 (heating are 20.91 eriods in 20.26 est of dw 0.75 (he rest of the re	344.36 (73)m 620.65 seasor the living a, h1,m May 0.62 ea T1 (f 20.95 rest of 20.27 welling, 0.57 of dwell	3-4 (8-60) ing : (so ollo ollo 22) h2, (co ollo ollo ollo ollo ollo ollo ollo	area fee Ta Jun 0.43 w ste 0.96 relling 0.28 m (se 0.39	329.61 watts 579.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26	301 5557 All 0.3 7 in T 20. able 9 20. 9a) 0.2	Th1 (°C)  Sep 4 0.53  Sable 9c) 96 20.96  9, Th2 (°C) 28 20.27  8 0.48  to 7 in Table 22 20.21	198.85 478.35  Oct 0.83  20.91  20.27  0.79 e 9c) 20.15	Nov 0.97 20.71 20.26	Dec 0.99 20.52 20.26 0.99	21 ]	(84) (85) (86) (87) (88) (89)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean interpretation factors  Utilisation factors (86)m= 0.99  Mean internation (87)m= 20.54  Temperature (88)m= 20.25  Utilisation factors (89)m= 0.98  Mean internation factors (90)m= 19.64	internal and 497.95 55 rnal temperate during heat ctor for gain Feb 0.97 0 al temperatu 20.67 2 ctor for gain 0.96 0 al temperatu 19.82 2	solar 55.28 ature ( ting possible size in land) attre in land)	307.09 (84)m = 599.41 (heating eriods in 20.79 iving are 20.91 eriods in 20.26 est of dv 0.75 he rest of 20.15	344.36 (73)m 620.65 seasor the livities, h1,m May 0.62 ea T1 (f 20.95 rest of 20.27 welling, 0.57 of dwell 20.2	3-4 (8 60 1) sing (1) (1) (1) (2) (2) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	area f ee Ta Jun 0.43 w ste 0.96 elling 0.28 m (se 0.39 T2 (fc	329.61 watts 579.89 from Table 9a) Jul 0.31 0.31 0.26 from Ta 20.28 e Table 0.26 ollow ste 20.22	301 5557 ble 9 0.3 7 in T 20. 9a) 0.2 eps 3	Th1 (°C)  Sep 4 0.53  Sable 9c) 96 20.96  9, Th2 (°C) 28 20.27  8 0.48  to 7 in Table 22 20.21	198.85 478.35  Oct 0.83  20.91  20.27  0.79 e 9c) 20.15	Nov 0.97 20.71 20.26 0.96	Dec 0.99 20.52 20.26 0.99		(84) (85) (86) (87) (88) (89)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean interpretature Utilisation fact  Jan (86)m= 0.99  Mean internations (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fact (89)m= 0.98  Mean internations (90)m= 19.64	179.57 24 internal and 497.95 55 rnal temperate during hea ctor for gain Feb 0.97 0 al temperatu 20.67 2 ctor for gain 0.96 0 al temperatu 19.82 2 al temperatu	solar solar solar sting possions for li mar solar sola	307.09 (84)m = 599.41 (heating eriods in Apr 0.79 iving are 20.91 eriods in 20.26 est of dv 0.75 he rest of 20.15	344.36  (73)m 620.65  seasor the livities, h1,m May 0.62 ea T1 (f 20.95 rest of 20.27 welling, 0.57 of dwell 20.2	3-4 (8 60 n) ing : (so ollo ollo per control ollo per con	area f ee Ta Jun 0.43 w ste 0.96 relling 0.28 m (se 0.39 T2 (fc 0.22	329.61 watts 579.89 rom Table 9a) Jul 0.31 os 3 to 7 20.96 from Ta 20.28 e Table 0.26 ollow ste 20.22	301 5557 A) 0.3 7 in T 20. 9a) 0.2 eps 3 20.	92   267.83 2.1   531.12 Th1 (°C) ug   Sep 4   0.53 Table 9c) 96   20.96 9, Th2 (°C) 28   20.27 8   0.48 to 7 in Table 22   20.21 f 	198.85 478.35  Oct 0.83  20.91  20.27  0.79 e 9c) 20.15  LA = Liv	Nov 0.97 20.71 20.26 0.96	Dec 0.99 20.52 20.26 0.99 19.61		(84) (85) (86) (87) (88) (89) (90) (91)
(83)m= 105.03 Total gains – i (84)m= 425.11  7. Mean interpretation factors  Utilisation factors (86)m= 0.99  Mean internation (87)m= 20.54  Temperature (88)m= 20.25  Utilisation factors (89)m= 0.98  Mean internation factors (90)m= 19.64	179.57   24	solar 55.28 ature (ting possible solution of the content of the co	307.09  (84)m = 599.41  (heating eriods in eving are 20.91  eriods in 20.26  est of dv 0.75  he rest of 20.15  r the who 20.8	344.36 (73)m 620.65 seasor the livities, h1,m May 0.62 ea T1 (ff 20.95 rest of 20.27 welling, 0.57 of dwell 20.2	32 + (8 60 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1)	area f ee Ta Jun 0.43 w ste 0.96 elling 0.28 m (se 0.39 T2 (fc 0.22	329.61 , watts 579.89  rom Table 9a)  Jul 0.31  0.31  0.5 3 to 7 20.96  from Ta 20.28  e Table 0.26  bllow ste 20.22  A × T1 20.85	301 5557 AA 0.3 7' in T 20. 9a) 0.2 eps 3 20. + (1 20.	Th1 (°C)  Sep 4 0.53  Sable 9c) 96 20.96  O, Th2 (°C) 28 20.27  8 0.48  to 7 in Table 22 20.21  f	198.85 478.35  Oct 0.83  20.91  20.27  0.79  e 9c) 20.15  LA = Liv	Nov 0.97 20.71 20.26 0.96 19.9 ving area ÷ (4	Dec 0.99 20.52 20.26 0.99		(84) (85) (86) (87) (88) (89)











User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 15 - 3B6P - MF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor (1a) x 2.7 (2a) =(3a) 169 456.3 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)169 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =456.3 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration	rate (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.16 0.1		0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effective If mechanical ver	•	rate for t	he appli	cable ca	se	-	-	-	-	-		(220)
If exhaust air heat pu		endix N. (2	23b) = (23a	a) × Fmv (e	eguation (I	N5)) . othe	rwise (23b	) = (23a)			0.5	(23a) (23b)
If balanced with heat								, (===,			74.8	(23c)
a) If balanced me	-	-	_					2b)m + (	23b) <b>x</b> [	1 – (23c)		(230)
(24a)m= 0.29 0.2		0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28	]	(24a)
b) If balanced me	chanical v	entilation	without	heat red	covery (N	иV) (24t	m = (22)	2b)m + (2	23b)	I	l	
(24b)m= 0 0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house if (22b)m < 0			•	-				5 × (23h	. <u> </u>	•	•	
(24c)m= 0 0		0	0	0	0	0	0	0	0	0		(24c)
d) If natural venti	!			<u> </u>		<u> </u>	<u> </u>					, ,
if (22b)m = 1								0.5]			_	
(24d)m = 0 0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air char	ge rate - e	nter (24a	) or (24b	o) or (24	c) or (24	d) in bo	x (25)				•	
(25)m= 0.29 0.2	9 0.28	0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28		(25)
3. Heat losses and	heat loss	paramet	er:									
	Gross rea (m²)	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-l		A X k J/K
Win <mark>dows</mark> Type 1												
				3.6	x1.	/[1/( 1.1 )+	0.04] =	3.79				(27)
Windows Type 2				3.6	_	/ <mark>[1/( 1.1 )</mark> + /[1/( 1.1 )+		3.79 2.53				(27) (27)
Windows Type 2 Windows Type 3					x1		0.04] =					
				2.4	x1 x1	/[1/( 1.1 )+	0.04] = [	2.53				(27)
Windows Type 3				2.4 9.36	x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+	[0.04] = [0.04] = [0.04] = [0.04]	2.53 9.86				(27) (27)
Windows Type 3 Windows Type 4				2.4 9.36 2.4	x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	[0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04]	2.53 9.86 2.53				(27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5				2.4 9.36 2.4 1.78	x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix}$	2.53 9.86 2.53 1.88				(27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6				2.4 9.36 2.4 1.78	x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.53 9.86 2.53 1.88 1.11				(27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8	86.43	27.6	4	2.4 9.36 2.4 1.78 1.05	x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.53 9.86 2.53 1.88 1.11				(27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1	86.43 27.27	27.6	4	2.4 9.36 2.4 1.78 1.05 1.05	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.53 9.86 2.53 1.88 1.11 1.11 3.79				(27) (27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = 0.04] = 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05				(27) (27) (27) (27) (27) (27) (27) (29)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = 0.04] = 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05				(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of elements	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7	x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86				(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of elements	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86				(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of elements Party wall Party floor	27.27  nts, m²	0 effective wi	indow U-va	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calcul	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86	as given in	paragraph		(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of element Party wall Party floor Party ceiling * for windows and roof windows and windows	27.27  nts, m²  vindows, use on the sides of i	0 effective w	indow U-va	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calcul	x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86	as given in	paragraph	7 3.2	(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of element Party wall Party floor Party ceiling * for windows and roof with include the areas on the second	27.27  nts, m²  vindows, use of the sides of	0 effective w	indow U-va	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calcul	x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{array}{c} 0.04 \\ 0.$	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86				(27) (27) (27) (27) (27) (27) (27) (29) (31) (32) (32a) (32a)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of element Party wall Party floor Party ceiling * for windows and roof windows and wind	orindows, use of its of its idea of its id	effective winternal wal	indow U-va	2.4 9.36 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calculatitions	x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{array}{c} 0.04 \\ 0.$	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86 0	2) + (32a).		40.04	(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a) (32b)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)17.05 if details of thermal bridging are not known (36) =  $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)57.09 Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)$ m x (5)Oct Feb Mar Jul Sep Dec .lan Apr May Jun Aug Nov (38)m =43.45 42.97 42.49 40.09 39.61 37.21 37.21 36.73 38.17 39.61 40.57 41.53 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =100.54 100.06 99.58 97.18 96.7 94.3 94.3 93.82 95.26 96.7 97.66 98.62 Average =  $Sum(39)_{1...12}/12=$ (39)97.06 Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m  $\div$  (4)0.57 0.56 0.59 0.59 0.59 0.58 0.56 0.56 0.56 0.57 0.58 0.58 (40)m =(40)Average =  $Sum(40)_{1...12}/12=$ 0.57 Number of days in month (Table 1a) Jan Feb Mar Jun Apr May Jul Aug Sep Oct Nov Dec (41)31 28 31 30 31 30 31 31 30 31 30 31 (41)m =4. Water heating energy requirement: Assumed occupancy, N (42)2.96 if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)104.53 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) 114.98 110.8 106.62 102.44 94.08 94.08 98.26 102.44 106.62 110.8 114.98 (44)m =98.26 (44)Total =  $Sum(44)_{1...12}$  = 1254.35 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) 170.52 149.13 111.09 165.13 (45)m =153.89 134.17 128.74 102.94 118.13 119.54 139.31 152.07 (45)Total =  $Sum(45)_{1...12}$  = 1644.65 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.58 22.37 23.08 20.13 19.31 15.44 17.72 17.93 20.9 22.81 24.77 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 305 (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): 1.63 (48)Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year  $(48) \times (49) =$ 0.88 (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 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)



	(54)
Enter (50) or (54) in (55) $0.88$ Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	(55)
	(EC)
(56)m= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 [ 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	(56)
	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (22.51 23.26 22.51 23.26 (22.51 23.26 22.51 23.26 (22.51 23.2	(59)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 221.06 194.79 204.44 183.09 179.29 160.01 153.49 168.68 168.46 189.86 200.99 215.68	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 221.06 194.79 204.44 183.09 179.29 160.01 153.49 168.68 168.46 189.86 200.99 215.68	
Output from water heater (annual) <sub>112</sub> 2239.82	(64)
Heat gains from water heating, kWh/month 0.25 $^{\prime}$ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
	(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	
I dan I i co I iviai I Api I iviay I dan I dan I Aug I dep I dei I ivov I dec I	
	(66)
(66)m= 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06 148.06	(66)
(66)m= 148.06 14	(66)
(66)m=       148.06	
(66)m=       148.06	
(66)m=       148.06	(67)
(66)m= 148.06 14	(67)
(66)m=       148.06	(67)
(66)m= 148.06 14	(67) (68) (69)
(66)m=	(67)
(66)m=	(67) (68) (69)
(66)m=	(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 Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.	9x 0.77	X	3.6	x	10.63	x	0.45	x	0.67	=	8	(74)
North 0.	9x 0.77	X	2.4	х	10.63	х	0.45	х	0.67	=	5.33	(74)
North 0.	9x 0.77	X	3.6	х	10.63	х	0.45	х	0.67	=	8	(74)
North 0.	9x 0.77	x	3.6	x	20.32	х	0.45	x	0.67	] =	15.29	(74)
North 0.	9x 0.77	x	2.4	x	20.32	х	0.45	х	0.67	] =	10.19	(74)
North 0.	9x 0.77	X	3.6	х	20.32	х	0.45	х	0.67	=	15.29	(74)
North 0.	9x 0.77	X	3.6	х	34.53	х	0.45	х	0.67	=	25.97	(74)
North 0.	9x 0.77	X	2.4	x	34.53	x	0.45	x	0.67	=	17.32	(74)
North 0.	9x 0.77	X	3.6	x	34.53	x	0.45	х	0.67	=	25.97	(74)
North 0.	9x 0.77	X	3.6	x	55.46	x	0.45	x	0.67	=	41.72	(74)
North 0.	9x 0.77	X	2.4	x	55.46	x	0.45	x	0.67	=	27.81	(74)
North 0.	9x 0.77	X	3.6	x	55.46	x	0.45	x	0.67	=	41.72	(74)
North 0.	9x 0.77	X	3.6	x	74.72	x	0.45	x	0.67	=	56.2	(74)
North 0.	9x 0.77	X	2.4	x	74.72	x	0.45	x	0.67	=	37.47	(74)
North 0.	9x 0.77	X	3.6	x	74.72	x	0.45	x	0.67	=	56.2	(74)
North 0.	9x 0.77	X	3.6	X	79.99	X	0.45	X	0.67	] =	60.16	(74)
North 0.	9x 0.77	x	2.4	x	79.99	х	0.45	x	0.67		40.11	(74)
North 0.	9x 0.77	] x	3.6	х	79.99	×	0.45	x	0.67	=	60.16	(74)
North 0.	9x 0.77	x	3.6	x	74.68	x	0.45	x	0.67	=	56.17	(74)
North 0.	9x 0.77	] x	2.4	x	74.68	х	0.45	x	0.67	=	37.45	(74)
North 0.	9x 0.77	] x	3.6	x	74.68	X	0.45	x	0.67	=	56.17	(74)
North 0.	9x 0.77	x	3.6	х	59.25	x	0.45	x	0.67	=	44.56	(74)
North 0.	9x 0.77	X	2.4	x	59.25	x	0.45	х	0.67	=	29.71	(74)
North 0.	9x 0.77	X	3.6	x	59.25	x	0.45	X	0.67	=	44.56	(74)
North 0.	9x 0.77	X	3.6	X	41.52	X	0.45	X	0.67	=	31.23	(74)
North 0.	9x 0.77	X	2.4	x	41.52	X	0.45	X	0.67	=	20.82	(74)
North 0.	9x 0.77	X	3.6	x	41.52	X	0.45	X	0.67	=	31.23	(74)
North 0.	9x 0.77	X	3.6	x	24.19	x	0.45	x	0.67	=	18.19	(74)
North 0.	9x 0.77	X	2.4	X	24.19	X	0.45	X	0.67	=	12.13	(74)
North 0.	9x 0.77	X	3.6	X	24.19	X	0.45	X	0.67	=	18.19	(74)
North 0.	9x 0.77	X	3.6	X	13.12	X	0.45	X	0.67	=	9.87	(74)
North 0.	9x 0.77	X	2.4	x	13.12	x	0.45	x	0.67	=	6.58	(74)
North 0.	9x 0.77	X	3.6	X	13.12	X	0.45	X	0.67	=	9.87	(74)
North 0.	9x 0.77	X	3.6	X	8.86	X	0.45	X	0.67	=	6.67	(74)
North 0.	9x 0.77	X	2.4	x	8.86	x	0.45	x	0.67	=	4.45	(74)
North 0.	9x 0.77	x	3.6	x	8.86	x	0.45	x	0.67	=	6.67	(74)
Northeast <sub>0.</sub>	9x 0.77	x	1.05	x	11.28	x	0.45	x	0.67	=	2.48	(75)
Northeast <sub>0.</sub>	9x 0.77	x	1.05	x	22.97	x	0.45	x	0.67	=	5.04	(75)
Northeast <sub>0.</sub>	9x 0.77	X	1.05	X	41.38	X	0.45	X	0.67	=	9.08	(75)



Northoast a a		1		1		1		1		1		7,75
Northeast 0.9x	0	X	1.05	X	67.96	X	0.45	X	0.67	] = 	14.91	(75)
Northeast 0.9x		X	1.05	X	91.35	X	0.45	X	0.67	] = 1	20.04	<u> </u> (75)
Northeast 0.9x		X	1.05	X	97.38	X	0.45	X	0.67	=	21.36	<u> </u> (75)
Northeast 0.9x		X	1.05	X	91.1	X	0.45	X	0.67	=	19.99	<u> </u> (75)
Northeast 0.9x		X	1.05	X	72.63	X	0.45	X	0.67	=	15.93	(75)
Northeast 0.9x	****	X	1.05	X	50.42	X	0.45	X	0.67	=	11.06	(75)
Northeast 0.9x	••••	X	1.05	X	28.07	X	0.45	X	0.67	=	6.16	(75)
Northeast 0.9x		X	1.05	X	14.2	X	0.45	X	0.67	=	3.11	(75)
Northeast 0.9x		X	1.05	X	9.21	X	0.45	X	0.67	=	2.02	(75)
Southeast 0.9x		X	1.78	X	36.79	X	0.45	X	0.67	<u> </u>	13.68	(77)
Southeast 0.9x	0.77	X	1.78	X	62.67	X	0.45	X	0.67	=	23.31	(77)
Southeast 0.9x	0.77	X	1.78	X	85.75	X	0.45	X	0.67	=	31.89	(77)
Southeast 0.9x	0.77	X	1.78	X	106.25	X	0.45	X	0.67	=	39.52	(77)
Southeast 0.9x	0.77	X	1.78	X	119.01	x	0.45	X	0.67	=	44.26	(77)
Southeast 0.9x	0.77	X	1.78	X	118.15	x	0.45	X	0.67	=	43.94	(77)
Southeast 0.9x	0.77	X	1.78	X	113.91	x	0.45	x	0.67	=	42.36	(77)
Southeast 0.9x	0.77	X	1.78	X	104.39	x	0.45	x	0.67	=	38.82	(77)
Southeast 0.9x	0.77	X	1.78	X	92.85	Х	0.45	X	0.67	=	34.53	(77)
Southeast 0.9x	0.77	x	1.78	x	69.27	x	0.45	x	0.67	=	25.76	(77)
Southeast 0.9x	0.77	x	1.78	х	44.07	x	0.45	x	0.67	=	16.39	(77)
Southeast 0.9x	0.77	x	1.78	x	31.49	x	0.45	x	0.67	=	11.71	(77)
South 0.9x	0.54	x	9.36	x	46.75	Х	0.45	x	0.67	=	64.12	(78)
South 0.9x	0.77	x	2.4	x	46.75	X	0.45	x	0.67	=	46.89	(78)
South 0.9x	0.54	x	9.36	x	76.57	x	0.45	x	0.67	=	105.01	(78)
South 0.9x	0.77	X	2.4	x	76.57	x	0.45	x	0.67	=	76.79	(78)
South 0.9x	0.54	X	9.36	X	97.53	x	0.45	x	0.67	=	133.77	(78)
South 0.9x	0.77	X	2.4	x	97.53	x	0.45	x	0.67	=	97.82	(78)
South 0.9x	0.54	X	9.36	X	110.23	x	0.45	x	0.67	=	151.19	(78)
South 0.9x	0.77	X	2.4	x	110.23	x	0.45	x	0.67	=	110.56	(78)
South 0.9x	0.54	X	9.36	x	114.87	x	0.45	x	0.67	=	157.55	(78)
South 0.9x	0.77	X	2.4	x	114.87	x	0.45	x	0.67	=	115.21	(78)
South 0.9x	0.54	X	9.36	x	110.55	x	0.45	x	0.67	=	151.62	(78)
South 0.9x	0.77	X	2.4	x	110.55	x	0.45	x	0.67	=	110.87	(78)
South 0.9x	0.54	X	9.36	x	108.01	x	0.45	x	0.67	<b>=</b>	148.14	(78)
South 0.9x	0.77	X	2.4	x	108.01	x	0.45	x	0.67	<b>=</b>	108.33	(78)
South 0.9x	0.54	x	9.36	x	104.89	x	0.45	x	0.67	] =	143.86	(78)
South 0.9x	0.77	x	2.4	x	104.89	x	0.45	x	0.67	] =	105.2	(78)
South 0.9x	0.54	x	9.36	x	101.89	x	0.45	x	0.67	=	139.74	(78)
South 0.9x	0.77	X	2.4	x	101.89	x	0.45	x	0.67	j =	102.18	(78)
South 0.9x	0.54	X	9.36	x	82.59	x	0.45	x	0.67	j =	113.27	(78)
South 0.9x	0.77	X	2.4	x	82.59	x	0.45	x	0.67	=	82.83	(78)
		_		1		ı		1		•		_



South 0.9x	0.54	X	9.3	36	x	55.4	2	x	0.45	x	0.67	=		76.01	(78)
South 0.9x	0.77	X	2.4	4	X	55.4	12	x	0.45	x	0.67			55.58	(78)
South 0.9x	0.54	X	9.3	36	x	40.4	4	x	0.45	x	0.67			55.41	(78)
South 0.9x	0.77	X	2.4	4	X	40.4	4	x	0.45	x	0.67			40.52	(78)
Northwest 0.9x	0.77	X	1.0	)5	x	11.2	28	x	0.45	x	0.67			2.48	(81)
Northwest 0.9x	0.77	x	1.0	)5	x	22.9	7	x	0.45	x	0.67	╡ -		5.04	(81)
Northwest 0.9x	0.77	x	1.0	)5	x	41.3	38	x	0.45	×	0.67	╡ -		9.08	(81)
Northwest 0.9x	0.77	x	1.0	)5	x	67.9	96	x	0.45	x	0.67	╡ -		14.91	(81)
Northwest 0.9x	0.77	X	1.0	)5	x	91.3	35	x	0.45	x	0.67	_ =		20.04	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	97.3	38	x	0.45	x	0.67		:	21.36	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	91.1	1	x	0.45	x	0.67			19.99	(81)
Northwest 0.9x	0.77	X	1.0	)5	x	72.6	33	x	0.45	x	0.67	=		15.93	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	50.4	2	x	0.45	x	0.67	=		11.06	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	28.0	)7	x	0.45	x	0.67	=		6.16	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	14.2	2	X	0.45	x	0.67			3.11	(81)
Northwest 0.9x	0.77	X	1.0	)5	X	9.21	1	x	0.45	x	0.67			2.02	(81)
Solar gains in	watts, cald	culated	for each	h mont	h		(83	3)m =	Sum(74)m	.(82)m					
(83)m= 150.97	255.95	350.9	442.33	506.96	5	09.59 48	88.59	438.59	381.85	282.69	180.51	129.46			(83)
Total gains -	internal an	d solar	(84)m =	= (73)m	+ (8	33)m , w	/atts								
(84)m= 724.74	827.23	902.9	962.9	994.72	9	66.58 92	26.15 8	383.01	842.94	775.45	709.63	686.69			(84)
7. Mean inte	rnal tempe	rature (	heating	seaso	n)					•				•	
7. Mean inte						area fror	m Table							21	(85)
Temperature	e during he	ating pe	eriods ir	n the liv	ring	/				Ī				21	(85)
Temperature Utilisation fa	e during he	ating pe	eriods in	the live ea, h1,r	ring m (s	ee Table	e 9a)	9, TI	h1 (°C)	Oct		Dec		21	(85)
Temperature	e during he	ating pe	eriods ir	n the liv	ring m (s	ee Table Jun				Oct 0.98	Nov 1	Dec		21	(85)
Temperature Utilisation fa  Jan  (86)m= 1	ctor for gai	ating poor line Mar	eriods ir ving are Apr 0.97	n the live ea, h1,r May	ring m (s	Jun 0.62 (	9a) Jul 0.45	9, TI Aug 0.49	Sep 0.76		Nov			21	
Utilisation fa  Utilisation fa  Jan  (86)m= 1  Mean intern	ctor for gai Feb	ating pens for line Mar 0.99	eriods ir ving are Apr 0.97	n the livea, h1,r May 0.85	ring m (s	ee Table Jun 0.62 ( w steps	9a) Jul 0.45 3 to 7 ir	Aug 0.49	Sep 0.76 ole 9c)	0.98	Nov 1	1	<u> </u>	21	(86)
Temperature Utilisation fa  Jan  (86)m= 1	ctor for gai Feb	ating poor line Mar	eriods ir ving are Apr 0.97	n the live ea, h1,r May	ring m (s	ee Table Jun 0.62 ( w steps	9a) Jul 0.45 3 to 7 ir	9, TI Aug 0.49	Sep 0.76		Nov		<u> </u>	21	
Utilisation fa  Utilisation fa  Jan  (86)m= 1  Mean intern	reduring he ctor for gai Feb 1 1 al temperat 20.6	ating pens for line Mar 0.99 ture in line 20.72	eriods in ving are Apr 0.97 iving are 20.86 eriods in	n the livea, h1,r May 0.85 ea T1 (1 20.94	ring m (s follo	Jun  0.62  w steps 0.97  2  relling from	9a) Jul 0.45 3 to 7 in	Aug 0.49 n Tab 20.97	Sep 0.76 ole 9c) 20.96 of 1/2 (°C)	0.98	Nov 1	1	<u> </u>	21	(86)
Temperature Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.53	reduring he ctor for gai Feb 1 1 al temperate 20.6 e during he	ating pens for line Mar 0.99 ture in line 20.72	eriods in ving are Apr 0.97 iving are 20.86	n the livea, h1,r May 0.85 ea T1 (1 20.94	ring m (s follo	Jun  0.62  w steps 0.97  2  relling from	9a) Jul 0.45  3 to 7 in 20.97	Aug 0.49 n Tab 20.97	Sep 0.76 0.76 0.96 0.96	0.98	Nov 1	1		21	(86)
Temperature Utilisation fa  Jan (86)m= 1  Mean intern (87)m= 20.53  Temperature	reduring he ctor for gai Feb 1 1 al temperate 20.6 e during he 20.44	ating person of the second of	Apr 0.97 iving are 20.86 eriods ir 20.45	n the lives, h1,r May 0.85 ea T1 (120.94 en rest of 20.46	follo	Jun  0.62  w steps 0.97  2 relling from 0.47  2	3 to 7 in 20.97 20.47	Aug 0.49 n Tab 20.97 le 9, 1	Sep 0.76 ole 9c) 20.96 of 1/2 (°C)	0.98	Nov 1	20.52		21	(86)
Temperature  Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43	reduring he ctor for gai Feb 1 1 al temperate 20.6 e during he 20.44	ating person of the second of	Apr 0.97 iving are 20.86 eriods ir 20.45	n the lives, h1,r May 0.85 ea T1 (120.94 en rest of 20.46	ring (some (some some some some some some some some	Jun  0.62  w steps 0.97  celling fro 0.47  2  m (see	9a) Jul 0.45 3 to 7 in 20.97 com Tabl 20.47 Table 9a	Aug 0.49 n Tab 20.97 le 9, 1	Sep 0.76 ole 9c) 20.96 of 1/2 (°C)	0.98	Nov 1	20.52		21	(86)
Temperature  Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1	reduring he ctor for gai Feb 1 al temperat 20.6 e during he 20.44 ctor for gai 1	ating pens for line on the control of the control o	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95	n the livea, h1,r May 0.85 ea T1 ( 20.94 n rest o 20.46 welling,	follo follo 2 f dw	Jun  0.62  w steps 0.97  celling fro 0.47  2  m (see 1 0.57	3 to 7 in 20.97 ::  Table 9a    Table 9a    Table 9a    0.39    Table 9a    0.30    Ta	Aug 0.49 n Tab 20.97 le 9, 1 20.47 a)	Sep 0.76   0.76   0.76   0.71   0.71	0.98 20.85 20.46	Nov 1 20.67	20.52		21	(86) (87) (88)
Temperature  Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa	reduring he ctor for gai Feb 1  al temperat 20.6  e during he 20.44  ctor for gai 1  al temperat at te	ating pens for line on the control of the control o	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95	n the livea, h1,r May 0.85 ea T1 ( 20.94 n rest o 20.46 welling,	follo	w steps 0.97 2 relling fro 0.47 2 m (see 1 0.57 0 T2 (follo	3 to 7 in 20.97 20.47 20.47 20.39 20.39 20 w steps	Aug 0.49 n Tab 20.97 le 9, 1 20.47 a)	Sep 0.76   0.76   0.76   0.71   0.71	0.98 20.85 20.46	Nov 1 20.67	20.52		21	(86) (87) (88)
Temperature  Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern	reduring he ctor for gai Feb 1 al temperat 20.6 e during he 20.44 ctor for gai 1 al temperat 1	ating persons for line of the control of the contro	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95 he rest	ea, h1,r May 0.85 ea T1 ( 20.94 n rest o 20.46 welling, 0.81	follo	w steps 0.97 2 relling fro 0.47 2 m (see 1 0.57 0 T2 (follo	3 to 7 in 20.97 20.47 20.47 20.39 20.39 20.39	Aug 0.49 n Tab 20.97 le 9, 1 20.47 a) 0.43	Sep 0.76 lle 9c) 20.96 Th2 (°C) 20.46  0.71 7 in Table 20.41	0.98  20.85  20.46  0.97  9c) 20.27	Nov 1 20.67 20.45	1 20.52 20.44 1 19.78		0.24	(86) (87) (88) (89)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78	reduring he ctor for gai Feb 1 al temperat 20.6 e during he 20.44 ctor for gai 1 al temperat 19.9	ating persons for line of the control of the contro	eriods in ving are Apr 0.97 iving are 20.86 eriods in 20.45 est of dv 0.95 he rest 20.27	n the live ea, h1,r May 0.85 ea T1 (20.94 en rest of 20.46 exelling, 0.81 en control of dwelling, 20.39	ring m (s	w steps 0.62 (0.97 2 elling fro 0.47 2 m (see 1 0.57 (follo	3 to 7 in 20.97 20.47 20.47 20.39 20.42 20.42	Aug 0.49 n Tab 20.97 le 9, 1 20.47 a) 0.43 s 3 to 20.43	Sep 0.76   0.76   0.76   0.76   0.71   7 in Table 20.41   11	0.98  20.85  20.46  0.97  9c) 20.27	20.67 20.45	1 20.52 20.44 1 19.78			(86) (87) (88) (89)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78	reduring he ctor for gai Feb 1  al temperat 20.6  e during he 20.44  ctor for gai 1  al temperat 19.9	ating persons for III  Mar  0.99  ture in II  20.72  ating persons for reconstruction to the construction to the construction of the construction	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95 he rest 20.27	ea, h1,r May 0.85 ea T1 ( 20.94 n rest o 20.46 welling, 0.81 of dwel 20.39	ring (second second sec	ee Table  Jun  0.62  w steps 0.97  2  relling fro 0.47  2  m (see 1 0.57  T2 (follo 0.42  2  g) = fLA	9a)  Jul  0.45  3 to 7 in  20.97  com Table  20.47  Table 9a  0.39  cow steps  20.42  × T1 +	Aug 0.49 n Tab 20.97 le 9, 1 20.47 a) 0.43 s 3 to 20.43	Sep 0.76    Sep 0.76   20.96     20.96	0.98  20.85  20.46  0.97  9 9c)  20.27  A = Liv	Nov 1 20.67 20.45	1 20.52 20.44 1 19.78			(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78  Mean intern  (92)m= 19.96	reduring he ctor for gai Feb 1  al temperat 20.6  during he 20.44  ctor for gai 1  al temperat 19.9  al temperat 19.9	ating persons for line of the control of the contro	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95 he rest 20.27	n the live ea, h1,r May 0.85 ea T1 (20.94 n rest of 20.46 welling 0.81 of dwel 20.39 ole dwel 20.52	ring m (s folloo	w steps 0.62 (0.97 2 elling fro 0.47 2 m (see 1 0.57 (follo 0.42 2 g) = fLA 0.56 2	3 to 7 in 20.97 : 20.97 : 20.47 : 20.47 : 20.42 : 20.42 : 20.56 : 20.56	Aug 0.49 n Tab 20.97 le 9, 7 20.47 a) 0.43 s 3 to 20.43 (1 - f	Sep 0.76   0.76   0.76   0.76   0.71   7 in Table 20.41   ft.   LA) × T2   20.55   0.7	0.98  20.85  20.46  0.97  9 9c)  20.27  A = Liv	20.67 20.45	1 20.52 20.44 1 19.78			(86) (87) (88) (89)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78  Mean intern  (92)m= 19.96  Apply adjust	reduring he ctor for gai Feb 1  al temperat 20.6  e during he 20.44  ctor for gai 1  al temperat 19.9  al temperat 20.07  ment to the	ating pens for line at	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95 he rest 20.27 r the wh 20.41 internal	n the live ea, h1,r May 0.85 ea T1 (** 20.94 n rest of 20.46 welling 0.81 of dwel 20.39 ole dwere 20.52 tempe	folloging folloging folloging folloging folloging folloging folloging folloging following follow	w steps 0.97 2 relling fro 0.57 0 T2 (follo 0.42 2 g) = fLA 0.56 2	9a)  Jul  0.45  3 to 7 in  20.97  com Table  20.47  Table 9a  0.39  cow steps  20.42  x T1 +  20.56  Table 4	Aug 0.49 n Tab 20.97 le 9, 1 20.47 a) 0.43 s 3 to 20.43 (1 - f 20.56 e, wh	Sep 0.76    Sep 0.76    20.96    Ch2 (°C)   20.46    O.71    7 in Table   20.41   ft    LA) × T2   20.55   ere appro-	0.98  20.85  20.46  0.97  9 9c)  20.27  A = Liv	Nov 1 20.67 20.45 1 20 ing area ÷ (4	1 20.52 20.44 1 19.78 4) =			(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78  Mean intern  (92)m= 19.96  Apply adjust  (93)m= 19.81	reduring he ctor for gai Feb 1  al temperat 20.6 e during he 20.44 ctor for gai 1  al temperat 19.9 eal temperat 20.07 ement to the 19.92	ating pens for line on the control of the control o	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95 he rest 20.27	n the live ea, h1,r May 0.85 ea T1 (20.94 n rest of 20.46 welling 0.81 of dwel 20.39 ole dwel 20.52	folloging folloging folloging folloging folloging folloging folloging folloging following follow	w steps 0.97 2 relling fro 0.57 0 T2 (follo 0.42 2 g) = fLA 0.56 2 re from	9a)  Jul  0.45  3 to 7 in  20.97  com Table  20.47  Table 9a  0.39  cow steps  20.42  x T1 +  20.56  Table 4	Aug 0.49 n Tab 20.97 le 9, 7 20.47 a) 0.43 s 3 to 20.43 (1 - f	Sep 0.76   0.76   0.76   0.76   0.71   7 in Table 20.41   ft.   LA) × T2   20.55   0.55   0.7	0.98  20.85  20.46  0.97  9 9c)  20.27  A = Liv	Nov 1 20.67 20.45	1 20.52 20.44 1 19.78			(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78  Mean intern  (92)m= 19.96  Apply adjust  (93)m= 19.81  8. Space he	reduring he ctor for gai Feb 1  al temperat 20.6 e during he 20.44 ctor for gai 1  al temperat 19.9 e latemperat 20.07 e latemp	ating persons for line of the control of the contro	Apr 0.97 iving are 20.86 eriods ir 20.45 est of do 0.95 he rest of 20.27 r the wh 20.41 internal 20.26	ea, h1,r May 0.85 ea T1 ( 20.94 n rest o 20.46 welling, 0.81 of dwel 20.39 ole dwe 20.52 tempe 20.37	ring m (s folloo 2 f dw 2 llling 3 llling 2 llling 2 llling 2 llling 2 llling 2 llling 2 llling 3 llli	w steps 0.97 2 elling fro 0.47 2 m (see 1 0.57 0 T2 (follo 0.42 2 g) = fLA 0.56 2 re from 0.41 2	3 to 7 in 20.97   20.97   20.47   20.47   20.42   20.42   20.56   20.41   20.4	Aug 0.49 n Tab 20.97 le 9, 7 20.47 a) 0.43 s 3 to 20.43 (1 – f 20.56 e, wh	Sep 0.76    Sep 0.76    20.96    20.96    7 in Table 20.41    LA) x T2 20.55   ere approximate approxi	0.98  20.85  20.46  0.97  9 9c)  20.27  A = Liv  20.42  priate  20.27	Nov 1 20.67 20.45 1 20 ing area ÷ (4 20.16 20.01	1 20.52 20.44 1 19.78 19.96		0.24	(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fa  Jan  (86)m= 1  Mean intern  (87)m= 20.53  Temperature  (88)m= 20.43  Utilisation fa  (89)m= 1  Mean intern  (90)m= 19.78  Mean intern  (92)m= 19.96  Apply adjust  (93)m= 19.81	te during he ctor for gai Feb 1  al temperat 20.6  during he 20.44  ctor for gai 1  al temperat 19.9  al temperat 20.07  ment to the 19.92  ating requiremean interests	ating persons for line of the content of the conten	eriods in ving are Apr 0.97 iving are 20.86 eriods in 20.45 est of do 0.95 he rest 20.27 rest the wheeler and 20.41 internal 20.26 enperature.	n the live ea, h1,r May 0.85 ea T1 (1 20.94 n rest o 20.46 welling 0.81 of dwel 20.39 ole dwel 20.52 tempe 20.37	ring m (s folloo 2 f dw 2 llling 3 llling 2 llling 2 llling 2 llling 2 llling 2 llling 2 llling 3 llli	w steps 0.97 2 elling fro 0.47 2 m (see 1 0.57 0 T2 (follo 0.42 2 g) = fLA 0.56 2 re from 0.41 2	3 to 7 in 20.97   20.97   20.47   20.47   20.42   20.42   20.56   20.41   20.4	Aug 0.49 n Tab 20.97 le 9, 7 20.47 a) 0.43 s 3 to 20.43 (1 – f 20.56 e, wh	Sep 0.76    Sep 0.76    20.96    20.96    7 in Table 20.41    LA) x T2 20.55   ere approximate approxi	0.98  20.85  20.46  0.97  9 9c)  20.27  A = Liv  20.42  priate  20.27	Nov 1 20.67 20.45 1 20 ing area ÷ (4 20.16 20.01	1 20.52 20.44 1 19.78 19.96		0.24	(86) (87) (88) (89) (90) (91) (92)

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

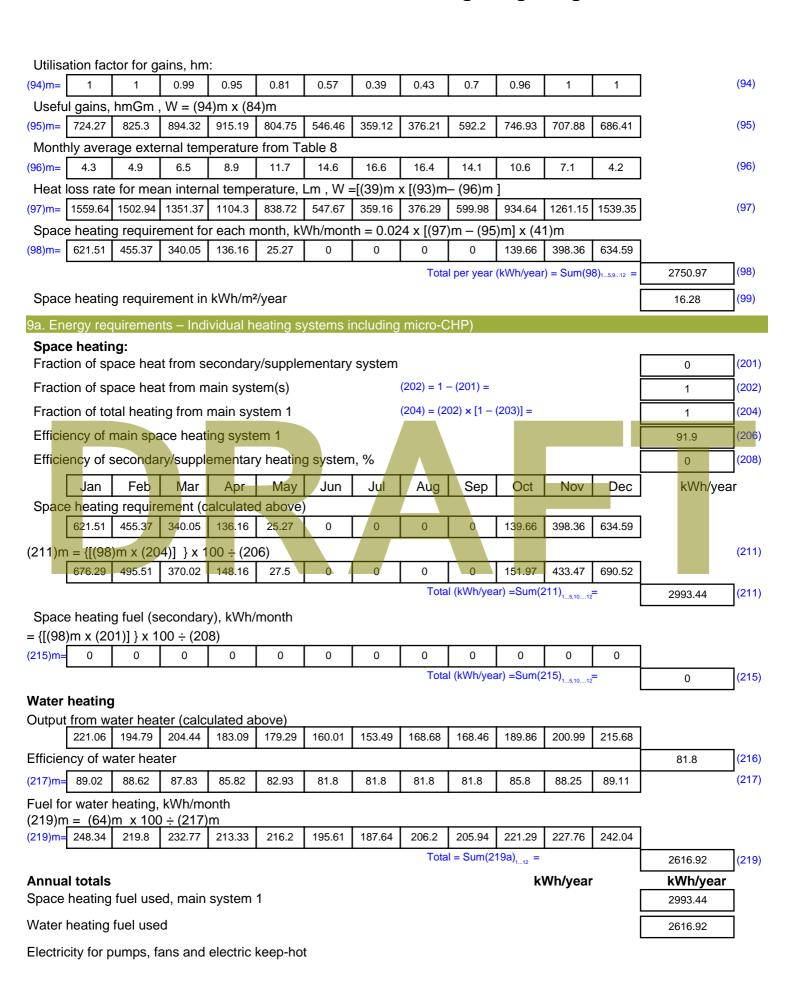
Dec

Mar

Jan

Feb







mechanical ventilation - balanced, extract or positive input from outside 521.89 (230a) central heating pump: (230c)30 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 551.89 (232) Electricity for lighting 569.73 12a. CO2 emissions - Individual heating systems including micro-CHP **Emission factor Emissions Energy** kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261) 0.216 646.58 Space heating (secondary) (215) x (263)0.519 (219) x Water heating (264)0.216 565.26 (261) + (262) + (263) + (264) =Space and water heating (265)1211.84 (231) x Electricity for pumps, fans and electric keep-hot (267)0.519 286.43 (232) x Electricity for lighting 0.519 295.69 (268)sum of (265)...(271) = Total CO2, kg/year 1793.96 (272)**Dwelling CO2 Emission Rate**  $(272) \div (4) =$ (273) 10.62 El rating (section 14) (274)89



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 23 - 2B4P - MF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 97.32 (1a) x 2.7 (2a) =262.76 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)97.32 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =262.76 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) =	: (21a) x (22a)m
0.16	0.12 0.13 0.14 0.14 0.15
Calculate effective air change rate for the applicable case	
If mechanical ventilation:	0.5 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (	(200)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from	n Table 4h) = 73.95 (23c)
a) If balanced mechanical ventilation with heat recovery (MV	
(24a)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25	0.25 0.26 0.27 0.27 0.28 (24a)
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 (24b)
c) If whole house extract ventilation or positive input ventilation if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (23b)$	
(24c)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilati if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m =	
(24d)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24	ld) in box (25)
(25)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25	0.25 0.26 0.27 0.27 0.28 (25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross area (m²) Openings Net Area A ,m²	U-value A X U k-value A X k W/m2K (W/K) kJ/m²-K kJ/K
Windows Type 1 2.85 x1	/[1/(1.1) + 0.04] = 3 (27)
Windows Type 2	/[1/( 1.1 )+ 0.04] = 3 (27)
Windows Type 3	/[1/(1.1) + 0.04] = 9.36 (27)
Windows Type 4 2.67 x1	/[1/(1.1) + 0.04] = 2.81 (27)
Windows Type 5	$/[1/(1.1) + 0.04] = \boxed{1.88} \tag{27}$
Walls Type1 92.42 27.4 65.02 x	0.12 = 7.8 (29)
Walls Type2 29.89 0 29.89 x	0.14 = 4.23 (29)
Total area of elements, m <sup>2</sup>	(31)
Party wall 23.22 x	0 = 0 (32)
Party floor 97.32	(32a)
Party ceiling 97.32	(32b)
* for windows and roof windows, use effective window U-value calculated using ** include the areas on both sides of internal walls and partitions	
Fabric heat loss, W/K = S (A x U)	(26)(30) + (32) = 40.9 (33)
Heat capacity Cm = S(A x k)	((28) (20) + (22) + (220) (220) -
	((28)(30) + (32) + (32a)(32e) = 14501 (34)
Thermal mass parameter (TMP = $Cm \div TFA$ ) in $kJ/m^2K$	((26)(30) + (32) + (324)(32e) = 14501  Indicative Value: Medium 250 (35)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K  For design assessments where the details of the construction are not known p  can be used instead of a detailed calculation.	Indicative Value: Medium 250 (35)
For design assessments where the details of the construction are not known p	Indicative Value: Medium 250 (35)
For design assessments where the details of the construction are not known p can be used instead of a detailed calculation.	Indicative Value: Medium  250 (35)  recisely the indicative values of TMP in Table 1f



entilation 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		
3)m= 25.39	25.11	24.84	23.46	23.18	21.8	21.8	21.52	22.35	23.18	23.73	24.28		(38
eat transfer o	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
9)m= 84.64	84.36	84.09	82.7	82.43	81.05	81.05	80.77	81.6	82.43	82.98	83.53		
								,	Average =	Sum(39) <sub>1</sub> .	12 /12=	82.63	(39
eat loss para		<del> </del>					ı	·	= (39)m ÷	•			
0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86		<b>—</b> ,,,
umber of day	s in moi	nth (Tab	le 1a)					/	Average =	Sum(40) <sub>1.</sub>	12 /12=	0.85	(40
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
. Water heat	ting ene	rgy requi	rement:								kWh/ye	ar:	
ssumed occu											71		(4
if TFA > 13.9 if TFA £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	A -13.9	)2)] + 0.0	013 x (	ΓFA -13.	.9)	_		
nnual averag	•	ater usad	ae in litre	s per da	ıv Vd.av	erage =	(25 x N)	+ 36		98	.64		(4
edu <mark>ce the annua</mark>	al average	hot water	usage by	5% if the a	welling is	designed t			se target o				(
t more that 125	litres per <sub>l</sub>	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t 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)						
)m= 108.5	104.56	100.61	96.67	92.72	88.78	88.78	92.72	96.67	100.61	104.56	108.5		_
ergy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1183.69	(4
5)m= 160.91	140.73	145.22	126.61	121.48	104.83	97.14	111.47	112.8	131.46	143.5	155.83		
									Γotal = Su	m(45) <sub>112</sub> =	-	1552	(4
nstantaneous w		ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)	) to (61)					
m= 24.14	21.11	21.78	18.99	18.22	15.72	14.57	16.72	16.92	19.72	21.53	23.37		(4
ater storage		includin	na anv sa	مامت مت ۸۸									
	io (iiti 00)			1121 OI VI	/WHRS:	storage	within sa	me ves	sel		255		(4
•	eating a					•	within sa	ime ves	sel		255		(4
community h	-	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)				255		(4
community h	stored	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)				255		(4
community herwise if no atter storage	stored loss:	ind no ta hot wate	nk in dw er (this in	elling, e cludes i	nter 110 nstantan	litres in neous co	(47)			47)	255 49		
community herwise if no ater storage If manufact	o stored loss: urer's de	ind no ta hot wate eclared l	nk in dw er (this in oss facto	elling, e cludes i	nter 110 nstantan	litres in neous co	(47)			47)			(4
community herwise if no ater storage If manufact mperature for the storage in the	o stored loss: urer's de actor fro	nd no ta hot wate eclared le m Table storage	onk in dwer (this in oss facto 2b , kWh/ye	elling, e cludes i or is kno ear	nter 110 nstantan wn (kWh	litres in neous co n/day):	(47)	ers) ente		1.	49		(4
community herwise if no ater storage If manufact mperature for the ater storage in the	o stored loss: urer's de actor fro om water urer's de	nd no ta hot wate eclared le m Table storage eclared d	onk in dw er (this in oss facto 2b , kWh/ye	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		1. 0.	49 54 .8		(4 (4
community herwise if no ater storage of the storage	o stored loss: urer's de actor fro om water urer's de age loss	nd no ta hot wate eclared lem Table storage eclared of factor fr	onk in dw er (this in oss facto 2b , kWh/ye cylinder l om Tabl	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		1. 0.	49 54		(4 (4 (5
community herwise if no ater storage If manufact imperature for a lergy lost from the lergy lost from the lergy lost from the lergy lost water storage community here.	o stored loss: urer's de actor fro om water urer's de age loss neating s	nd no ta hot wate eclared le m Table storage eclared of factor frace section	onk in dw er (this in oss facto 2b , kWh/ye cylinder l om Tabl	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		47)  1.  0.  0	49 54 .8		(4 (4 (5
community herwise if no ater storage of the storage	o stored loss: urer's de actor fro water urer's de age loss leating s from Ta	hot water eclared I m Table storage eclared of factor frace see section	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		47)  1. 0. 0	49 54 .8		(4 (4 (5 (5
community herwise if no ater storage of the manufact emperature for the manufact of water storage of the manufact emperature for the manufact of the manufact of the manufact of the manufact of the manufactor emperature for the manufactor end at the manuf	o stored loss: curer's de actor fro sage loss leating s from Ta actor fro	nnd no ta hot wate eclared I m Table storage eclared of factor from ee section ble 2a m Table	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto e 2 (kWl	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boild (48) x (49)	ers) ente	er 'O' in (	47)  1.  0.  0	49 54 .8 0		(4) (4) (5) (5) (5)
community he community he community he cater storage of the cater storag	o stored loss: curer's de actor fro loss age loss age loss agetor from Talactor from water age mater actor from water	eclared lem Table storage factor frace section ble 2a m Table storage	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto e 2 (kWl	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente	er 'O' in (	47)  1. 0. 0	49 54 .8 0		(44 (4 (5 (5 (5 (5 (5 (5
community he herwise if no ater storage of the manufact of the manufact of water storage of the manufact of water storage of the manufact r of the manufac	o stored loss: curer's de actor fro meating s from Ta actor from water (54) in (5	hot water eclared I m Table storage eclared of factor from the section ble 2a m Table storage	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3 2b , kWh/ye	relling, e cludes i or is kno ear oss fact e 2 (kWl	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boild (48) x (49)	ers) ente	er 'O' in (	47)  1. 0. 0	49 54 .8 0		(44 (44 (55 (55 (55 (55 (55



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 24.94 22.53 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 209.11 184.27 193.43 173.26 169.69 151.48 145.35 159.68 159.45 179.67 190.15 204.04	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 209.11 184.27 193.43 173.26 169.69 151.48 145.35 159.68 159.45 179.67 190.15 204.04	
Output from water heater (annual) <sub>112</sub> 2119.58	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]	
(65)m= 92.07 81.63 86.85 79.42 78.96 72.18 70.86 75.63 74.83 82.27 85.03 90.38	(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):	
o. Internal gains (see Table Cana sa).	
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(66) (67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	` /
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	` /
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       135.66	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       135.66	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       135.66	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70) (71) (72)

Flux

Table 6a Table 6b Table 6c

Orientation: Access Factor Area Table 6d m²

Gains

(W)

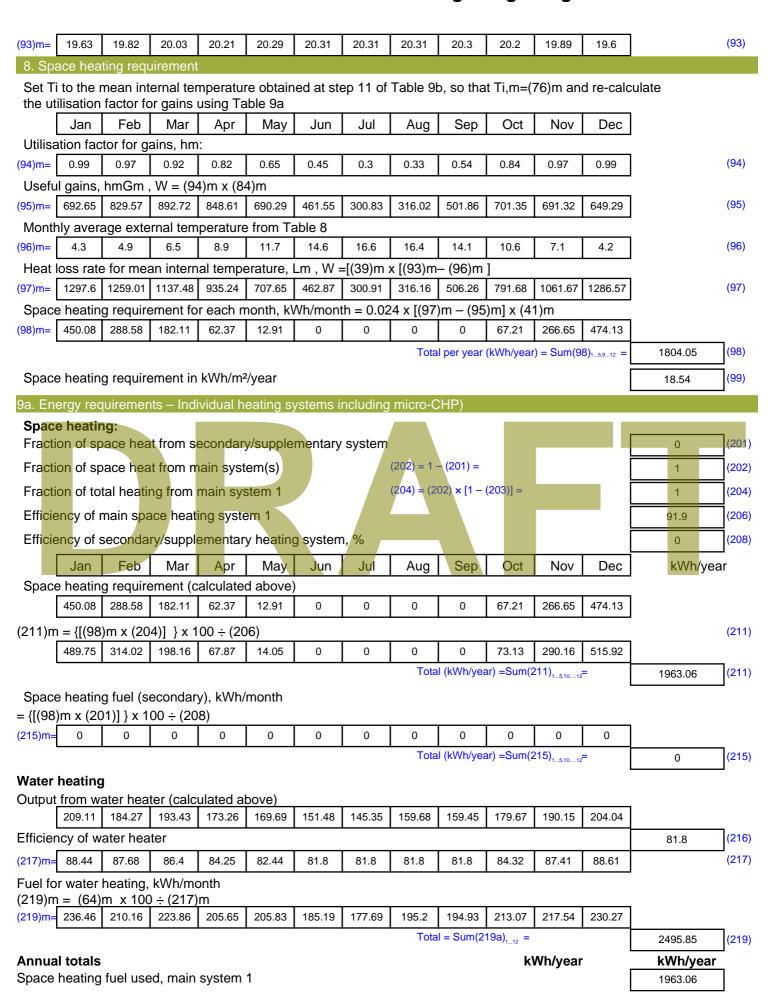


Southeast 0.9x	0.77	X	8.88	X	36.79	X	0.45	x	0.67	=	68.27	(77)
Southeast 0.9x	0.77	x	1.78	x	36.79	X	0.45	x	0.67	=	13.68	(77)
Southeast 0.9x	0.77	X	8.88	X	62.67	X	0.45	x	0.67	=	116.28	(77)
Southeast 0.9x	0.77	X	1.78	x	62.67	x	0.45	x	0.67	=	23.31	(77)
Southeast 0.9x	0.77	X	8.88	x	85.75	x	0.45	x	0.67	=	159.1	(77)
Southeast 0.9x	0.77	X	1.78	x	85.75	x	0.45	x	0.67	=	31.89	(77)
Southeast 0.9x	0.77	X	8.88	x	106.25	X	0.45	x	0.67	=	197.14	(77)
Southeast 0.9x	0.77	X	1.78	x	106.25	X	0.45	x	0.67	=	39.52	(77)
Southeast 0.9x	0.77	X	8.88	X	119.01	X	0.45	x	0.67	=	220.81	(77)
Southeast 0.9x	0.77	X	1.78	X	119.01	X	0.45	x	0.67	=	44.26	(77)
Southeast 0.9x	0.77	X	8.88	X	118.15	X	0.45	x	0.67	=	219.21	(77)
Southeast 0.9x	0.77	X	1.78	X	118.15	X	0.45	x	0.67	=	43.94	(77)
Southeast 0.9x	0.77	X	8.88	x	113.91	x	0.45	x	0.67	=	211.35	(77)
Southeast 0.9x	0.77	X	1.78	x	113.91	X	0.45	x	0.67	=	42.36	(77)
Southeast 0.9x	0.77	X	8.88	x	104.39	x	0.45	x	0.67	=	193.68	(77)
Southeast 0.9x	0.77	x	1.78	x	104.39	x	0.45	x	0.67	=	38.82	(77)
Southeast 0.9x	0.77	X	8.88	x	92.85	X	0.45	x	0.67	=	172.28	(77)
Southeast 0.9x	0.77	X	1.78	X	92.85	X	0.45	X	0.67	=	34.53	(77)
Southeast <sub>0.9x</sub>	0.77	x	8.88	х	69.27	x	0.45	x	0.67	=	128.52	(77)
Southeast <sub>0.9x</sub>	0.77	x	1.78	х	69.27	×	0.45	x	0.67	=	25.76	(77)
Southeast 0.9x	0.77	x	8.88	X	44.07	x	0.45	x	0.67	=	81.77	(77)
Southeast 0.9x	0.77	x	1.78	x	44.07	х	0.45	x	0.67	=	16.39	(77)
Southeast 0.9x	0.77	x	8.88	x	31.49	X	0.45	x	0.67	=	58.42	(77)
Southeast 0.9x	0.77	x	1.78	х	31.49	X	0.45	x	0.67	=	11.71	(77)
South 0.9x	0.77	X	2.85	x	46.75	X	0.45	x	0.67	=	55.68	(78)
South 0.9x	0.77	X	2.85	X	46.75	X	0.45	x	0.67	=	55.68	(78)
South 0.9x	0.77	X	2.85	x	76.57	X	0.45	x	0.67	=	91.19	(78)
South 0.9x	0.77	X	2.85	x	76.57	x	0.45	x	0.67	=	91.19	(78)
South 0.9x	0.77	X	2.85	X	97.53	X	0.45	x	0.67	=	116.16	(78)
South 0.9x	0.77	X	2.85	X	97.53	X	0.45	x	0.67	=	116.16	(78)
South 0.9x	0.77	X	2.85	X	110.23	X	0.45	x	0.67	=	131.28	(78)
South 0.9x	0.77	X	2.85	X	110.23	X	0.45	x	0.67	=	131.28	(78)
South 0.9x	0.77	X	2.85	x	114.87	X	0.45	x	0.67	=	136.81	(78)
South 0.9x	0.77	X	2.85	x	114.87	X	0.45	x	0.67	=	136.81	(78)
South 0.9x	0.77	X	2.85	x	110.55	x	0.45	x	0.67	=	131.66	(78)
South 0.9x	0.77	x	2.85	x	110.55	x	0.45	x	0.67	=	131.66	(78)
South 0.9x	0.77	x	2.85	x	108.01	x	0.45	x	0.67	=	128.64	(78)
South 0.9x	0.77	x	2.85	x	108.01	x	0.45	x	0.67	=	128.64	(78)
South 0.9x	0.77	x	2.85	x	104.89	x	0.45	x	0.67	=	124.92	(78)
South 0.9x	0.77	x	2.85	x	104.89	x	0.45	x	0.67	=	124.92	(78)
South 0.9x	0.77	x	2.85	x	101.89	x	0.45	x	0.67	=	121.34	(78)
-												



South 0.9x	0.77	X	2.85	5 X	1	01.89	X	0.45	X	0.67	=	121.34	(78)
South 0.9x	0.77	X	2.85	5 x	8	32.59	x	0.45	X	0.67	=	98.36	(78)
South 0.9x	0.77	X	2.85	5 x	8	32.59	X	0.45	X	0.67	=	98.36	(78)
South 0.9x	0.77	X	2.85	5 ×	Ę	55.42	x	0.45	X	0.67	=	66	(78)
South 0.9x	0.77	X	2.85	5 x	į	55.42	x	0.45	x	0.67	=	66	(78)
South 0.9x	0.77	X	2.85	5 x		40.4	X	0.45	x	0.67	=	48.11	(78)
South 0.9x	0.77	X	2.85	5 x		40.4	x	0.45	X	0.67	=	48.11	(78)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	3	36.79		0.45	X	0.67	=	41.05	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	(	62.67		0.45	X	0.67	=	69.93	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	8	35.75		0.45	X	0.67	=	95.68	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	1	06.25		0.45	X	0.67	=	118.55	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	1	19.01		0.45	X	0.67	=	132.78	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	1	18.15		0.45	X	0.67	=	131.82	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	1	13.91		0.45	X	0.67	=	127.09	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	1	04.39		0.45	X	0.67	=	116.47	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	(	92.85		0.45	x	0.67	=	103.6	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×	(	69.27		0.45	X	0.67	=	77.28	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	7 ×		14.07		0.45	X	0.67	=	49.17	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.67	7 ×	3	31.49		0.45	x	0.67	=	35.13	(79)
Sola <mark>r gains ir</mark>	watts, calc	culated	for each	month			(83)m	= Sum(74)m .	(82)m				
(83)m= 234.36		518.99	617.77		658.29	638.08	598	.83   553.09	428.28	279.33	201.49		(83)
Lotal gains –					(00)								
			(84)m =	` \	· /								(0.4)
(84)m= 699.19			(84)m = 1040.98	` '	(83)m 1032.57	996.86	963	.92 930.77	830.58	709.95	653.55		(84)
	854.55	966.59	1040.98	1069.7	· /		963	.92 930.77	830.58	709.95	653.55		(84)
(84)m= 699.19	854.55 g	966.59 rature (	1040.98 heating	1069.7 season)	1032.57	996.86			830.58	709.95	653.55	21	(84)
(84)m= 699.19 7. Mean inte	ernal tempe e during hea	rature ( ating pe	heating eriods in ving area	season) the living	g area	996.86 from Tab	ole 9	Th1 (°C)	830.58	709.95		21	_
7. Mean interest Temperature Utilisation fa	ernal tempe e during hea ctor for gain	rature ( ating pensions for li	heating eriods in ving area	season) the living a, h1,m (	g area see Ta Jun	996.86 from Tab able 9a)	ole 9	Th1 (°C)	Oct	Nov	Dec	21	(85)
7. Mean intercept Temperature Utilisation fa	ernal tempe e during hea	rature ( ating pe	heating eriods in ving area	season) the living	g area	996.86 from Tab	ole 9	Th1 (°C)				21	_
7. Mean interest Temperature Utilisation fa	854.55 strnal tempers during heat ctor for gain Feb 0.98	rature ( ating pensions for li Mar 0.94	heating eriods in ving area Apr 0.85	season) the living a, h1,m ( May 0.69	g area see Ta Jun	996.86  from Table 9a)  Jul  0.36	ole 9	Th1 (°C)  ug Sep  8 0.6	Oct	Nov	Dec	21	(85)
7. Mean interest Temperature Utilisation far  (86)m= 0.99	rnal tempe e during heactor for gain Feb 0.98	rature ( ating pensions for li Mar 0.94	heating eriods in ving area Apr 0.85	season) the living a, h1,m ( May 0.69	g area see Ta Jun	996.86  from Table 9a)  Jul  0.36	ole 9	Th1 (°C)  ug Sep  18 0.6  Table 9c)	Oct	Nov 0.98	Dec	21	(85)
7. Mean interaction (84)m = 699.19 7. Mean interaction factor (86)m = 0.99 Mean interaction factor (86)m = 0.99	rnal tempe e during heactor for gain Feb 0.98 all temperat 20.56	rature ( ating pens for li Mar 0.94  ure in li 20.72	heating eriods in ving area 0.85 iving are 20.87	season) the living a, h1,m ( May 0.69 ea T1 (foll 20.94	g area see Ta Jun 0.5 ow ste 20.96	996.86  from Takable 9a)  Jul  0.36  pps 3 to 7  20.96	Ole 9,	Th1 (°C)  ug Sep  18 0.6  Table 9c)  96 20.95	Oct 0.88	Nov 0.98	Dec 1	21	(85)
7. Mean interaction (84)m = 699.19 7. Mean interaction factor (86)m = 0.99  Mean interaction (87)m = 20.41	rnal tempe e during heactor for gain Feb 0.98 all temperat 20.56	rature ( ating pens for li Mar 0.94  ure in li 20.72	heating eriods in ving area 0.85 iving are 20.87	season) the living a, h1,m ( May 0.69 ea T1 (foll 20.94	g area see Ta Jun 0.5 ow ste 20.96	996.86  from Takable 9a)  Jul  0.36  pps 3 to 7  20.96	Ole 9,	Th1 (°C)  ug Sep  8 0.6  Table 9c)  96 20.95  9, Th2 (°C)	Oct 0.88	Nov 0.98	Dec 1	21	(85)
7. Mean interconstruction (84)m = 699.19 7. Mean interconstruction far and far	rnal temper e during heat ctor for gain Feb 0.98 al temperat 20.56 e during heat 20.2	rature ( ating pens for li Mar 0.94 ure in li 20.72 ating pensenge	heating eriods in ving area Apr 0.85 iving are 20.87 eriods in 20.21	the living a, h1,m ( May 0.69 at T1 (foll 20.94 rest of d 20.21	g area see Ta Jun 0.5 ow stee 20.96 welling 20.23	996.86  from Table 9a)  Jul  0.36  pps 3 to 7  20.96  from Table  20.23	Al 0.37 in T 20.	Th1 (°C)  ug Sep  8 0.6  Table 9c)  96 20.95  9, Th2 (°C)	Oct 0.88	Nov 0.98	Dec 1	21	(85) (86) (87)
7. Mean interpretation (84)m= 699.19 7. Mean interpretation far Jan (86)m= 0.99 Mean interpretation (87)m= 20.41 Temperature (88)m= 20.19	rnal temper e during heat ctor for gain Feb 0.98 al temperat 20.56 e during heat 20.2	rature ( ating pens for li Mar 0.94 ure in li 20.72 ating pensenge	heating eriods in ving area Apr 0.85 iving are 20.87 eriods in 20.21	the living a, h1,m ( May 0.69 at T1 (foll 20.94 rest of d 20.21	g area see Ta Jun 0.5 ow stee 20.96 welling 20.23	996.86  from Table 9a)  Jul  0.36  pps 3 to 7  20.96  from Table  20.23	Al 0.37 in T 20.	Th1 (°C)  ug Sep  18 0.6  Table 9c)  96 20.95  0, Th2 (°C)  23 20.22	Oct 0.88	Nov 0.98	Dec 1	21	(85) (86) (87)
7. Mean interaction of the control o	rnal temper e during heat ctor for gain self temperate 20.56 e during heat 20.2 ctor for gain self temperate 20.97	rature ( ating persons for li Mar 0.94  ure in li 20.72  ating persons for re 0.93	heating eriods in ving area Apr 0.85 iving area 20.87 eriods in 20.21 est of dw 0.82	the living a, h1,m ( May 0.69 a T1 (foll 20.94 rest of d 20.21 velling, h2 0.64	g area see Ta Jun 0.5 ow ste 20.96 welling 20.23 2,m (se 0.44	996.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table  0.29	Al 0.3   Al	Th1 (°C)  ug Sep 18 0.6  Table 9c) 96 20.95 0, Th2 (°C) 23 20.22	Oct 0.88 20.86 20.21	Nov 0.98 20.61	Dec 1 20.38	21	(85) (86) (87) (88)
7. Mean interaction (84)m = 699.19 7. Mean interaction factor (86)m = 0.99  Mean interaction (87)m = 20.41  Temperature (88)m = 20.19  Utilisation factor (84)m = 20.19	smal temper end during head temperate 20.56 end during head 20.2 ctor for gain 0.97 end temperate 20.97 en	rature ( ating persons for li Mar 0.94  ure in li 20.72  ating persons for re 0.93	heating eriods in ving area Apr 0.85 iving area 20.87 eriods in 20.21 est of dw 0.82	the living a, h1,m ( May 0.69 a T1 (foll 20.94 rest of d 20.21 velling, h2 0.64	g area see Ta Jun 0.5 ow ste 20.96 welling 20.23 2,m (se 0.44	996.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table  0.29	Al 0.3   Al	Th1 (°C)  ug Sep  8 0.6  Table 9c)  96 20.95  9, Th2 (°C)  23 20.22  12 0.53  to 7 in Table	Oct 0.88 20.86 20.21	Nov 0.98 20.61 20.21	Dec 1 20.38	21	(85) (86) (87) (88)
7. Mean interaction (84)m = 699.19  7. Mean interaction far Jan (86)m = 0.99  Mean interaction far 20.41  Temperature (88)m = 20.19  Utilisation far (89)m = 0.99  Mean interaction far (89)m = 0.99  Mean interaction far (89)m = 0.99	smal temper end during head temperate 20.56 end during head 20.2 ctor for gain 0.97 end temperate 20.97 en	rature ( ating pens for li Mar 0.94  ure in li 20.72  ating pens for re 0.93  ure in t	heating eriods in ving area 20.87 eriods in 20.21 est of dw 0.82 he rest of	the living a, h1,m ( May 0.69 at T1 (foll 20.94 at Co.21 co.21 co.64 co.	g area see Ta Jun 0.5 ow ste 20.96 welling 20.23 2,m (se 0.44 g T2 (f	996.86  from Table 9a)  Jul  0.36  pps 3 to 7  20.96  from Table  0.29  ollow ste	Al 0.3   Al	Th1 (°C)  ug Sep 18 0.6  Table 9c) 96 20.95  9, Th2 (°C) 23 20.22  12 0.53  to 7 in Table 17 20.15	Oct 0.88  20.86  20.21  0.84  e 9c)  20.05	Nov 0.98 20.61 20.21	Dec 1 20.38 20.2 0.99	21	(85) (86) (87) (88) (89)
7. Mean intermoderature Utilisation fa  (86)m= 0.99  Mean intermoderature (87)m= 20.41  Temperature (88)m= 20.19  Utilisation fa (89)m= 0.99  Mean intermoderature (90)m= 19.4	rnal temper e during head temperate 20.56 e during head 20.2 ctor for gain 19.62	rature ( ating pens for li Mar 0.94 ure in li 20.72 ating pens for re 0.93 ure in t 19.85	heating eriods in ving area Apr 0.85 iving area 20.87 eriods in 20.21 est of dw 0.82 he rest of 20.05	season) the living a, h1,m ( May  0.69 ea T1 (foll 20.94  rest of d 20.21  velling, h2 0.64  of dwellin 20.13	g area see Ta Jun 0.5 ow stee 20.96 welling 20.23 2,m (see 0.44 g T2 (f	996.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table 0.29  ollow stee  20.16	Al 0.3  / in T 20.  ble 9  20.  9a)  0.3  20.	Th1 (°C)  ug Sep  88 0.6  Table 9c)  96 20.95  2), Th2 (°C)  23 20.22  10 7 in Table  17 20.15	Oct 0.88  20.86  20.21  0.84  e 9c)  20.05	Nov 0.98 20.61 20.21 0.98	Dec 1 20.38 20.2 0.99		(85) (86) (87) (88) (89) (90)
7. Mean interaction (84)m = 699.19  7. Mean interaction far Jan (86)m = 0.99  Mean internation far (87)m = 20.41  Temperature (88)m = 20.19  Utilisation far (89)m = 0.99  Mean internation far (90)m = 19.4	854.55 strain temper end during head temperate 20.56 end during head 20.2 ctor for gain 19.62 end temperate 19.62 end temperat	rature ( ating persons for li Mar 0.94 ure in li 20.72 ating persons for re 0.93 ure in t 19.85 ure (for	heating eriods in ving area 20.87 eriods in 20.21 est of dw 0.82 he rest control of the whole of	the living a, h1,m ( May 0.69 at T1 (foll 20.94 at Co.21 at Co.21 at Co.64	g area see Ta Jun 0.5 ow ste 20.96 welling 20.23 2,m (se 0.44 g T2 (f 20.16	996.86  from Table 9a)  Jul  0.36  pps 3 to 7  20.96  from Table  20.23  ee Table  0.29  ollow stee  20.16	Al 0.3   Al	Th1 (°C)  ug Sep  88 0.6  Table 9c)  96 20.95  9, Th2 (°C)  23 20.22  15 0.53  15 0.7 in Table  17 20.15  f  - fLA) × T2	Oct 0.88 20.86 20.21 0.84 e 9c) 20.05 LA = Liv	Nov 0.98 20.61 20.21 0.98	Dec 1 20.38 20.2 0.99 19.37		(85) (86) (87) (88) (89) (90) (91)
7. Mean intermoderature Utilisation fa  (86)m= 0.99  Mean intermoderature (87)m= 20.41  Temperature (88)m= 20.19  Utilisation fa (89)m= 0.99  Mean intermoderature (90)m= 19.4	rnal temper e during head temperate 20.56 e during head 20.2 ctor for gain 19.62 e during head 19.97 e dur	rature ( ating pens for li Mar 0.94  ure in li 20.72  ating pens for re 0.93  ure in t 19.85  ure (for	heating eriods in ving area 20.87 eriods in 20.21 est of dw 0.82 he rest of 20.05 er the who 20.36	the living a, h1,m ( May 0.69 at T1 (foll 20.94 at 20.21 at 20.21 at 20.13 at 20.13 at 20.13 at 20.14 at 20.13 at 20.14	g area see Ta Jun 0.5 ow ste 20.96 welling 20.23 2,m (se 0.44 g T2 (f 20.16	996.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table 20.23  ee Table  0.29  ollow stell 20.16	All 0.3 All 0.3 All 1 Al	Th1 (°C)  ug Sep  88 0.6  Table 9c)  96 20.95  9, Th2 (°C)  23 20.22  12 0.53  to 7 in Tabl  17 20.15  f	Oct 0.88  20.86  20.21  0.84  e 9c) 20.05  LA = Liv	Nov 0.98 20.61 20.21 0.98 19.7 ring area ÷ (4	Dec 1 20.38 20.2 0.99		(85) (86) (87) (88) (89) (90)







Water heating fuel used 2495.85 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 272.49 central heating pump: (230c)30 sum of (230a)...(230g) = Total electricity for the above, kWh/year 302.49 (231)Electricity for lighting (232)396.63 12a. CO2 emissions – Individual heating systems including micro-CHP **Energy Emission factor Emissions** kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261)0.216 424.02 (215) x Space heating (secondary) (263)0.519 0 (219) x Water heating (264)0.216 539.1 (261) + (262) + (263) + (264) =Space and water heating 963.12 (265)(231) x Electricity for pumps, fans and electric keep-hot 0.519 (267)156.99 (232) x Electricity for lighting (268)0.519 205.85 sum of (265)...(271) = Total CO2, kg/year (272)1325.97  $(272) \div (4) =$ **Dwelling CO2 Emission Rate** (273)13.62 El rating (section 14) (274)88



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 31 - 3B6P - TF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 192.4 (1a) x (2a) =(3a) 2.6 500.24 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)192.4 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =500.24 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.14 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



174.9<sub>age 2</sub> of 39)

Average =  $Sum(39)_{1...12}/12=$ 

## DER WorkSheet: New dwelling design stage

0.18	ration rat	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	1	
alculate effe		_	rate for t	he appli	cable ca	se		l			!		
If mechanic												0.5	(2
If exhaust air		0 11		, ,	,	. `	,, .	,	) = (23a)			0.5	(2
If balanced wi	th heat rec	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =				75.65	(2
a) If balance	ed mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
1a)m= 0.3	0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28	]	(2
b) If balance	ed mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b	m = (22)	2b)m + (	23b)		,	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole				•	•								
	m < 0.5	<del>``</del>	<u> </u>	<del></del>	ŕ	<u> </u>	<del>_``</del>	ŕ	· ` `	ŕ	1	1	
4c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(2
d) If natura				•	•				0.51				
	$\frac{m = 1, th}{1}$	en (24a)	m = (22)	o)m otne		4a)m =	0.5 + [(2	20)m² x	0.5]	0	0	1	(:
				<u> </u>					0			]	(4
Effective ai	<del></del>		<u> </u>	<del>``</del>	<del></del>	<del>r``</del>	<del></del>	<del>`</del>	0.07	0.00	0.00	1	(:
5)m= 0.3	0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(,
. Heat loss	es and he	eat loss	oaram <b>et</b>	er:									
L <mark>EME</mark> NT	Gro		Openin		Net Ar		U-val		AXU		k-value		ΑXk
		(m²)	m	) <sup>2</sup>	A ,r		W/m2		(W/I	K)	kJ/m²-l	K	kJ/K
indows Typ					10.34	=4	/[1/( 1.1 )+		10.89				(:
in <mark>dows</mark> Typ	e 2				9.9	x1.	/[1/( 1.1 )+	0.04] =	10.43	Ц			(:
indows Typ	e 3				5.25	x1.	/[1/( 1.1 )+	0.04] =	5.53				(:
indows Typ	e 4	'			5.5	x1,	/[1/( 1.1 )+	0.04] =	5.8				(:
alls Type1	146.	45	30.9	9	115.4	6 x	0.12	= [	13.85				(:
alls Type2	26.7	73	0		26.73	3 X	0.14	=	3.78			$\neg \vdash \vdash$	(2
oof	19	1	0		191	x	0.13	<u> </u>	24.83	₹ i		7 M	<u> </u>
otal area of	elements	 s. m²	L		364.1	8	<u> </u>						^ (;
arty floor		,			191					Г			`` (;
or windows an	d roof wind	lows use e	effective wi	ndow H-va		l lated using	ı formula 1	/[(1/Ll-valu	ıe)+0 041 a	L as aiven in	naragranh		(
include the are						a.o.a a.og	, , , , , , , , , , , , , , , , , , , ,	, [( , , o , t a.a.	,	.o g o	pa.ag.ap.	. 5.2	
bric heat Ic	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				75.12	(
eat capacity	Cm = S	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	19312.16	(
nermal mas	s parame	eter (TMF	P = Cm -	: TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(:
r design asses	ssments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
n be used inst													
nermal bridg	,	,			-	K						54.63	(
<i>letails of thern</i> otal fabric h		are not kr	own (36) =	= 0.05 x (3	11)			(22) 1	(36) =				—,
		alaulata :	l manshi	a.						(25)m v: (5)		129.75	(;
entilation he	1	1	· ·		1, ,	1, ,1	۸			(25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	1
3)m= 49.3	48.73	48.16	45.29	44.72	41.86	41.86	41.29	43	44.72	45.87	47.01	]	(;
eat transfer	coefficie	nt, W/K	T	•	,	,	,	(39)m	= (37) + (	38)m		1	

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at loss para	•	<del></del>			1	1	,	<del>- ` '</del>	= (39)m ÷	r ·			
)m= 0.93	0.93	0.92	0.91	0.91	0.89	0.89	0.89	0.9	0.91	0.91	0.92		
mber of day	s in moi	nth (Tahl	le 1a)						Average =	Sum(40) <sub>1</sub> .	12 /12=	0.91	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
					<u> </u>					<u> </u>			
Water heat	ing ener	rgy requi	rement:								kWh/ye	ar:	
sumed occu			[4 0)/0	( 0 0003	)40 v /T[	-A 12.0	)2)] . O (	0012 v /	TEA 12		99		(4
f TFA > 13.9 f TFA £ 13.9		+ 1.76 X	[i - exp	(-0.0003	949 X (11	-A -13.9	)2)] + 0.(	0013 X (	IFA -13.	.9)			
nual averag											5.26		(4
duce the annua more that 125	_				_	_	to acnieve	a water us	se target o	)†			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
water usage in								Госр	1 001	1101			
m= 115.79	111.58	107.37	103.16	98.94	94.73	94.73	98.94	103.16	107.37	111.58	115.79		
								<u> </u>		M(44) <sub>112</sub> =	=	1263.13	(4
ergy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	Tm / 3600	0 kWh/mor	nth ( <mark>see Ta</mark>	ables 1b, 1	c, 1d)		
)m= 171.71	150.18	154.97	135.11	129.64	111.87	103.66	118.95	120.37	140.28	153.13	166.29		
							. / \		Total = Su	m(45) <sub>112</sub> =		1656.16	(4
st <mark>antane</mark> ous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	i) to (61)					
m= 25.76	22.53	23.25	20.27	19.45	16.78	15.55	17.84	18.06	21.04	22.97	24.94		(4
ater storage orage volum		includin	na anv so	olar or M	/WHRS	storage	within s	ame ves	امء		305		(4
community h			•						001		303		(-
nerwise if no	•			•			` '	ers) ente	er '0' in (	(47)			
ater storage	loss:		`					,	·	,			
If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):				1.	63		(4
mperature fa	actor fro	m Table	2b							0.	54		(4
ergy lost fro		-	-				(48) x (49	) =		0.	88		(5
If manufact t water stora			-										/5
community h	•			6 Z (KVV	11/11116/08	iy <i>)</i>					0		(5
lume factor	•										0		(5
mperature fa	actor fro	m Table	2b								0		(5
ergy lost fro	m water	storage	, kWh/ye	ear			(47) x (51	) x (52) x (	53) =		0		(5
nter (50) or (	54) in (5	55)								0.	88		(5
ater storage	loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m				
m= 27.29	24.65	27.29	26.41	27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(5
linder contains	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 Appendix	κН	
m= 27.29	24.65	27.29	26.41	27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(!
mary oircuit	loss (on	nual) fra	m Toble	. 3	ı						0		(5
mary circuit mary circuit	•	•			59)m = 1	(58) ± 36	35 × (41)	)m			~		,,
mary oncuit				,	•		, ,						
modified by	factor fi	rom Tabl	le H5 if t	here is s	solar wat	er heati	ng and a	a cylinde	r thermo	stat)			

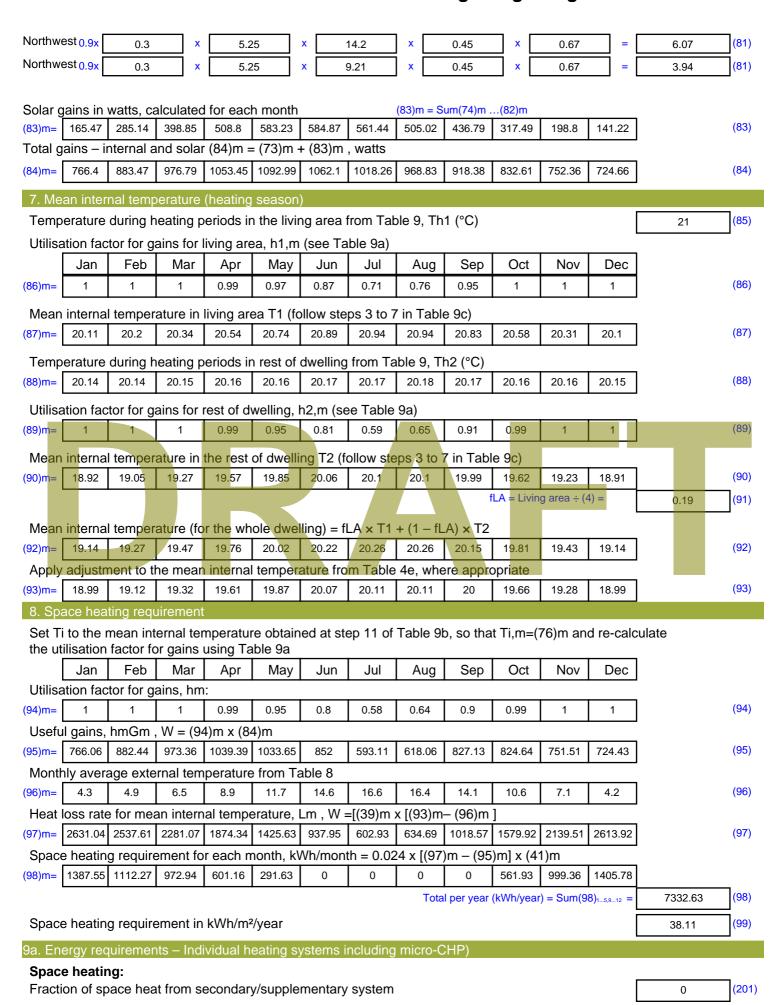


0	1- 1-(-1	<b>.</b>		(04)	(00) 0	05 (44)	<b>\</b>						
Combi loss ca					` '	<del>- ` ` `</del>		Ι ο	Ι ,	Ι ,	Ι ,	1	(61)
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0	(50)	(01)
							<del>`</del>		<del>`                                    </del>	<del>ì ´</del>	<del>`</del>	(59)m + (61)m 1	(00)
(62)m= 222.26	195.83	205.52	184.02	180.19	160.79	154.21	169.5	169.29	190.83	202.05	216.84		(62)
Solar DHW input									r contribut	tion to wate	er heating)		
(add additional		rGHKS 0	and/or v	0	applies 0	s, see Ap	pendix 0		0	0	0	1	(63)
			0	U	0			1 0				I	(00)
Output from w (64)m= 222.26	195.83	205.52	184.02	180.19	160.79	154.21	169.5	169.29	190.83	202.05	216.84	]	
(6.)	100.00		.002			1 .0	<u> </u>	tput from w		<u> </u>	l	2251.33	(64)
Heat gains fro	m water	heating	k\/\/h/m/	anth () 24	5 ′ [0 85	× (45)m							], ,
(65)m= 97.53	86.46	91.97	84.06	83.54	76.33	74.91	79.99	79.16	87.08	90.05	95.73	]	(65)
include (57)						<u> </u>		ļ		<u> </u>		l seating	, ,
5. Internal g				•	yiiriddi	3 111 1110 (	aweiiiig	g or riot w	ater is in	OIII COIII	indinty i	leating	
	Ì			) •									
Metabolic gair Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 149.6	149.6	149.6	149.6	149.6	149.6	149.6	149.6	149.6	149.6	149.6	149.6		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5	_				
(67)m= $35.19$	31.26	25.42	19.24	14.38	12.14	13.12	17.06	22.89	29.07	33.93	36.17		(67)
Appliances ga	ins (ca <mark>lc</mark>	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5				
(68)m= 363.76		358.03	337.78	312.21	288.19	272.14	268.36		298.13	323.69	347.71		(68)
Cooking gains	(calcula	ted in A	pendix	L, equat	ion L15	or L15a	), also s	see Table	5				
$(69)$ m= $\boxed{37.96}$	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.96		(69)
Pumps and fa	ns gains	(Table 5	ia)				•			•	•		
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. ev	vaporatio	n (negat	ive valu	es) (Tab	le 5)	•	•	•	•	•	•	'	
(71)m= -119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119.68		(71)
Water heating	gains (T	able 5)				•	•	•	•	•	•	•	
(72)m= 131.09	128.66	123.61	116.75	112.29	106.01	100.68	107.51	109.94	117.05	125.07	128.67		(72)
Total internal	gains =				(66	)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	(1)m + (72)	)m	•	
(73)m= 600.93	598.33	577.94	544.65	509.77	477.23	456.82	463.82	481.59	515.12	553.57	583.43		(73)
6. Solar gain	s:												
Solar gains are	calculated	using sola	r flux from	Table 6a		•	itions to d	convert to th	ne applicat		tion.		
Orientation:		actor	Area m²		Flu			g_ Table 6b	_	FF		Gains	
	Table 6d				Га	ble 6a	. –	able ob	_ '	able 6c		(W)	,
Northeast 0.9x	0.3	X	5.	5	X	11.28	X	0.45	x	0.67	=	5.05	(75)
Northeast 0.9x	0.3	Х	5.	5	x 2	22.97	X	0.45	x	0.67	=	10.28	(75)
Northeast <sub>0.9x</sub>	0.3	X	5.	5	X A	41.38	x	0.45	×	0.67	=	18.53	(75)
Northeast 0.9x	0.3	X	5.	5	x (	67.96	×	0.45	x	0.67	=	30.43	(75)
Northeast <sub>0.9x</sub>	0.3	X	5.	5	X S	91.35	X	0.45	x	0.67	=	40.9	(75)



Northeast 0.9x			,				,		1				7
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.3	X	5.5	X	97.38	X	0.45	X	0.67	=	43.6	(75)
Northeast 0.00	<u>L</u>	0.3	X	5.5	X	91.1	X	0.45	X	0.67	=	40.79	(75)
Northeast 0.5%	<u>L</u>	0.3	X	5.5	X	72.63	X	0.45	X	0.67	=	32.52	(75)
Northeast 0.9x	<u>L</u>	0.3	X	5.5	X	50.42	X	0.45	X	0.67	=	22.57	(75)
Northeast 0.9%	<u> </u>	0.3	X	5.5	X	28.07	X	0.45	X	0.67	=	12.57	(75)
Southeast 0, 9x	<u> </u>	0.3	X	5.5	X	14.2	X	0.45	X	0.67	=	6.36	(75)
Southeast 0, 9, 0, 77	<u>L</u>	0.3	X	5.5	X	9.21	X	0.45	X	0.67	=	4.13	(75)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	36.79	X	0.45	X	0.67	=	76.11	(77)
Southeast 0.9% 0.77	<u>L</u>	0.77	X	9.9	X	62.67	X	0.45	X	0.67	=	129.64	(77)
Southeast 0.9x	Southeast 0.9x	0.77	X	9.9	X	85.75	X	0.45	X	0.67	=	177.38	(77)
Southeast 0.9x	L	0.77	X	9.9	X	106.25	X	0.45	X	0.67	=	219.78	(77)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	119.01	X	0.45	X	0.67	=	246.17	(77)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	118.15	X	0.45	x	0.67	=	244.39	(77)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	113.91	x	0.45	X	0.67	=	235.62	(77)
Southeast 0,9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	104.39	x	0.45	x	0.67	=	215.93	(77)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	92.85	X	0.45	X	0.67	=	192.06	(77)
Southeast 0.9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	69.27	x	0.45	X	0.67	=	143.28	(77)
Southwesto, 9x	Southeast <sub>0.9x</sub>	0.77	X	9.9	X	44.07	Х	0.45	X	0.67	-	91.16	(77)
Southwest0.9x 0.77	Southeast 0.9x	0.77	x	9.9	х	31.49	×	0.45	x	0.67	=	65.13	(77)
Southwesto.9x 0.77 x 10.34 x 106.25	Southwest <sub>0.9x</sub>	0.77	x	10.34	х	36.79		0.45	X	0.67	=	79.49	(79)
Southwesto.9x         0.77         x         10.34         x         106.25         0.45         x         0.67         =         229.55         (79)           Southwesto.9x         0.77         x         10.34         x         118.15         0.45         x         0.67         =         257.11         (79)           Southwesto.9x         0.77         x         10.34         x         1118.15         0.45         x         0.67         =         255.26         (79)           Southwesto.9x         0.77         x         10.34         x         113.91         0.45         x         0.67         =         246.09         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         149.65         (79)           Southwesto.9x <t< td=""><td>Southwest<sub>0.9x</sub></td><td>0.77</td><td>X</td><td>10.34</td><td>X</td><td>62.67</td><td></td><td>0.45</td><td>X</td><td>0.67</td><td>=</td><td>135.4</td><td>(79)</td></t<>	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	62.67		0.45	X	0.67	=	135.4	(79)
Southwesto.9x         0.77         x         10.34         x         1/9.01         0.45         x         0.67         =         257.11         (79)           Southwesto.9x         0.77         x         10.34         x         118.15         0.45         x         0.67         =         255.26         (79)           Southwesto.9x         0.77         x         10.34         x         113.91         0.45         x         0.67         =         246.09         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         92.85         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         149.65         (79)           Southwesto.9x	Southwest <sub>0.9x</sub>	0.77	x	10.34	X	85.75		0.45	X	0.67	=	185.26	(79)
Southwesto.9x         0.77         x         10.34         x         118.15         0.45         x         0.67         =         255.26         (79)           Southwesto.9x         0.77         x         10.34         x         113.91         0.45         x         0.67         =         246.09         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         92.85         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         149.65         (79)           Southwesto.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         95.21         (79)           Northwesto.9x <td>Southwest<sub>0.9x</sub></td> <td>0.77</td> <td>x</td> <td>10.34</td> <td>x</td> <td>106.25</td> <td></td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>229.55</td> <td>(79)</td>	Southwest <sub>0.9x</sub>	0.77	x	10.34	x	106.25		0.45	X	0.67	=	229.55	(79)
Southwesto.9x         0.77         x         10.34         x         113.91         0.45         x         0.67         =         246.09         (79)           Southwesto.9x         0.77         x         10.34         x         104.39         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         200.6         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         149.65         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         149.65         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.45         x         0.67         =         95.21         (79)           Southwesto.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         4.82         (81)           Northwest 0.9x	Southwest <sub>0.9x</sub>	0.77	x	10.34	x	119.01		0.45	X	0.67	=	257.11	(79)
Southwesto.9x         0.77         x         10.34         x         104.39         0.45         x         0.67         =         225.53         (79)           Southwesto.9x         0.77         x         10.34         x         92.85         0.45         x         0.67         =         200.6         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         149.65         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         95.21         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.45         x         0.67         =         95.21         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         95.21         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         4.82         (81)           Nort	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	118.15		0.45	X	0.67	=	255.26	(79)
Southwesto.9x         0.77         x         10.34         x         92.85         0.45         x         0.67         =         200.6         (79)           Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         149.65         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         95.21         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.45         x         0.67         =         95.21         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         68.03         (79)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.45         x         0.67         =         4.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         17.68         (81)	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	113.91		0.45	X	0.67	=	246.09	(79)
Southwesto.9x         0.77         x         10.34         x         69.27         0.45         x         0.67         =         149.65         (79)           Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         95.21         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.45         x         0.67         =         68.03         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         68.03         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         4.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         17.68         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.45         x         0.67         =         29.04         (81)	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	104.39		0.45	X	0.67	=	225.53	(79)
Southwesto.9x         0.77         x         10.34         x         44.07         0.45         x         0.67         =         95.21         (79)           Southwesto.9x         0.77         x         10.34         x         31.49         0.45         x         0.67         =         68.03         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         4.82         (81)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.45         x         0.67         =         9.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         9.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         29.04         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.45         x         0.67         =         39.04	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	92.85		0.45	x	0.67	=	200.6	(79)
Southwesto.9x         0.77         x         10.34         x         31.49         0.45         x         0.67         =         68.03         (79)           Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         4.82         (81)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.45         x         0.67         =         9.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         17.68         (81)           Northwest 0.9x         0.3         x         5.25         x         67.96         x         0.45         x         0.67         =         29.04         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.45         x         0.67         =         39.04         (81)           Northwest 0.9x         0.3         x         5.25         x         97.38         x         0.45         x         0.67         =	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	69.27		0.45	X	0.67	=	149.65	(79)
Northwest 0.9x         0.3         x         5.25         x         11.28         x         0.45         x         0.67         =         4.82         (81)           Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.45         x         0.67         =         9.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         17.68         (81)           Northwest 0.9x         0.3         x         5.25         x         67.96         x         0.45         x         0.67         =         29.04         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.45         x         0.67         =         39.04         (81)           Northwest 0.9x         0.3         x         5.25         x         97.38         x         0.45         x         0.67         =         41.62         (81)           Northwest 0.9x         0.3         x         5.25         x         72.63         x         0.45         x         0.67         =	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	44.07		0.45	X	0.67	=	95.21	(79)
Northwest 0.9x         0.3         x         5.25         x         22.97         x         0.45         x         0.67         =         9.82         (81)           Northwest 0.9x         0.3         x         5.25         x         41.38         x         0.45         x         0.67         =         17.68         (81)           Northwest 0.9x         0.3         x         5.25         x         67.96         x         0.45         x         0.67         =         29.04         (81)           Northwest 0.9x         0.3         x         5.25         x         91.35         x         0.45         x         0.67         =         39.04         (81)           Northwest 0.9x         0.3         x         5.25         x         97.38         x         0.45         x         0.67         =         41.62         (81)           Northwest 0.9x         0.3         x         5.25         x         91.1         x         0.45         x         0.67         =         38.93         (81)           Northwest 0.9x         0.3         x         5.25         x         72.63         x         0.45         x         0.67         =	Southwest <sub>0.9x</sub>	0.77	X	10.34	X	31.49		0.45	X	0.67	=	68.03	(79)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	11.28	X	0.45	X	0.67	=	4.82	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	22.97	X	0.45	x	0.67	] =	9.82	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	41.38	X	0.45	x	0.67	=	17.68	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	67.96	X	0.45	X	0.67	=	29.04	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	91.35	X	0.45	x	0.67	=	39.04	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	×	97.38	x	0.45	x	0.67	] =	41.62	(81)
Northwest 0.9x	Northwest 0.9x	0.3	X	5.25	X	91.1	X	0.45	x	0.67	=	38.93	(81)
	Northwest 0.9x	0.3	X	5.25	×	72.63	x	0.45	x	0.67	] =	31.04	(81)
Northwest $0.9x$ 0.3 x 5.25 x 28.07 x 0.45 x 0.67 = 12 (81)	Northwest 0.9x	0.3	X	5.25	×	50.42	X	0.45	x	0.67	] =	21.55	(81)
	Northwest 0.9x	0.3	×	5.25	x	28.07	×	0.45	x	0.67	=	12	(81)







Fraction of space heat from main system(s)		(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from main system 1		(204) = (20	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1							91.9	(206)
Efficiency of secondary/supplementary heating s	ystem, %					_	0	(208)
	Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)  1387.55   1112.27   972.94   601.16   291.63	0 0	0	0	561.93	999.36	1405.78	1	
	0   0	0	0	361.93	999.30	1405.76		(211)
$ (211)m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ 1509.85 \ 1210.31 \ 1058.7 \ 654.15 \ 317.34 $	0 0	0	0	611.45	1087.45	1529.68		(211)
			l (kWh/yea	ar) =Sum(2			7978.92	(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		<b>¬</b>
		lota	I (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	F	0	(215)
Water heating Output from water heater (calculated above)								
	60.79 154.21	169.5	169.29	190.83	202.05	216.84		
Efficiency of water heater							81.8	(216)
(217)m= 90.36 90.23 89.96 89.32 87.76 8	81.8	81.8	81.8	89.11	90.03	90.41		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m								
`	96.56 188.52	207.21	206.96	214.15	224.42	239.84		
		Tota	I = Sum(2	19a) <sub>112</sub> =			2580.47	(219)
Annual totals				k'	Wh/year	•	kWh/year	
Space heating fuel used, main system 1							7978.92	╡
Water heating fuel used							2580.47	╛
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or posi	itive input fror	n outside	9			465.35		(230a
central heating pump:						30		(2300
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			495.35	(231)
Electricity for lighting							621.47	(232)
12a. CO2 emissions – Individual heating systems	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	=	1723.45	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	
Water heating	(219) x			0.2		=	557.38	(264)
Space and water heating	(261) + (262)	+ (263) + (	264) =	<u> </u>	. •		2280.83	(265)
•	(231) x	( / (	,	0.5	40	=		
Electricity for pumps, fans and electric keep-hot				0.5			257.09	(267)
Electricity for lighting	(232) x			0.5	19 I	=	322.54	(268)



Total CO2, kg/year

**Dwelling CO2 Emission Rate** 

El rating (section 14)

sum of (265)...(271) =

 $(272) \div (4) =$ 

2860.46 (272)

14.87 (273)

84 (274)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 32 - 2B4P - TF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.4 (2a) =283.2 (3a) 118 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)118 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =283.2 (5) total m<sup>3</sup> per hour main secondary other heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18



0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	1	
alculate effec		-	rate for t	he appli	cable ca	se							
If mechanica												0.5	(
If exhaust air he									) = (23a)			0.5	(
If balanced with												73.95	(
a) If balance						<u> </u>	<del></del>	<del>``</del>	<del>- ` `</del>	<del></del>	<del>` ` ´</del>	÷ 100]	
la)m= 0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	]	(
b) If balance		1					<u> </u>	<u> </u>	<del></del>	<del></del>	ī	1	
b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
c) If whole he				•	•				F (00)	,			
if (22b)m	1 < 0.5 ×	(230), t	<u> </u>	(230)	o); otnerv	· ` ·	ŕ	0) m + 0.	· `	<del></del>		1	
c)m= 0			0			0	0		0	0	0	J	
d) If natural v if (22b)m									0.5]			_	
d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
Effective air	change	rate - er	nter (24a	or (24k	o) or (24	c) or (24	d) in box	(25)				_	
i)m= 0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28		(
. Heat losses	and he	at loss i	naramet	or.								_	-
EMENT	Gros		Openin		Net Ar	ea	U-valı	IE.	AXU		k-value	a .	ΑΧk
	area		m		A ,r		W/m2		(W/I	K)	kJ/m <sup>2</sup> ·l		kJ/K
n <mark>dows</mark> Type	1				6.2	x1.	/[1/( 1.1 )+	0.04] =	6.53				
n <mark>dows</mark> Type	2				0.36	x1.	/[1/( 1.1 )+	0.04] =	0.38	П			
alls Type1	103.	96	6.56		97.4	X	0.12	=	11.69	П			
alls Type2	4.93	3	0	= "	4.93	x	0.14	=	0.7	٦ i		5 F	
of	118	3	0		118	×	0.13	<u> </u>	15.34	<b>=</b>		7 F	
tal area of e	lements	 , m²			226.8	9							
r windows and			effective wi	ndow U-va			formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	n 3.2	
nclude the area	s on both	sides of in	nternal wal	ls and par	titions								
bric heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				34.64	
at capacity (	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	8224.8	2
ermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	
r design assess n be used instea				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
ermal bridge				ısina Ar	nendix k	<b>(</b>						34.03	
etails of therma	,	,		• .	•	`						34.03	'
tal fabric hea			()	(1	,			(33) +	(36) =			68.67	
ntilation hea	t 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	]	
)m= 27.37	27.07	26.77	25.28	24.98	23.49	23.49	23.19	24.09	24.98	25.58	26.17	1	
at transfer c	oefficier	nt, W/K			•			(39)m	= (37) + (37)	38)m	•	•	
	95.74	95.44	93.95	93.65	92.16	92.16	91.86	92.76	93.65	94.25	94.84	]	
)m= 96.03													



Heat loss para	meter (l	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.81	0.81	0.81	0.8	0.79	0.78	0.78	0.78	0.79	0.79	0.8	0.8		
Number of day	e in mo	oth (Tab	lo 1a)			ļ.	<u>!</u>		Average =	Sum(40) <sub>1</sub>	12 /12=	0.8	(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	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13		86		(42)
Annual averag Reduce the annua not more that 125	al average	hot water	usage by	$5\%$ if the $\alpha$	lwelling is	designed			se target o		2.01		(43)
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= 112.21	108.13	104.05	99.97	95.89	91.81	91.81	95.89	99.97	104.05	108.13	112.21		<b>—</b> ,,,
Energy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1224.14	(44)
(45)m= 166.41	145.54	150.19	130.94	125.64	108.41	100.46	115.28	116.66	135.95	148.41	161.16		
									Total = Su	m(45) <sub>112</sub> =		1605.05	(45)
If inst <mark>antane</mark> ous w	ater he <mark>ati</mark>	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)					
(46)m= 24.96 Water storage	21.83	22.53	19.64	18.85	16.26	15.07	17.29	17.5	20.39	22.26	24.17		(46)
Storage volum		includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		250		(47)
If community h	eating a	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
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		eclared l	nss facto	nr is kna	wn (k\/\/h	n/day)·					49		(48)
Temperature fa				31 10 11110	**** (1.000)	ı, aay,					54		(49)
Energy lost fro				ear			(48) x (49)	) =			.8		(50)
b) If manufact	urer's d	eclared o	ylinder l	oss fact									( )
Hot water stora	-			e 2 (kW	h/litre/da	ay)					0		(51)
If community h Volume factor	_		JII 4.3								0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m watei	· storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (	(54) in (5	55)								0	.8		(55)
Water storage	loss cal	culated f	or each	month	_		((56)m = (	55) × (41)	m				
(56)m= 24.94	22.53	24.94	24.14	24.94	24.14	24.94	24.94	24.14	24.94	24.14	24.94		(56)
f cylinder contains	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 Appendi	x H	
(57)m= 24.94	22.53	24.94	24.14	24.94	24.14	24.94	24.94	24.14	24.94	24.14	24.94		(57)
Primary circuit	•	,									0		(58)
Primary circuit				,	•	. ,	, ,		r 4b	otot)			
(modified by					ı —		<u> </u>	<u> </u>		<del>-                                    </del>	22.06		(59)
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

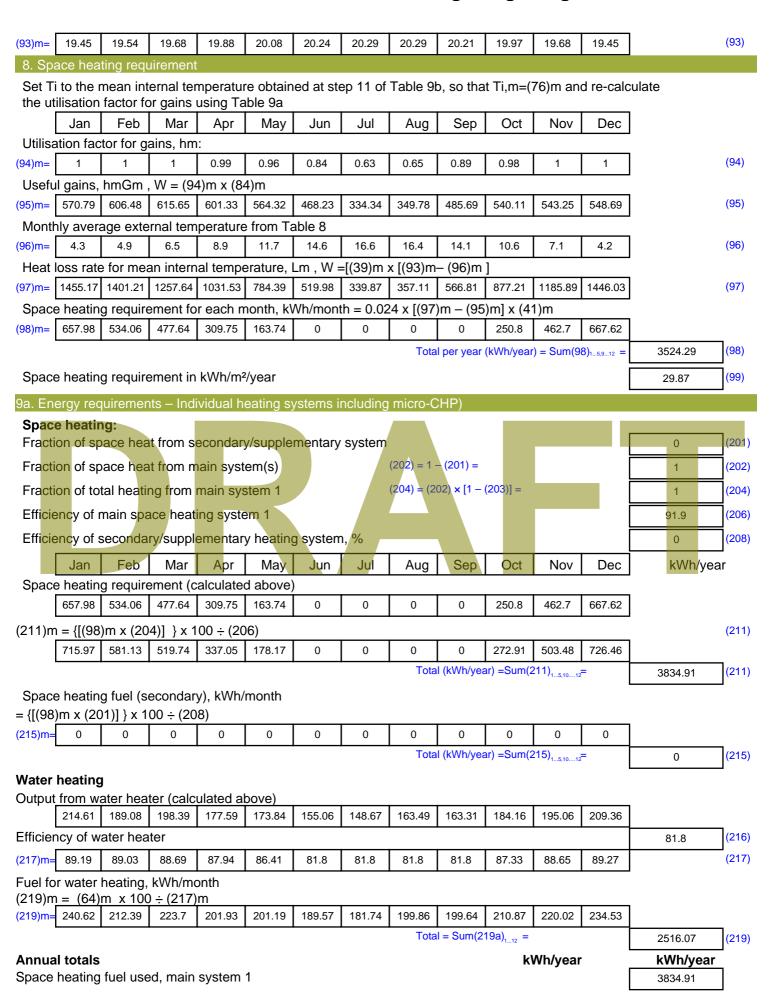


Combi loss calculated for each month (61)m = (60) $\div$ 365 x (41)m													
(61)m= 0	0 0	0	0	0	00) + 30	0	0	T 0	0	0	0	1	(61)
	uired for	water h	L eating ca	Lalculated	for eac	L h month	(62)m	= 0.85 × 0	L (45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 214.6°	<del>-</del>	198.39	177.59	173.84	155.06	148.67	163.49		184.16	195.06	209.36	]	(62)
Solar DHW inpu	t calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter	'0' if no sola	r contribu	tion to wate	er heating)	J	
(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	ter										_	
(64)m= 214.6°	189.08	198.39	177.59	173.84	155.06	148.67	163.49	163.31	184.16	195.06	209.36		,
							Οι	itput from w	ater heate	er (annual) <sub>1</sub>	112	2172.62	(64)
Heat gains fr	om water	heating,	kWh/m		5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]	
(65)m= 93.89	83.22	88.5	80.86	80.34	73.37	71.97	76.9	76.11	83.77	86.66	92.15		(65)
include (57	)m in cald	culation	of (65)m	only if c	ylinder i	s in the o	dwellin	g or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a	):									
Metabolic ga								1 -		T		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	<del></del>	Oct	Nov	Dec		(00)
(66)m= 142.76		142.76	142.76	142.76	142.76	142.76	142.76	1	142.76	142.76	142.76		(66)
Lighting gain	<u> </u>		_									1	(07)
(67)m= 32.48		23.46	17.76	13.28	11.21	12.11	15.74	21.13	26.83	31.31	33.38		(67)
Appliances g	<u> </u>								_			1	(00)
(68)m= 282.59		278.13	262.4	242.54	223.88	211.41	208.48		231.6	251.45	270.12		(68)
Cooking gain	<u> </u>								_	07.00	1 .7.00	1	(00)
(69)m= 37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28		(69)
Pumps and fa	1	·		_			l ,	1 2	Ι ,	1 ,	Ι ,	1	(70)
(70)m= 3	3	3	3	3 > ( <b>T</b>	3	3	3	3	3	3	3	J	(70)
Losses e.g. 6	<del></del>	<del>``</del>		<del></del>		111 21	1440	111121	14404	144.04	14424	1	(71)
(71)m= -114.2		-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	J	(7-1)
Water heatin (72)m= 126.2	<u> </u>	118.95	112.3	107.98	101.9	96.73	103.35	105.71	112.59	120.37	123.86	1	(72)
` '		<u> </u>	112.3	107.96		<u> </u>		n + (69)m +			I		(12)
<b>Total interna</b> (73)m= 510.1	507.04	489.37	461.29	432.63	405.81	389.08	396.4	411.53	439.85	471.96	496.18	1	(73)
6. Solar gai		400.01	401.20	402.00	400.01	000.00	000.4	411.00	400.00	47 1.00	400.10		(1-2)
Solar gains are		using sola	r flux from	Table 6a	and assoc	iated equa	itions to	convert to th	ne applica	ble orientat	tion.		
Orientation:	Access F	actor	Area		Flu	X		g_		FF		Gains	
	Table 6d		m²		Tal	ble 6a		Table 6b	Т	able 6c		(W)	
North 0.9x	0.77	х	0.3	36	x 1	0.63	х	0.45	х	0.67	=	0.8	(74)
North 0.9x	0.77	X	0.3	36	x 2	20.32	x	0.45	x [	0.67	=	1.53	(74)
North 0.9x	0.77	X	0.3	36	x 3	34.53	х	0.45	x [	0.67	=	2.6	(74)
North 0.9x	0.77	X	0.3	36	x 5	55.46	х	0.45	x [	0.67	=	4.17	(74)
North 0.9x	0.77	X	0.3	36	x 7	4.72	x	0.45	x [	0.67	=	5.62	(74)



	North 0.9x 0.77 x 0.36 x 79.99 x 0.45 x 0.67 = 6.02 (74)														
North	0.9x	0.77	X	0.3	6	X	7	9.99	x	0.45	X	0.67	=	6.02	(74)
North	0.9x	0.77	X	0.3	6	X	7	4.68	x	0.45	X	0.67	=	5.62	(74)
North	0.9x	0.77	X	0.3	6	X	5	9.25	x	0.45	X	0.67	=	4.46	(74)
North	0.9x	0.77	X	0.3	6	X	4	1.52	x	0.45	x	0.67	=	3.12	(74)
North	0.9x	0.77	X	0.3	6	X	2	4.19	x	0.45	x	0.67	=	1.82	(74)
North	0.9x	0.77	X	0.3	6	X	1	3.12	x	0.45	x	0.67	=	0.99	(74)
North	0.9x	0.77	X	0.3	6	X	8	3.86	x	0.45	x	0.67	=	0.67	(74)
South	0.9x	0.77	X	6.2	2	X	4	6.75	x	0.45	x	0.67	=	60.56	(78)
South	0.9x	0.77	X	6.2	2	X	7	6.57	x	0.45	X	0.67	=	99.19	(78)
South	0.9x	0.77	X	6.2	2	X	9	7.53	x	0.45	x	0.67	=	126.35	(78)
South	0.9x	0.77	X	6.2	2	X	11	0.23	x	0.45	x	0.67	=	142.8	(78)
South	0.9x	0.77	X	6.2	2	X	11	4.87	x	0.45	X	0.67	=	148.81	(78)
South	0.9x	0.77	X	6.2	2	X	11	0.55	x	0.45	x	0.67	=	143.21	(78)
South	0.9x	0.77	X	6.2	2	X	10	08.01	x	0.45	X	0.67	=	139.92	(78)
South	0.9x	0.77	X	6.2	2	X	10	)4.89	x	0.45	X	0.67	=	135.88	(78)
South	0.9x	0.77	X	6.2	2	X	10	1.89	x	0.45	x	0.67	=	131.99	(78)
South	0.9x	0.77	X	6.2	2	X	8	2.59	x	0.45	X	0.67	=	106.98	(78)
South	0.9x	0.77	X	6.2	2	X	5	5.42	Х	0.45	X	0.67	=	71.79	(78)
South	0.9x	0.77	X	6.2	2	X	4	0.4	x	0.45	x	0.67		52.33	(78)
Solar g		atts, <mark>calcul</mark>	ated	for each	n month	1			(83)m	= Sum(74)m.	(82)m			,	
(83)m=			3.95	146.97	154.43	<u> </u>	49.22	145.54	140	.34 135.11	108.8	72.78	53		(83)
		ternal and s	_			_								,	(0.1)
(84)m=	571.46	607.76 618	3.32	608.26	587.05	5	55.04	534.62	536	.74 546.64	548.6	5 544.74	549.18		(84)
7. Me	an intern	al temperat	ture (	heating	seaso	า)									_
Temp	erature c	luring heati	ng pe	eriods in	the liv	ing	area f	rom Tab	ole 9,	Th1 (°C)				21	(85)
Utilisa	ation factor	or for gains	-	ving are		<u> →</u>	ee Ta	ble 9a)					<del></del>	1	
	Jan		1ar	Apr	May	+	Jun	Jul		ug Sep	Oct	+	Dec		
(86)m=	1	1 /	1	0.99	0.98		0.9	0.73	0.7	75 0.93	0.99	1	1		(86)
Mean	internal	temperatur	e in l	iving are	ea T1 (1	ollo	w ste	os 3 to 7	in T	able 9c)				-	
(87)m=	20.3	20.37 20	.47	20.62	20.77	:	20.9	20.95	20.	95 20.88	20.69	20.47	20.29		(87)
											-				
Temp	erature c	luring heati	ng pe	eriods in	rest of	f dw	elling	from Ta	ble 9	9, Th2 (°C)					
Temp (88)m=	erature o		ng pe	eriods in	20.26	_	elling 0.27	from Ta	ble 9	<del></del>	20.26	20.25	20.25	]	(88)
(88)m=	20.24	20.24 20	.25	20.26	20.26	2	0.27	20.27	20.	<del></del>	20.26	20.25	20.25	]	(88)
(88)m=	20.24	20.24 20 or for gains	.25	20.26	20.26	h2,	0.27	20.27	20.	27 20.27	20.26	20.25	20.25	] ]	(88)
(88)m= Utilisa (89)m=	20.24 ation factor	20.24 20 or for gains	.25 for r	20.26 est of dv 0.99	20.26 welling, 0.97	h2,	m (se	20.27 e Table 0.62	20.: 9a) 0.6	27 20.27	0.99		!	]	
(88)m= Utilisa (89)m= Mean	20.24 ation factor	20.24 20 or for gains 1	.25 for r	20.26 est of dv 0.99	20.26 welling, 0.97	h2,	m (se	20.27 e Table 0.62	20.: 9a) 0.6	27 20.27 5 0.89 to 7 in Table	0.99	1	!	]	
(88)m= Utilisa (89)m=	20.24 ation factor 1 internal	20.24 20 or for gains 1	for ro	20.26 est of dv 0.99 he rest of	20.26 welling, 0.97 of dwel	h2,	m (se 0.85	e Table 0.62 ollow ste	20.: 9a) 0.6	27 20.27 55 0.89 to 7 in Tabl 21 20.13	0.99 le 9c)	1	19.28	0.31	(89)
(88)m=  Utilisa (89)m=  Mean (90)m=	20.24 ation factor 1 internal 19.29	20.24 20 or for gains 1 temperature 19.38 19	for rolling for the in t	20.26 est of dv 0.99 he rest of the rest o	20.26 welling, 0.97 of dwel 19.98	h2,	m (se 0.85 T2 (fo 0.16	e Table 0.62 bllow ste 20.21	20 9a) 0.6 pps 3	27 20.27 55 0.89 to 7 in Tabl 21 20.13	0.99 le 9c)	19.55	19.28	0.31	(89)
(88)m=  Utilisa (89)m=  Mean (90)m=	20.24 ation factor internal 19.29 internal	20.24 20 or for gains 1 temperature 19.38 19 temperature	for rolling for ro	20.26 est of dv 0.99 he rest of 19.76	20.26 welling, 0.97 of dwel 19.98	h2, ling 2	m (se 0.85 T2 (fo 0.16 g) = fL	20.27 e Table 0.62 bllow ste 20.21  A × T1	20.: 9a) 0.6 pps 3 20.:	27 20.27 55 0.89 to 7 in Tabl 21 20.13 - fLA) × T2	0.99 le 9c) 19.86 fLA = Liv	19.55	19.28	0.31	(89) (90) (91)
(88)m=  Utilisa (89)m=  Mean (90)m=  Mean (92)m=	20.24 ation factor internal 19.29 internal 19.6	20.24 20 or for gains 1 temperature 19.38 19 temperature 19.69 19	for re 1 e in t .54 e (for	20.26 est of dv 0.99 he rest of 19.76 the who	20.26  welling, 0.97  of dwel 19.98  ole dwe 20.23	h2, h2, ling 2	m (se 0.85 T2 (fc 0.16 g) = fL 0.39	20.27 e Table 0.62 bllow ste 20.21  A × T1 20.44	20.: 9a) 0.6 ps 3 20.: + (1	27 20.27 55 0.89 to 7 in Tabl 21 20.13 - fLA) × T2	0.99 le 9c) 19.86 fLA = Liv	19.55 ring area ÷ (-	19.28	0.31	(89)







Water heating fuel used 2516.07 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 293.68 central heating pump: (230c)30 sum of (230a)...(230g) = Total electricity for the above, kWh/year 323.68 (231)Electricity for lighting (232)573.57 12a. CO2 emissions – Individual heating systems including micro-CHP **Energy Emission factor Emissions** kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261)0.216 828.34 (215) x Space heating (secondary) (263)0.519 0 (219) x Water heating (264)0.216 543.47 (261) + (262) + (263) + (264) =Space and water heating 1371.81 (265)(231) x Electricity for pumps, fans and electric keep-hot 0.519 (267)167.99 Electricity for lighting (232) x (268)0.519 297.68 sum of (265)...(271) = Total CO2, kg/year (272)1837.48  $(272) \div (4) =$ **Dwelling CO2 Emission Rate** 15.57 (273)El rating (section 14) (274)85



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 33 - 1B2P -TF (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.4 (2a) =(3a) 59.88 143.71 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)59.88 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =143.71 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.12 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
alculate effec		_	rate for t	he appli	cable ca	se	<u> </u>			ļ.	!		
If mechanica												0.5	(2
If exhaust air he		0		, ,	,	. `	,, .	`	) = (23a)			0.5	(2
If balanced with		•	•	•		,		,				73.1	(2
a) If balance					·	<del>- ` ` </del>	<del>- ^ `</del>	<del>í `</del>	<del>– `</del>	<del></del>	<del>' ' '</del>	⊢÷ 100] 1	"
4a)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	]	(2
b) If balance						<del>-                                    </del>	<del>, ``</del>	ŕ	<del>r ´       `</del>	<del></del>	ı	1	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(2
c) If whole he				•	•				F (00h	. \			
if (22b)m lc)m= 0	1 < 0.5 ×	(23b), t	nen (240	(230)	o); otner	wise (24 0	$\frac{C}{C} = (22)$	o) m + 0.	.5 × (230	)   0	1 0	1	(:
									0	U	0	j	(4
d) If natural v if (22b)m									0.5]				
ld)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
Effective air	change	rate - er	nter (24a	or (24h	o) or (24	c) or (24	d) in box	x (25)				ı	
5)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27		(2
								<u> </u>					
. Heat losses									A >< 1.1				A 37.1
_EMENT	Gros area		Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-l	-	A X k kJ/K
indows					4.6		/[1/( 1.1 )+		4.85				(
all <mark>s Type1</mark>	72.9	2	4.6		68.3		0.12		8.2	Ħг			`(;
alls Type2	26.5		0	=	26.57	X	0.14	$\pm 1$	3.76	Ħ		= =	()
oof	55	_	0	╡╹			0.14			븍 片		╡	(;
otal area of e					55	×	0.13		7.15				`
or windows and			offective wi	ndow I I-ve	154.4		n formula 1	/[/1/    <sub>-</sub> val	(۱۸۵ مرامر	se aiven in	naraarank	n 2 2	(
include the area						aleu using	j iorriula i	/[( 1/ <b>U-</b> vaic	1 <del>0</del> )+0.04] a	is giveri iii	paragrapi	1 3.2	
bric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				23.95	(
eat capacity	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	7135.6	2 (
ermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	<del></del> (
r design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		
n be used instea						_							
nermal bridge	,	,		Ο.	•	<						23.17	(
letails of therma Ital fabric hea		are not kn	own (36) =	= <i>0.05 x (</i> 3	11)			(33) +	(36) =			47.40	(
entilation hea		alculator	l monthly	,					$= 0.33 \times ($	25\m v (5)	\	47.12	(
			<u> </u>		lun	Jul	Διια				Dec	1	
Jan 3)m= 13.41	Feb 13.27	Mar 13.13	Apr 12.44	May 12.31	Jun 11.62	11.62	11.48	Sep 11.89	12.31	12.58	12.86		(:
· L			12.44	12.31	11.02	11.02	11.40	<u> </u>	<u> </u>	<u>.                                    </u>	12.00	I	(-
eat transfer o									= (37) + (3			1	
0)m= 60.53	60.39	60.25	59.57	59.43	58.74	58.74	58.6	59.01	59.43	59.7	59.98	F0.7-	
( )	meter (F	HP) W	/m²K						Average = = (39)m ÷		12 /12=	59.53	(;
iat ingg nara								( )	(50)111 -	V 17			
eat loss para	1.01	1.01	0.99	0.99	0.98	0.98	0.98	0.99	0.99	1	1	]	



Number of days in month (Table 1a)

Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
n= 31	28	31	30	31	30	31	31	30	31	30	31		(4
Water h	eating ene	rgy requi	rement:								kWh/yea	ır:	
ssumed 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)													(4
	3.9, N = 1 3.9, N = 1	+ 1./6 X	[1 - exp	(-0.0003	349 x (11	-A -13.9	)2)] + 0.0	)013 x (	IFA -13.	.9)			
	rage hot wa										.18		(4
	nual average 125 litres per				_	-	to achieve	a water us	se target o	f			
Ja	<u> </u>	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ge in litres pe	l						Sep	Oct	INOV	Dec		
n= 89.	3 86.05	82.81	79.56	76.31	73.06	73.06	76.31	79.56	82.81	86.05	89.3		
	L				l .	l				m(44) <sub>112</sub> =		974.2	(4
gy conter	t of hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
n= 132.	43 115.83	119.52	104.2	99.98	86.28	79.95	91.74	92.84	108.2	118.1	128.25		<b>—</b> 1.
tantaneou	ıs water heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		Total = Su	m(45) <sub>112</sub> =		1277.33	(4
n= 19.8	6 17.37	17.93	15.63	15	12.94	11.99	13.76	13.93	16.23	17.72	19.24		(4
	ge loss:												
rage vol	ume (litre <mark>s</mark>	) inc <mark>ludi</mark> n	g any so	olar or W	WHRS	storage	within sa	ame ves	sel		150		(4
	y heating a						` '		(01) (	47)			
ter stora	no stored	not wate	er (tnis in	ciudes i	nstantar	ieous co	moi boii	ers) ente	er o in (	47)			
	acturer's d	eclared l	oss facto	or is kno	wn (kWł	n/day):				0.	99		(4
nperatur	e factor fro	m Table	2b							0.	54		(4
ergy lost	from water	rstorage	, kWh/ye	ear			(48) x (49)	) =		0.	53		(5
	acturer's d		,										
	torage loss y heating s			e∠(KVV	n/iitre/da	iy)					0		(5
	tor from Ta										0		(!
nperatur	e factor fro	m Table	2b								0		(!
rgy lost	from water	rstorage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		( !
` ,	or (54) in (	,								0.	53		(5
or otoro	ge loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m 				
er stora	7 4407	16.57	16.04	16.57	16.04	16.57	16.57	16.04	16.57	16.04	16.57		
n= 16.5						1144\1 . /5	0) alaa (F	7 m - (56)	m whore /	1 14 4 \ :a fra	A!'	1.1	(5
n= 16.5	ains dedicate		rage, (57)r	m = (56)m	x [(50) – (	H11)] ÷ (5	o), eise (5	7)111 = (30)	iii wilele (	H I I ) IS II 0	m Appendix	Н	(5
n= 16.5	ains dedicate		rage, (57)r 16.04	n = (56)m 16.57	x [(50) – (	16.57	16.57	16.04	16.57	16.04	m Appendix 16.57	н	(£

23.26

(59)m =

(61)m =

23.26

21.01

Primary circuit loss calculated for each month (59)m = (58)  $\div$  365 x (41)m

22.51

Combi loss calculated for each month (61)m = (60)  $\div$  365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

22.51

23.26

23.26

22.51

23.26

22.51

23.26

23.26

(59)

(61)



(82)   (82)   (82)   (82)   (82)   (82)   (82)   (82)   (82)   (82)   (82)   (82)   (83)   (82)   (83)   (82)   (83)	Companies   Comp
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)  (a) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)ms
Column   C	(63)me
Output from water heater  (64)me	Output from water heater  (64)m=
	Cooking gains (Calculated in Appendix L, equation L9 or L9a), also see Table 5   168.09   176.03   148.06   168.09   176.03   148.06   168.09   176.03   176.03   1
Couput from water heater (annual)	Couput from water heater (annual)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (65)m = 75.9 67.3 71.61 65.49 65.11 59.53 58.45 62.37 61.71 67.84 70.11 74.51 (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 = 98.91 9	Heat gains from water heating, kWh/month 0.25 ′ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] (65)m      75.9
(65)me   75.9   67.3   71.61   65.49   65.11   59.53   58.45   62.37   61.71   67.84   70.11   74.51   (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	(65)m= 75.9 67.3 71.61 65.49 65.11 59.53 58.45 62.37 61.71 67.84 70.11 74.51 (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
S. Internal gains (see Table 5 and 5a):   Metabolic gains (Table 5), Watts   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	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
Metabolic gains (Table 5), Watts   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec   (66)m=   98.91	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
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 98.91 9	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	Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5  (67)m= 18.86	Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5  (67)m= 18.86 16.76 13.63 10.32 7.71 6.51 7.03 9.14 12.27 15.58 18.19 19.39  Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5  (68)m= 172.64 174.44 169.92 160.31 148.18 136.78 129.16 127.37 131.88 141.49 153.62 165.03  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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= 18.86 16.76 13.63 10.32 7.71 6.51 7.03 9.14 12.27 15.58 18.19 19.39 (67)  Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 172.64 174.44 169.92 160.31 148.18 136.78 129.16 127.37 131.88 141.49 153.62 165.03 (68)  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 32.89 32.8	(67)   18.86
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5  (68)m= 172.64 174.44 169.92 160.31 148.18 136.78 129.16 127.37 131.88 141.49 153.62 165.03  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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	Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5  (68)m= 172.64 174.44 169.92 160.31 148.18 136.78 129.16 127.37 131.88 141.49 153.62 165.03  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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
(68)m = 172.64 174.44 169.92 160.31 148.18 136.78 129.16 127.37 131.88 141.49 153.62 165.03 (68)  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m = 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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	(68)m= 172.64 174.44 169.92 160.31 148.18 136.78 129.16 127.37 131.88 141.49 153.62 165.03  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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
Column	(69)m= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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
Column	(69)m= 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 32.89 (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
Crown	(70)   3   3   3   3   3   3   3   3   3
Crown	(70)   3   3   3   3   3   3   3   3   3
(71)m=	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Water heating gains (Table 5)  (72)m=	Water heating gains (Table 5)  (72)m= 102.02 100.14 96.25 90.95 87.52 82.68 78.56 83.83 85.71 91.19 97.37 100.15  Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m  (73)m= 349.2 347.01 335.47 317.25 299.08 281.64 270.43 276.02 285.53 303.94 324.86 340.24 (73)
(72)m=         102.02         100.14         96.25         90.95         87.52         82.68         78.56         83.83         85.71         91.19         97.37         100.15         (72)           Total internal gains =         (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m           (73)m=         349.2         347.01         335.47         317.25         299.08         281.64         270.43         276.02         285.53         303.94         324.86         340.24         (73)           6. Solar gains:           Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.           Orientation: Access Factor Table 6d         Area Mare Table 6a         Flux Table 6b         Table 6b         Table 6c         (W)           North         0.9x         0.77         x         4.6         x         20.32         x         0.45         x         0.67         =         19.53         (74)           North         0.9x         0.77         x         4.6         x         20.32         x         0.45         x         0.67         =         19.53         (74)           North         0.9x         0.77         x <t< td=""><td><math display="block"> \begin{array}{c ccccccccccccccccccccccccccccccccccc</math></td></t<>	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Total internal gains =	Total internal gains = $ (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m $ $ (73)m = 349.2  347.01  335.47  317.25  299.08  281.64  270.43  276.02  285.53  303.94  324.86  340.24 $ $ (73)$
(73)m=       349.2       347.01       335.47       317.25       299.08       281.64       270.43       276.02       285.53       303.94       324.86       340.24       (73)         6. Solar gains:         Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.         Orientation: Access Factor Table 6d       Area Table 6a       Flux Table 6b       Table 6b       FF       Gains (W)         North       0.9x       0.77       x       4.6       x       10.63       x       0.45       x       0.67       =       10.22       (74)         North       0.9x       0.77       x       4.6       x       20.32       x       0.45       x       0.67       =       19.53       (74)         North       0.9x       0.77       x       4.6       x       34.53       x       0.45       x       0.67       =       33.19       (74)         North       0.9x       0.77       x       4.6       x       55.46       x       0.45       x       0.67       =       53.31       (74)	(73)m= 349.2 347.01 335.47 317.25 299.08 281.64 270.43 276.02 285.53 303.94 324.86 340.24 (73)
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 $m^2$ Table 6a Table 6b Table 6c $(W)$ North $0.9x$ $0.77$ $x$ $4.6$ $x$ $10.63$ $x$ $0.45$ $x$ $0.67$ $=$ $10.22$ $(74)$ North $0.9x$ $0.77$ $x$ $4.6$ $x$ $20.32$ $x$ $0.45$ $x$ $0.67$ $=$ $19.53$ $(74)$ North $0.9x$ $0.77$ $x$ $4.6$ $x$ $34.53$ $x$ $0.45$ $x$ $0.67$ $=$ $33.19$ $(74)$ North $0.9x$ $0.77$ $x$ $4.6$ $x$ $34.53$ $x$ $0.45$ $x$ $0.67$ $=$ $33.19$ $(74)$	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.  Orientation: Access Factor Table 6d $m^2$ Table 6a $Table 6b$ Table 6b Table 6c $m^2$ Table 6a $Table 6b$ Table 6c $m^2$ Table 6a $Table 6b$ Table 6c $m^2$ Table 6b Table 6c $m^2$	6. Solar gains:
Orientation:         Access Factor Table 6d         Area m²         Flux Table 6a $g_{-}$ Table 6b         FF Table 6c         Gains (W)           North         0.9x         0.77         x         4.6         x         10.63         x         0.45         x         0.67         =         10.22         (74)           North         0.9x         0.77         x         4.6         x         20.32         x         0.45         x         0.67         =         19.53         (74)           North         0.9x         0.77         x         4.6         x         34.53         x         0.45         x         0.67         =         33.19         (74)           North         0.9x         0.77         x         4.6         x         55.46         x         0.45         x         0.67         =         53.31         (74)	
Table 6d m <sup>2</sup> Table 6a Table 6b Table 6c (W)  North 0.9x 0.77 x 4.6 x 10.63 x 0.45 x 0.67 = 10.22 (74)  North 0.9x 0.77 x 4.6 x 20.32 x 0.45 x 0.67 = 19.53 (74)  North 0.9x 0.77 x 4.6 x 34.53 x 0.45 x 0.67 = 33.19 (74)  North 0.9x 0.77 x 4.6 x 55.46 x 0.45 x 0.67 = 53.31 (74)	Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
North 0.9x 0.77	<b>5</b> –
North 0.9x 0.77	Table 6d m² Table 6a Table 6b Table 6c (W)
North 0.9x 0.77 x 4.6 x 34.53 x 0.45 x 0.67 = 33.19 (74)  North 0.9x 0.77 x 4.6 x 55.46 x 0.45 x 0.67 = 53.31 (74)	North 0.9x 0.77 x 4.6 x 10.63 x 0.45 x 0.67 = 10.22 (74)
North 0.9x 0.77 x 4.6 x 55.46 x 0.45 x 0.67 = 53.31 (74)	North 0.9x 0.77 x 4.6 x 20.32 x 0.45 x 0.67 = 19.53 (74)
0.17	North 0.9x 0.77 x 4.6 x 34.53 x 0.45 x 0.67 = 33.19 (74)
North 0.97 0.77 × 0.65 × 74.70 × 0.67 - 74.94 (74)	North 0.9x 0.77 x 4.6 x 55.46 x 0.45 x 0.67 = 53.31 (74)
1.01	North 0.9x 0.77 x 4.6 x 74.72 x 0.45 x 0.67 = 71.81 (74)
North 0.9x 0.77 x 4.6 x 79.99 x 0.45 x 0.67 = 76.88 (74)	North 0.9x 0.77 x 4.6 x 79.99 x 0.45 x 0.67 = 76.88 (74)

74.68

59.25

0.45

0.67

0.67

North

North

0.9x

0.9x

0.77

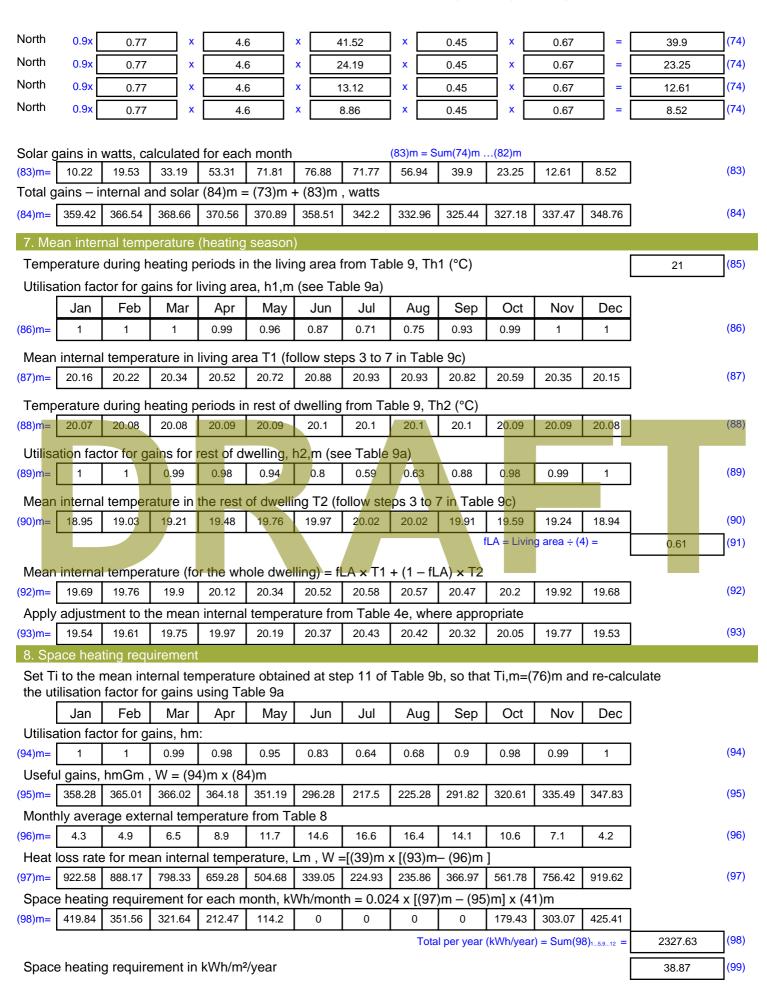
71.77

56.94

(74)

(74)







9a. Energy requirements	– Individual h	neating sy	/stems i	ncluding	micro-C	HP)					
Space heating:		<u> </u>				,					(004)
Fraction of space heat fr			mentary	•		(201) -				0	(201)
Fraction of space heat fr	•	` '			(202) = 1 -		(202)]			1	(202)
Fraction of total heating	•				(204) = (20	J2) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main space				<b>-</b> 0/						91.9	(206)
Efficiency of secondary/s	· ·	·	-	1						0	(208)
Jan Feb Space heating requirement	Mar Apr	May May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
· <del></del>	21.64 212.47	114.2	0	0	0	0	179.43	303.07	425.41		
[211)m = {[(98)m x (204)]	} x 100 ÷ (2	1———1 06)		<u> </u>	<u> </u>		<u> </u>	<u> </u>	<u> </u>	I	(211)
` <del>'                                   </del>	19.99 231.2	124.26	0	0	0	0	195.24	329.78	462.91		, , ,
	'	'		•	Tota	l (kWh/yea	ar) =Sum(2	211)		2532.78	(211)
Space heating fuel (second	• , .	/month									<u></u>
= {[(98)m x (201)] } x 100	1									1	
(215)m= 0 0	0 0	0	0	0	0 Tota	0 L(k\\\h\\ve	0 ar) =Sum(2	0	0	0	(215)
Water heating					7014	i (ittirii) y ot	ar) = <b>C</b> arri(1	- 10/15,1012	2	0	(213)
Output from water heater	(calculated a	ibove)									
	59.36 142.75	139.82	124.83	119.78	131.58	131.39	148.03	156.65	168.09		
Efficiency of water heater										81.8	(216)
	8.29 87.56	86.05	81.8	81.8	81.8	81.8	87.04	88.19	8 <mark>8.79</mark>		(217)
Fuel for water heating, kW (219)m = (64)m x 100 ÷											
	80.5 163.04	162.48	152.6	146.44	160.85	160.62	170.07	177.63	189.3		
					Tota	I = Sum(2	19a) <sub>112</sub> =			2029.05	(219)
Annual totals	main avatam	1					k'	Wh/yea	•	kWh/ye	ar
Space heating fuel used,	main system	1								2532.78	_
Water heating fuel used										2029.05	
Electricity for pumps, fans		·								-	
mechanical ventilation -	balanced, ex	tract or p	ositive i	nput fror	n outside	)			199.44		(230
central heating pump:									30		(230
Total electricity for the abo	ove, kWh/yea	ar			sum	of (230a).	(230g) =			229.44	(231)
Electricity for lighting										333.16	(232)
12a. CO2 emissions – In	dividual hea	ting syste	ems incl	uding mi	cro-CHP						
				e <b>rgy</b> /h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	Emissio	
Space heating (main system	em 1)			1) x			0.2		=	547.08	(261)
Space heating (secondary	•			5) x					=	0	(263)
	''		•	9) x			0.5				_
Water heating					. (000) : (	004)	0.2	16	=	438.28	(264)
Space and water heating			(26)	1) + (262)	+(263)+(	∠b4) =				985.36	(265)

# envision

Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	119.08	(267)
Electricity for lighting	(232)	x		0.519	=	172.91	(268)
Total CO2, kg/year			sum of	(265)(271) =		1277.34	(272)
Dwelling CO2 Emission Rate			(272) ÷	- (4) =		21.33	(273)
El rating (section 14)						84	(274)





User Details: **Assessor Name:** Stroma Number: **Software Version: Software Name:** Stroma FSAP 2012 Version: 1.0.4.23 Property Address: Gate House (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) **Basement** 36.22 (1a) x 3.2 (2a) =(3a) 115.9 Ground floor (1b) x (3b) 47.4 3.2 (2b) =151.68 First floor 36.22 (1c) x 3.2 (2c) 115.9 (3c)Second floor (1d) x 37.02 2.76 (2d) 102.18 (3d) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 156.86 (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =Dwelling volume 485.66 (5)2. Ventilation rate: main secondary other total m³ per hour heating heating x 40 =Number of chimneys 0 n 0 (6a) 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =0 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8)0 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) 0 (9)Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)(8) + (10) + (11) + (12) + (13) + (15) =Infiltration rate (16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1 Shelter factor  $(20) = 1 - [0.075 \times (19)] =$ 0.92 (20)Infiltration rate incorporating shelter factor  $(21) = (18) \times (20) =$ (21)0.14 Infiltration rate modified for monthly wind speed

Mar

Apr

Jun

May

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb



Monthly avera	ge wind s	speed fr	om Tabl	e 7									
(22)m= 5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	]	
Wind Factor (2	22a)m = (	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	
Adjusted infiltr	ation rate	e (allowi	na for st	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	1	
Calculate effe		•	rate for t	he appli	cable ca	se							(22-)
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (I	N5)) . othe	rwise (23b	) = (23a)			0.5	(23a) (23b)
If balanced with		0		, ,	, ,	. `	,, .	,	(===)			74.8	(23c)
a) If balance	ed mecha	ınical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [	1 – (23c)		(200)
(24a)m= 0.3	0.3	0.3	0.28	0.28	0.26	0.26	0.25	0.26	0.28	0.28	0.29	]	(24a)
b) If balance	ed mecha	ınical ve	entilation	without	heat rec	covery (I	ЛV) (24b	o)m = (22	2b)m + (2	23b)		-	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h				•					<b>5</b> (00)	`			
(24c)m = 0	$n < 0.5 \times$	(23b), t	nen (24)	(230) = (230)	o); otner	wise (24	(221)	o) m + 0.	$.5 \times (230)$	0	0	1	(24c)
d) If natural		-			-					0	0		(210)
,	n = 1, the								0.5]		_		
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change i	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in bo	x (25)				,	
(25)m= 0.3	0.3	0.3	0.28	0.28	0.26	0.26	0.25	0.26	0.28	0.28	0.29		(25)
3. Heat losse	s and he	at loss p	paramet	er:					_				
ELEMENT	Gros area	-	Openin		Net Ar								ΑXk
Doors Type 1		( )	m	l <sup>2</sup>	A ,r		U-val W/m2		A X U (W/ł	<)	k-value kJ/m²-l		kJ/K
Deers Ture 0		(··· <i>)</i>	m	l <sup>2</sup>		m²			_	<) 			
Doors Type 2		( )	m	) <sup>2</sup>	A ,r	m² x	W/m2	2K	(W/ł	<) 			kJ/K
Doors Type 3		(··· )	m	<b> </b> 2	A ,r	m <sup>2</sup>	1.2 1.2 1.2	2K =   =   =	(W/k 4.896	<) 			kJ/K (26)
Doors Type 3 Windows Type		(··· )	m	,2	A ,r 4.08	m <sup>2</sup>	W/m <sup>2</sup> 1.2 1.2 1.2 1.2 1.2 1.1.2	= = = = = = = = = = = = = = = = = = =	(W/k 4.896 2.916	<) 			kJ/K (26) (26)
Doors Type 3 Windows Type Windows Type	e 2	(··· /	m	,2	A ,r 4.08 2.43 2.43	m <sup>2</sup>	W/m2 1.2 1.2 1.2 1.2 (1/( 1.1 )+ (1/( 1.1 )+	=   =   =   0.04] =	(W/F 4.896 2.916 2.916	<)			kJ/K (26) (26) (26)
Doors Type 3 Windows Type Windows Type Windows Type	e 2 e 3	(··· /	m	2	A ,r 4.08 2.43 2.43 0.408	m <sup>2</sup>	W/m2 1.2 1.2 1.2 (1/(1.1)+ (1/(1.1)+ (1/(1.1)+	=     =     =     0.04  =     0.04  =	(W/k 4.896 2.916 2.916 0.43	<)			kJ/K (26) (26) (26) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4	(··· /	m	2	A ,r 4.08 2.43 2.43 0.408 1.84	m <sup>2</sup>	W/m2  1.2  1.2  1.2  (1/(1.1)+ (1/(1.1)+ (1/(1.1)+	EK =   =   =   =   =   =   =   =   =   =	(W/H 4.896 2.916 2.916 0.43 1.94	<)			kJ/K (26) (26) (26) (27) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5	(··· /	m	2	A ,r 4.08 2.43 2.43 0.408 1.84 0.408	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK =   =   =   =   =   =   =   =   =   =	(W/k 4.896 2.916 2.916 0.43 1.94 0.43	<)			kJ/K (26) (26) (26) (27) (27) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5 e 6		m	2	A ,r 4.08 2.43 2.43 0.408 1.84 0.408	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK =   =   =   =   =   =   =   =   =   =	(W/k 4.896 2.916 2.916 0.43 1.94 0.43				kJ/K (26) (26) (26) (27) (27) (27) (27)
Doors Type 3 Windows Type	e 2 e 3 e 4 e 5 e 6		m	2	A ,r 4.08 2.43 2.43 0.408 1.84 0.907	m <sup>2</sup>	W/m2  1.2  1.2  1.2  (1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+	EK = = = = = = = = = = = = = = = = = = =	(W/h 4.896 2.916 2.916 0.43 1.94 0.43 1.94 0.96	<)			kJ/K (26) (26) (26) (27) (27) (27) (27) (27)
Doors Type 3 Windows Type	e 2 e 3 e 4 e 5 e 6 e 7 e 8		m	2	A ,r  4.08  2.43  0.408  1.84  0.907  0.907  1.34  2.72	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK = = = = = = = = = = = = = = = = = = =	(W/h 4.896 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41 2.87				kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Type 3 Windows Type	e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9		m	2	A ,r  4.08  2.43  0.408  1.84  0.907  0.907  1.34  2.72  1.82	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK = = = = = = = = = = = = = = = = = = =	(W/h 4.896 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41 2.87 1.92				kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Type 3 Windows Type	e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9 e 10		m	2	A ,r  4.08  2.43  0.408  1.84  0.907  0.907  1.34  2.72	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK =   =   =   =   =   =   =   =   =   =	(W/h 4.896 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41 2.87				kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27



Windows Type 12	2.91 X	1/[1/( 1.1 )+	0.04] =	3.07				(27)
Windows Type 13	0.58 X	1/[1/( 1.1 )+	0.04] =	0.61				(27)
Floor Type 1	36.22 ×	0.12	=	4.3464				(28)
Floor Type 2	47.41 ×	0.12	=	5.6892				(28)
Walls Type1 66.24 4.08	62.16 ×	0.12	=	7.46				(29)
Walls Type2 76.51 11.17	65.34 ×	0.11	= [	7.48				(29)
Walls Type3 66.24 8.6	57.64 ×	0.12	= [	6.92				(29)
Walls Type4 75.9 4.94	70.96 ×	0.12	= [	8.52				(29)
Roof 45 0	45 X	0.13	= [	5.85				(30)
Total area of elements, m <sup>2</sup>	413.52						_	(31)
Party wall	14.08 ×	0	= [	0				(32)
Party wall	14.08 ×	0	=	0				(32)
Party wall	14.08 ×	0	=	0				(32)
Party wall	9.91 ×	0	=	0				(32)
Party floor	36.22							(32a)
Party floor	37.02							(32a)
Party ceiling	36.22							(32b)
Party ceiling	47.4							(32b)
Party ceiling	36.22							(32b)
* for windows and roof windows, use effective window U-va ** include the areas on both sides of internal walls and par		g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	_
Fabric heat loss, W/K = S (A x U)		(26)(30)	+ (32) =				77.9	(33)
Heat capacity Cm = S(A x k)			((28)	.(30) + (32	2) + (32a).	(32e) =	37002.6	(34)
The rmal mass parameter (TMP = $Cm \div TFA$ ) in	n kJ/m²K		Indica	tive Value:	Medium		250	(35)
For design assessments where the details of the construct can be used instead of a detailed calculation.	ion are not known p	recisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridges: S (L x Y) calculated using Ap	pendix K						62.03	(36)
if details of thermal bridging are not known (36) = $0.05 \times (3)$	•						000	<b>」</b> ` ′
Total fabric heat loss			(33) +	(36) =			139.93	(37)
Ventilation heat loss calculated monthly		1		= 0.33 × (	25)m x (5)	ı	ı	
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)m= 48.55 47.99 47.43 44.65 44.1	41.32 41.32	40.76	42.43	44.1	45.21	46.32		(38)
Heat transfer coefficient, W/K	104.05 1.04.05	1,00,00		= (37) + (3	-	400.05		
(39)m= 188.48 187.92 187.36 184.58 184.03	181.25 181.25	180.69	182.36	184.03 Average =	185.14	186.25	184.45	(39)
Heat loss parameter (HLP), W/m²K				= (39)m ÷		12 / 12=	104.40	<b>_</b> (33)
(40)m= 1.2 1.2 1.19 1.18 1.17	1.16 1.16	1.15	1.16	1.17	1.18	1.19		
N. all and death of the state o				Average =	Sum(40) <sub>1</sub> .	12 /12=	1.18	(40)
Number of days in month (Table 1a)	lug lud	Δ	Can	0-4	Navi	Daa		
Jan   Feb   Mar   Apr   May   (41)m=   31   28   31   30   31	Jun         Jul           30         31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(41)
(11)	1 00 1 01	1 "		J 1				(2.7)

4. Water heating energy requirement:

kWh/year:

2.94

Assumed occupancy, N if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ 

 $Str_{\mbox{\scriptsize MP}} \mbox{${\rm MP}$123.19}, \mbox{${\rm We}$rsion}: 1.0.4.23 \ (SAP\ 9.92) - http://www.stroma.com$ 

Annual average hot water usage in litres per day Vd average =  $(25 \times N) + 36$ 

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(42)



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) 169.86 148.56 153.31 133.66 128.25 110.67 102.55 117.68 119.08 138.78 151.49 164.5 (45)m =Total =  $Sum(45)_{1...12}$  = 1638.38 (45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)25.48 22.28 20.05 19.24 16.6 15.38 20.82 22.72 24.68 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 305 (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): (48)1.63 Temperature factor from Table 2b 0.54 (49)Energy lost from water storage, kWh/year  $(48) \times (49) =$ (50)0.88 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) (51)0 If community heating see section 4.3 Volume factor from Table 2a 0 (52)Temperature factor from Table 2b 0 (53)Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)Enter (50) or (54) in (55) (55)0.88 Water storage loss calculated for each month  $((56)m = (55) \times (41)m$ (56)m =27.29 24.65 27.29 26.41 27.29 26.41 27.29 27.29 26.41 27.29 26.41 (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 **2**7.29 24.65 27.29 26.41 27.29 26.41 27.29 27.29 26.41 27.29 26.41 27.29 (57)(57)m =(58)Primary circuit loss (annual) from Table 3 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 thermostat) (59)(59)m =23.26 21.01 23.26 23.26 22.51 23.26 22.51 23.26 22.51 23.26 Combi loss calculated for each month (61)m = (60)  $\div$  365 x (41)m 0 0 0 0 0 (61)(61)m =0 0 Total heat required for water heating calculated for each month  $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ 182.57 220.41 194.22 203.85 (62)178.79 159.58 153.1 168.22 168 189.33 200.4 215.05 (62)m =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)(63)m =0 0 0 0 0 0 0 Output from water heater 220.41 194.22 203.85 (64)m =182.57 178.79 159.58 153.1 168.22 168 189.33 200.4 215.05 (64)Output from water heater (annual) 1...12 2233.55 Heat gains from water heating, kWh/month  $0.25 (0.85 \times (45)) + (61) + 0.8 \times ((46)) + (57) + (59) +$ 74.54 79.57 (65)(65)m =96.92 91.41 83.57 83.08 75.93 78.73 86.58 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



(00)				. <del>.</del>			·		1	1		1	(00)
(66)m= 147.		147.22	l l		147.22	147.22	147.		147.22	147.22	147.22		(66)
, <u>, , , , , , , , , , , , , , , , , , </u>	ns (calculate	<del></del> i	·						_	<u> </u>		1	(07)
(67)m= 32.3		23.39	!_	13.24	11.17	12.07	15.0	!	26.75	31.22	33.28		(67)
· · · · —	gains (calcu		<del>'''</del>				<del>–</del>		1		ı	1	(22)
(68)m= 327.	89 331.29	322.72	304.46 2	81.42	259.77	245.3	241	.9 250.47	268.73	291.77	313.42		(68)
Cooking ga	ins (calculate	<del>i</del>	<del></del>	<del></del>		or L15a)	, als	see Table				1	
(69)m= 37.7	72 37.72	37.72	37.72	37.72	37.72	37.72	37.	72 37.72	37.72	37.72	37.72		(69)
Pumps and	fans gains (	Table 5	a)							_		•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporation	n (negati	ive values)	) (Table	e 5)					_		•	
(71)m= -117.	78 -117.78	-117.78	-117.78 -1	17.78 -	-117	.78 -117.78	-117.78	3 -117.78	-117.78		(71)		
Water heati	ng gains (Ta	able 5)										-	
(72)m= 130.	27 127.86	122.87	116.08 1	11.67	105.46	100.18	106	94 109.35	116.37	124.31	127.87		(72)
Total interi	nal gains =				(66)	m + (67)m	+ (68	)m + (69)m +	(70)m +	(71)m + (72)	m	•	
(73)m= 560	.7 558.08	539.14	508.41 4	76.49	446.57	427.72	434	.7 451.05	482.01	517.46	544.74		(73)
6. Solar ga													
	re calculated us	-		ble 6a ar			tions 1	o convert to the	ne applic		ion.		
Orientation:	Access Fa Table 6d	actor	Area m²		Flu	x ole 6a		g_ Table 6b		FF Table 6c		Gains (W)	
NI di								Table ob		Table oc		( • • )	
North 0.9		X	0.41	×		0.63	X	0.45	Х	0.67	=	0.91	(74)
North 0.9		×	1.84	×	1	0.63	X	0.45	Х	0.67	=	4.09	(74)
North 0.9		×	1.34	×	1	0.63	Х	0.45	Х	0.67	=	2.98	(74)
North 0.9		X	2.72	×	1	0.63	X	0.45	X	0.67	=	6.04	(74)
North 0.9	0.77	X	1.45	X	1	0.63	X	0.45	X	0.67	=	3.22	(74)
North 0.9	9x 0.77	X	0.58	X	1	0.63	X	0.45	X	0.67	=	1.29	(74)
North 0.9	0.77	X	0.41	x	2	0.32	X	0.45	X	0.67	=	1.73	(74)
North 0.9	0.77	X	1.84	х	2	0.32	X	0.45	X	0.67	=	7.81	(74)
North 0.9	0.77	X	1.34	х	2	0.32	X	0.45	X	0.67	=	5.69	(74)
North 0.9	0.77	X	2.72	X	2	0.32	X	0.45	X	0.67	=	11.55	(74)
North 0.9	9x 0.77	X	1.45	х	2	0.32	X	0.45	X	0.67	=	6.16	(74)
North 0.9	9x 0.77	X	0.58	X	2	0.32	X	0.45	X	0.67	=	2.46	(74)
North 0.9	9x 0.77	X	0.41	Х	3	4.53	X	0.45	X	0.67	=	2.94	(74)
North 0.9	0.77	X	1.84	X	3	4.53	X	0.45	X	0.67	=	13.28	(74)
North 0.9	0.77	X	1.34	x	3	4.53	X	0.45	X	0.67	=	9.67	(74)
North 0.9	0.77	X	2.72	х	3	4.53	X	0.45	x	0.67	=	19.62	(74)
North 0.9	9x 0.77	X	1.45	x	3	4.53	X	0.45	X	0.67	=	10.46	(74)
North 0.9	9x 0.77	X	0.58	×	3	4.53	x	0.45	x	0.67	=	4.18	(74)
North 0.9	0.77	X	0.41	x	5	5.46	x	0.45	x	0.67	=	4.73	(74)
North 0.9	0.77	x	1.84	x	5	5.46	x	0.45	x	0.67	=	21.32	(74)
North 0.9	9x 0.77	x	1.34	×	5	5.46	x	0.45	x	0.67	=	15.53	(74)



	_		-										_
North	0.9x	0.77	X	2.72	X	55.46	X	0.45	X	0.67	=	31.52	(74)
North	0.9x	0.77	X	1.45	X	55.46	X	0.45	X	0.67	=	16.8	(74)
North	0.9x	0.77	X	0.58	X	55.46	X	0.45	X	0.67	=	6.72	(74)
North	0.9x	0.77	X	0.41	X	74.72	X	0.45	X	0.67	=	6.37	(74)
North	0.9x	0.77	X	1.84	X	74.72	X	0.45	X	0.67	=	28.72	(74)
North	0.9x	0.77	X	1.34	x	74.72	X	0.45	X	0.67	=	20.92	(74)
North	0.9x	0.77	X	2.72	X	74.72	X	0.45	X	0.67	] =	42.46	(74)
North	0.9x	0.77	X	1.45	X	74.72	X	0.45	X	0.67	=	22.64	(74)
North	0.9x	0.77	X	0.58	X	74.72	X	0.45	X	0.67	=	9.05	(74)
North	0.9x	0.77	X	0.41	X	79.99	X	0.45	X	0.67	] =	6.82	(74)
North	0.9x	0.77	X	1.84	x	79.99	X	0.45	X	0.67	=	30.75	(74)
North	0.9x	0.77	X	1.34	x	79.99	X	0.45	X	0.67	=	22.39	(74)
North	0.9x	0.77	X	2.72	x	79.99	X	0.45	X	0.67	=	45.46	(74)
North	0.9x	0.77	X	1.45	X	79.99	X	0.45	X	0.67	=	24.23	(74)
North	0.9x	0.77	X	0.58	x	79.99	X	0.45	X	0.67	=	9.69	(74)
North	0.9x	0.77	X	0.41	x	74.68	X	0.45	x	0.67	=	6.37	(74)
North	0.9x	0.77	X	1.84	X	74.68	X	0.45	X	0.67	=	28.71	(74)
North	0.9x	0.77	X	1.34	×	74.68	Х	0.45	X	0.67	-	20.91	(74)
North	0.9x	0.77	x	2.72	х	74.68	x	0.45	x	0.67	=	42.44	(74)
North	0.9x	0.77	X	1.45	х	74.68	X	0.45	x	0.67	=	22.62	(74)
North	0.9x	0.77	X	0.58	X	74.68	X	0.45	x	0.67	=	9.05	(74)
North	0.9x	0.77	X	0.41	x	59.25	Х	0.45	x	0.67	=	5.05	(74)
North	0.9x	0.77	X	1.84	х	59.25	X	0.45	x	0.67	=	22.78	(74)
North	0.9x	0.77	X	1.34	х	59.25	X	0.45	X	0.67	=	16.59	(74)
North	0.9x	0.77	X	2.72	X	59.25	X	0.45	X	0.67	=	33.67	(74)
North	0.9x	0.77	X	1.45	X	59.25	X	0.45	X	0.67	=	17.95	(74)
North	0.9x	0.77	X	0.58	x	59.25	X	0.45	X	0.67	=	7.18	(74)
North	0.9x	0.77	X	0.41	X	41.52	X	0.45	X	0.67	=	3.54	(74)
North	0.9x	0.77	X	1.84	x	41.52	X	0.45	X	0.67	=	15.96	(74)
North	0.9x	0.77	X	1.34	X	41.52	X	0.45	X	0.67	] =	11.62	(74)
North	0.9x	0.77	X	2.72	x	41.52	X	0.45	X	0.67	=	23.59	(74)
North	0.9x	0.77	X	1.45	X	41.52	X	0.45	X	0.67	=	12.58	(74)
North	0.9x	0.77	X	0.58	Х	41.52	X	0.45	X	0.67	=	5.03	(74)
North	0.9x	0.77	X	0.41	x	24.19	X	0.45	X	0.67	=	2.06	(74)
North	0.9x	0.77	X	1.84	x	24.19	X	0.45	X	0.67	=	9.3	(74)
North	0.9x	0.77	X	1.34	x	24.19	X	0.45	X	0.67	=	6.77	(74)
North	0.9x	0.77	X	2.72	x	24.19	X	0.45	X	0.67	=	13.75	(74)
North	0.9x	0.77	X	1.45	x	24.19	x	0.45	X	0.67	=	7.33	(74)
North	0.9x	0.77	X	0.58	x	24.19	x	0.45	x	0.67	] =	2.93	(74)
North	0.9x	0.77	X	0.41	x	13.12	X	0.45	X	0.67	=	1.12	(74)
North	0.9x	0.77	X	1.84	X	13.12	X	0.45	X	0.67	=	5.04	(74)

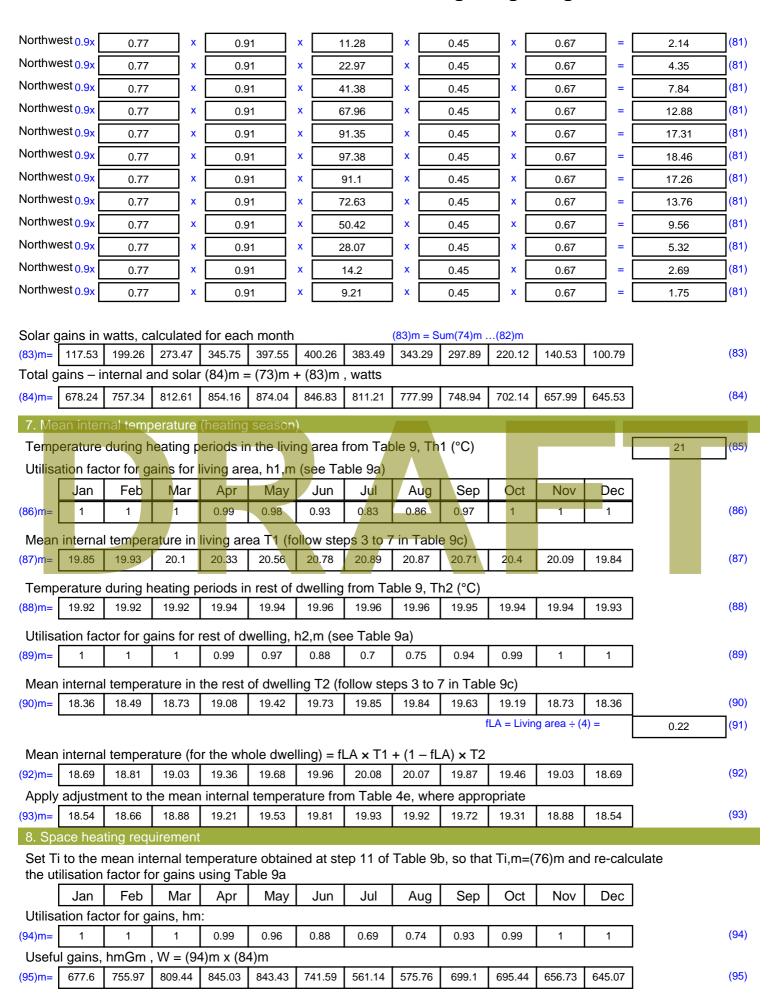


North														
North	North	0.9x	0.77	X	1.34	x	13.12	x	0.45	X	0.67	=	3.67	(74)
North	North	0.9x	0.77	X	2.72	x	13.12	x	0.45	x	0.67	=	7.45	(74)
North	North	0.9x	0.77	X	1.45	x	13.12	x	0.45	x	0.67	=	3.97	(74)
North 0.0x	North	0.9x	0.77	X	0.58	x	13.12	x	0.45	x	0.67	] =	1.59	(74)
North	North	0.9x	0.77	X	0.41	x	8.86	x	0.45	x	0.67	=	0.76	(74)
North	North	0.9x	0.77	X	1.84	x	8.86	x	0.45	x	0.67	=	3.41	(74)
North	North	0.9x	0.77	X	1.34	x	8.86	x	0.45	X	0.67	=	2.48	(74)
Northeast 0.9x	North	0.9x	0.77	X	2.72	x	8.86	x	0.45	X	0.67	=	5.04	(74)
Northeast 0,5% 0,77	North	0.9x	0.77	X	1.45	X	8.86	x	0.45	X	0.67	=	2.69	(74)
Northeast 0.9x	North	0.9x	0.77	X	0.58	x	8.86	X	0.45	x	0.67	=	1.07	(74)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	11.28	X	0.45	X	0.67	=	2.14	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	22.97	x	0.45	X	0.67	=	4.35	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	x	41.38	x	0.45	X	0.67	=	7.84	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	67.96	x	0.45	X	0.67	=	12.88	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	91.35	x	0.45	X	0.67	=	17.31	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	x	97.38	x	0.45	x	0.67	=	18.46	(75)
Northeast 0.9x 0.77	Northeast	0.9x	0.77	X	0.91	X	91.1	x	0.45	X	0.67	=	17.26	(75)
Northeast 0.9x	Northeast	0.9x	0.77	x	0.91	X	72.63	X	0.45	X	0.67	=	13.76	(75)
Northeast 0.9x	Northeast	0.9x	0.77	x	0.91	x	50.42	] x	0.45	X	0.67	=	9.56	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	х	28.07	x	0.45	X	0.67	=	5.32	(75)
South         0.9x         0.77         x         0.41         x         46,75         x         0.45         x         0.67         =         3.99         (78)           South         0.9x         0.77         x         1.84         x         46,75         x         0.45         x         0.67         =         17.97         (78)           South         0.9x         0.77         x         1.82         x         46,75         x         0.45         x         0.67         =         17.78         (78)           South         0.9x         0.77         x         2.72         x         46,75         x         0.45         x         0.67         =         26,57         (78)           South         0.9x         0.77         x         2.91         x         46,75         x         0.45         x         0.67         =         28,43         (78)           South         0.9x         0.77         x         1.84         x         76,57         x         0.45         x         0.67         =         29,44         (78)           South         0.9x         0.77         x         1.82         x         76,57 </td <td>Northeast</td> <td>0.9x</td> <td>0.77</td> <td>] x</td> <td>0.91</td> <td>X</td> <td>14.2</td> <td>x</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>=</td> <td>2.69</td> <td>(75)</td>	Northeast	0.9x	0.77	] x	0.91	X	14.2	x	0.45	x	0.67	=	2.69	(75)
South 0.9x 0.77 x 1.84 x 46.75 x 0.45 x 0.67 = 17.97 (78)  South 0.9x 0.77 x 1.82 x 46.75 x 0.45 x 0.67 = 17.97 (78)  South 0.9x 0.77 x 2.72 x 46.75 x 0.45 x 0.67 = 26.57 (78)  South 0.9x 0.77 x 2.91 x 46.75 x 0.45 x 0.67 = 28.43 (78)  South 0.9x 0.77 x 0.41 x 76.57 x 0.45 x 0.67 = 29.44 (78)  South 0.9x 0.77 x 1.84 x 76.57 x 0.45 x 0.67 = 29.44 (78)  South 0.9x 0.77 x 1.82 x 76.57 x 0.45 x 0.67 = 29.12 (78)  South 0.9x 0.77 x 2.91 x 76.57 x 0.45 x 0.67 = 29.12 (78)  South 0.9x 0.77 x 2.91 x 76.57 x 0.45 x 0.67 = 43.51 (78)  South 0.9x 0.77 x 2.91 x 76.57 x 0.45 x 0.67 = 43.51 (78)  South 0.9x 0.77 x 0.41 x 97.53 x 0.45 x 0.67 = 44.55 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.09 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 55.43 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 55.43 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 59.3 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 42.38 (78)	Northeast	0.9x	0.77	x	0.91	x	9.21	Х	0.45	X	0.67	=	1.75	(75)
South         0.9x         0.77         x         1.82         x         46.75         x         0.45         x         0.67         =         17.78         (78)           South         0.9x         0.77         x         2.72         x         46.75         x         0.45         x         0.67         =         26.57         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57<	South	0.9x	0.77	] x	0.41	x	46.75	X	0.45	x	0.67	=	3.99	(78)
South         0.9x         0.77         x         2.72         x         46.75         x         0.45         x         0.67         =         26.57         (78)           South         0.9x         0.77         x         2.91         x         46.75         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         0.41         x         97.53<	South	0.9x	0.77	x	1.84	x	46.75	X	0.45	x	0.67	=	17.97	(78)
South         0.9x         0.77         x         2.91         x         46.75         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         6.53         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         1.84         x         97.53 </td <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>1.82</td> <td>x</td> <td>46.75</td> <td>x</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>=</td> <td>17.78</td> <td>(78)</td>	South	0.9x	0.77	X	1.82	x	46.75	x	0.45	x	0.67	=	17.78	(78)
South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         6.53         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.82         x         97.53 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>2.72</td> <td>x</td> <td>46.75</td> <td>x</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>] =</td> <td>26.57</td> <td>(78)</td>	South	0.9x	0.77	X	2.72	x	46.75	x	0.45	x	0.67	] =	26.57	(78)
South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         46.55         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53 </td <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>2.91</td> <td>x</td> <td>46.75</td> <td>X</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>] =</td> <td>28.43</td> <td>(78)</td>	South	0.9x	0.77	X	2.91	x	46.75	X	0.45	x	0.67	] =	28.43	(78)
South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>0.41</td> <td>x</td> <td>76.57</td> <td>x</td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>6.53</td> <td>(78)</td>	South	0.9x	0.77	X	0.41	x	76.57	x	0.45	X	0.67	=	6.53	(78)
South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         46.55         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>1.84</td> <td>x</td> <td>76.57</td> <td>X</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>] =</td> <td>29.44</td> <td>(78)</td>	South	0.9x	0.77	X	1.84	x	76.57	X	0.45	x	0.67	] =	29.44	(78)
South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         46.55         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         0.41         x         110.23 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>1.82</td> <td>X</td> <td>76.57</td> <td>X</td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>29.12</td> <td>(78)</td>	South	0.9x	0.77	X	1.82	X	76.57	X	0.45	X	0.67	=	29.12	(78)
South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         0.41         x         110.23 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>2.72</td> <td>X</td> <td>76.57</td> <td>X</td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>43.51</td> <td>(78)</td>	South	0.9x	0.77	X	2.72	X	76.57	X	0.45	X	0.67	=	43.51	(78)
South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         0.41         x         110.23         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         1.84         x         110.23         x         0.45         x         0.67         =         42.38         (78)           South         0.9x         0.77         x         1.82         x         110.23	South	0.9x	0.77	X	2.91	X	76.57	X	0.45	X	0.67	=	46.55	(78)
South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         0.41         x         110.23         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         0.41         x         110.23         x         0.45         x         0.67         =         9.4         (78)           South         0.9x         0.77         x         1.84         x         110.23         x         0.45         x         0.67         =         42.38         (78)           South         0.9x         0.77         x         1.82         x         110.23         x         0.45         x         0.67         =         41.92         (78)	South	0.9x	0.77	X	0.41	X	97.53	X	0.45	X	0.67	=	8.31	(78)
South       0.9x       0.77       x       2.72       x       97.53       x       0.45       x       0.67       =       55.43       (78)         South       0.9x       0.77       x       2.91       x       97.53       x       0.45       x       0.67       =       59.3       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.45       x       0.67       =       9.4       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.45       x       0.67       =       42.38       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.45       x       0.67       =       41.92       (78)		0.9x	0.77	X	1.84	X	97.53	X	0.45	X	0.67	=	37.5	(78)
South       0.9x       0.77       x       2.91       x       97.53       x       0.45       x       0.67       =       59.3       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.45       x       0.67       =       9.4       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.45       x       0.67       =       42.38       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.45       x       0.67       =       41.92       (78)	South	0.9x	0.77	X	1.82	X	97.53	X	0.45	X	0.67	=	37.09	(78)
South       0.9x       0.77       x       0.41       x       110.23       x       0.45       x       0.67       =       9.4       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.45       x       0.67       =       42.38       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.45       x       0.67       =       41.92       (78)		0.9x	0.77	X	2.72	x	97.53	x	0.45	x	0.67	_ =	55.43	(78)
South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 42.38 (78) South 0.9x 0.77 x 1.82 x 110.23 x 0.45 x 0.67 = 41.92 (78)				X	2.91	X	97.53	x	0.45	x	0.67	_ =	59.3	(78)
South 0.9x 0.77 x 1.82 x 110.23 x 0.45 x 0.67 = 41.92 (78)		0.9x	0.77	X	0.41	x	110.23	x	0.45	x	0.67	_ =	9.4	(78)
On the Control of the		0.9x	0.77	X	1.84	x	110.23	x	0.45	x	0.67	] =	42.38	(78)
South $0.9x$ $0.77$ $\times$ $2.72$ $\times$ $110.23$ $\times$ $0.45$ $\times$ $0.67$ = $62.65$ $(78)$		0.9x	0.77	X	1.82	x	110.23	x	0.45	x	0.67	] =	41.92	(78)
	South	0.9x	0.77	X	2.72	X	110.23	X	0.45	X	0.67	=	62.65	(78)



South	0.9x	0.77	x	2.91	x	110.23	x	0.45	x	0.67	=	67.02	(78)
South	0.9x	0.77	x	0.41	x	114.87	x	0.45	x	0.67	=	9.79	(78)
South	0.9x	0.77	X	1.84	x	114.87	x	0.45	x	0.67	=	44.16	(78)
South	0.9x	0.77	X	1.82	x	114.87	x	0.45	x	0.67	=	43.68	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.45	x	0.67	=	65.28	(78)
South	0.9x	0.77	X	2.91	x	114.87	X	0.45	x	0.67	=	69.84	(78)
South	0.9x	0.77	X	0.41	x	110.55	x	0.45	x	0.67	=	9.42	(78)
South	0.9x	0.77	X	1.84	x	110.55	x	0.45	x	0.67	=	42.5	(78)
South	0.9x	0.77	X	1.82	x	110.55	x	0.45	x	0.67	=	42.04	(78)
South	0.9x	0.77	X	2.72	x	110.55	x	0.45	x	0.67	=	62.83	(78)
South	0.9x	0.77	X	2.91	x	110.55	X	0.45	X	0.67	=	67.21	(78)
South	0.9x	0.77	X	0.41	x	108.01	x	0.45	x	0.67	=	9.21	(78)
South	0.9x	0.77	X	1.84	x	108.01	x	0.45	x	0.67	=	41.53	(78)
South	0.9x	0.77	X	1.82	x	108.01	x	0.45	x	0.67	=	41.07	(78)
South	0.9x	0.77	X	2.72	x	108.01	x	0.45	x	0.67	=	61.38	(78)
South	0.9x	0.77	X	2.91	x	108.01	x	0.45	x	0.67	=	65.67	(78)
South	0.9x	0.77	X	0.41	X	104.89	X	0.45	X	0.67	=	8.94	(78)
South	0.9x	0.77	X	1.84	X	104.89	Х	0.45	X	0.67	=	40.33	(78)
South	0.9x	0.77	X	1.82	х	104.89	x	0.45	x	0.67	=	39.89	(78)
South	0.9x	0.77	X	2.72	х	104.89	x	0.45	x	0.67	=	59.61	(78)
South	0.9x	0.77	X	2.91	X	104.89	X	0.45	x	0.67	=	63.78	(78)
South	0.9x	0.77	X	0.41	х	101.89	Х	0.45	x	0.67	=	8.69	(78)
South	0.9x	0.77	X	1.84	х	101.89	X	0.45	x	0.67	=	39.17	(78)
South	0.9x	0.77	X	1.82	х	101.89	X	0.45	X	0.67	=	38.74	(78)
South	0.9x	0.77	X	2.72	x	101.89	X	0.45	X	0.67	=	57.9	(78)
South	0.9x	0.77	X	2.91	x	101.89	X	0.45	X	0.67	=	61.95	(78)
South	0.9x	0.77	X	0.41	x	82.59	X	0.45	X	0.67	=	7.04	(78)
South	0.9x	0.77	X	1.84	x	82.59	X	0.45	X	0.67	=	31.75	(78)
South	0.9x	0.77	X	1.82	x	82.59	X	0.45	X	0.67	=	31.4	(78)
South	0.9x	0.77	X	2.72	x	82.59	X	0.45	X	0.67	=	46.93	(78)
South	0.9x	0.77	X	2.91	x	82.59	X	0.45	X	0.67	=	50.21	(78)
South	0.9x	0.77	X	0.41	x	55.42	X	0.45	X	0.67	=	4.72	(78)
South	0.9x	0.77	X	1.84	X	55.42	X	0.45	X	0.67	=	21.31	(78)
South	0.9x	0.77	X	1.82	X	55.42	X	0.45	X	0.67	=	21.07	(78)
South	0.9x	0.77	X	2.72	x	55.42	X	0.45	X	0.67	=	31.49	(78)
South	0.9x	0.77	x	2.91	x	55.42	x	0.45	x	0.67	=	33.69	(78)
South	0.9x	0.77	x	0.41	x	40.4	x	0.45	x	0.67	=	3.44	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.45	x	0.67	=	15.53	(78)
South	0.9x	0.77	x	1.82	x	40.4	x	0.45	x	0.67	=	15.36	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.45	x	0.67	=	22.96	(78)
South	0.9x	0.77	X	2.91	X	40.4	X	0.45	X	0.67	=	24.56	(78)







Mont	thly avera	age exte	ernal tem	nerature	e 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)
Heat	loss rate	for me	an intern	ıal temp	erature,	Lm , W :	=[(39)m :	x [(93)m	– (96)m	]	<u>!</u>			
(97)m=	2684.04	2586.4	2320.36	1902.43	1440.45	945.09	603.42	635.74	1025.21	1603.07	2181.46	2670.09		(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=	1492.8	1230.05	1124.13	761.33	444.18	0	0	0	0	675.28	1097.81	1506.62		_
								Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	8332.19	(98)
Spac	e heatin	g require	ement in	kWh/m²	²/year								53.12	(99)
9a. Er	nergy rec	uiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	e heatir	•			/l-		(					ſ		7(004)
	tion of sp					mentary	•		(004)				0	(201)
	tion of sp			•	` '			(202) = 1 -	,	,			1	(202)
	tion of to		•	•				(204) = (204)	02) × [1 –	(203)] =			1	(204)
	ency of r	•		•									91.9	(206)
Effici	ency of s	seconda	ry/supple	ementar	y heating	g systen	า, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Spac	e heatin		· `				<u> </u>							
			1124.13			0	0	0	0	675.28	1097.81	1506.6 <mark>2</mark>		
(211)r	$n = \{[(98)]\}$	1		·						7040	140457	1000 11		(211)
	1624.37	1338.46	1223.21	828.43	483.33	0	0	0 Tota	0 (k\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	734.8	1194.57 211) <sub>15.1012</sub>	1 <mark>6</mark> 39.41	0000 50	7(211)
Cnac	o bootin	a fuel (e	o o o o do r	14\A/b	(month			Tota	ii (KVVII) yCe	ar) =0arri(2	1 15,1012		9066.58	(211)
	ce h <mark>eatin</mark> g 3)m x (20	`		. , .	monun									
(215)m		0	0	0	0	0	0	0	0	0	0	0		
						I.		Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water	heating	I										'		
Outpu	t from w					T	ı	ı	Г	<u> </u>	ı			
<b>-</b> (C) -1 -	220.41	194.22	203.85	182.57	178.79	159.58	153.1	168.22	168	189.33	200.4	215.05		7(040)
	ncy of w		r -	00.70	00.75		I 04 0	04.0	04.0	00.40	00.40	00.5	81.8	(216)
(217)m:		90.38	90.19	89.76	88.75	81.8	81.8	81.8	81.8	89.48	90.18	90.5		(217)
	or water n = (64)	•												
. ,	243.65	214.9	226.03	203.41	201.45	195.09	187.16	205.65	205.38	211.58	222.22	237.62		
								Tota	I = Sum(2	19a) <sub>112</sub> =			2554.14	(219)
	al totals									k\	Wh/year		kWh/yea	ır
Space	heating	tuel use	ed, main	system	1								9066.58	
Water	heating	fuel use	ed										2554.14	
Electr	icity for p	umps, f	ans and	electric	keep-ho	t								
mech	nanical v	entilatio	n - balan	ced, ext	ract or p	ositive i	nput fron	n outside	Э			555.48		(230a)
centr	al heatin	g pump	:									30		(230c)
	al heatin electricity	•		‹Wh/yea	ır			sum	of (230a).	(230g) =		30	585.48	(230c) (231)



Electricity for lighting 571.83 (232)

#### 12a. CO2 emissions – Individual heating systems including micro-CHP

	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1958.38 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	551.69 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2510.08 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	303.86 (267)
Electricity for lighting	(232) x	0.519 =	296.78 (268)
Total CO2, kg/year	sum	of (265)(271) =	3110.72 (272)
Dwelling CO2 Emission Rate	(272	(a) ÷ (4) =	19.83 (273)
EI rating (section 14)			79 (274)





User Details: **Assessor Name:** Stroma Number: **Software Version: Software Name:** Stroma FSAP 2012 Version: 1.0.4.23 Property Address: Triplex (Be Lean) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) **Basement** 70.32 (1a) x 3.2 (2a) =225.02 (3a) Ground floor (1b) x (2b) (3b) 82.3 3.2 263.36 First floor 115 (1c) x (2c) 310.5 (3c)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 267.62 (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =Dwelling volume (5) 798.88 2. Ventilation rate: other total main secondary m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues (6b) 0 0 0 0 0 Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents 0 0 (7b) Number of flueless gas fires x 40 =0 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = 0 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)O Additional infiltration (10)[(9)-1]x0.1 =0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ (15)0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 Infiltration rate modified for monthly wind speed Jan Feb Mar Jul Sep Oct Nov Apr May Jun Aug Dec Monthly average wind speed from Table 7

4.4

4.3

3.8

3.8

3.7

4.9

(22)m =

5.1

5

4.3

4.5

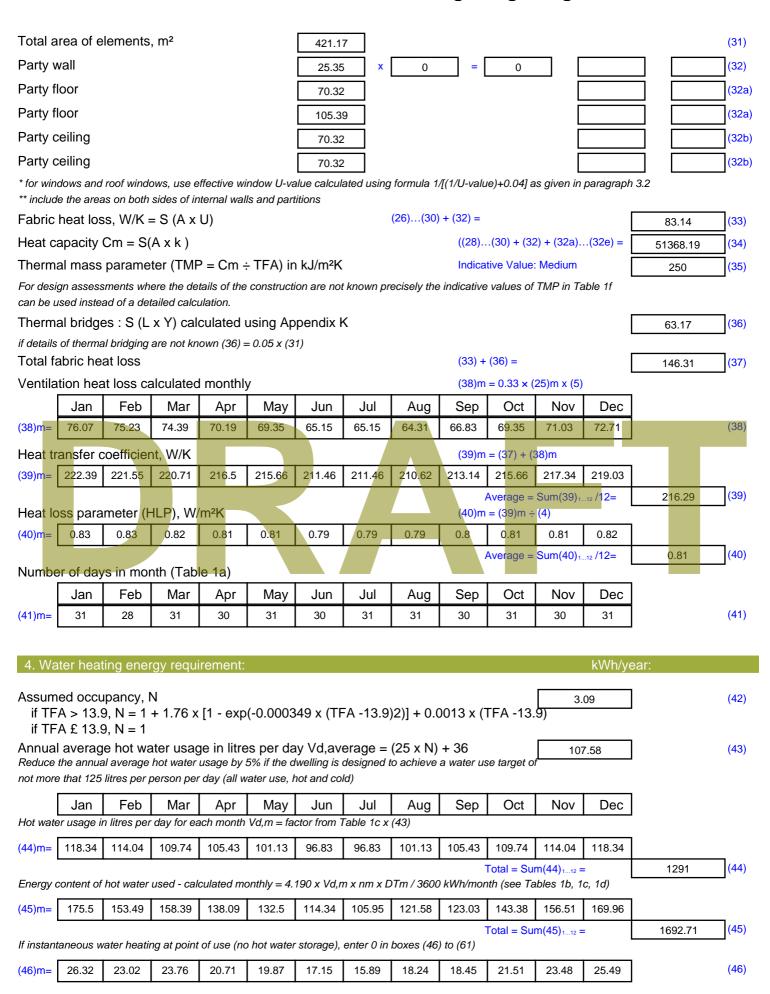
4.7

4



Wind Factor (	(22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infilt	ration rat	e (allowi	ng for sl	nelter an	d wind s	peed) =	: (21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effe		_	rate for t	he appli	cable ca	se	!	!		!			
If mechanic			andiv N (2	3h) - (23a	a) v Emy (e	auation (	N5N othe	nvice (23k	n) = (33a)			0.	
If balanced wi									)) = (23a)			0.	
a) If balanc		•	-	_					2h)m + (	23h) <b>x</b> [1	 1 <i>– (2</i> 3c)	74 ÷ 1001	.8 (23c)
(24a)m= 0.29	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28	. 100]	(24a)
b) If balanc	ed mech	anical ve	entilation	without	heat rec	overy (I	MV) (24t	m = (2)	2b)m + (	23b)		l	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole	house ex	tract ver	ntilation o	or positiv	e input v	/entilatio	on from o	outside		-	-		
	m < 0.5 >	<u> </u>	· ` `	<u> </u>	<del></del>	· ` `	<del></del>	ŕ	· ` `	<del></del>	ı	l	(0.1.)
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	l ventilation m = 1, the			•	•				0.51				
$ (24d)_{m=} 0 $	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective ai	r change	rate - er	nter (24a	) or (24k	o) or (24	c) or (2 <mark>4</mark>	ld) in box	k (25)					
(25)m= 0.29	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28		(25)
3. Heat loss	es and he	eat loss	paramet	er:									
3. Heat loss	Gros	ss	Openin	gs	Net Ar		U-val		AXU		k-value		A X k
ELEMENT		ss		gs	A ,n	n²	W/m2	2K	(W/	<)	k-value kJ/m²-ł		kJ/K
ELEMENT  Doors Type 1	Gros area	ss	Openin	gs	A ,n	m² x	W/m2	2K =	(W/ 4.032	<)			kJ/K (26)
ELEMENT  Doors Type 1  Doors Type 2	Gros area	ss	Openin	gs	A ,n 3.36 2.8	m <sup>2</sup> x x	W/m2 1.2	= =	4.032 3.36	<) 			kJ/K (26) (26)
Doors Type 1 Doors Type 2 Windows Type	Gros area	ss	Openin	gs	A ,n 3.36 2.8 2.72	x x x1	W/m2 1.2 1.2 /[1/( 1.1 )+	= = = = = = = = = = = = = = = = = = =	4.032 3.36 2.87	<) 			kJ/K (26) (26) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ	Gros area	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18	x x x x x x x x x x x x x x x x x x x	W/m2 1.2 1.2 /[1/( 1.1 )+ /[1/( 1.1 )+	= = 0.04] = 0.04] =	4.032 3.36 2.87 6.51	K)			kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ	Gros area de 1 de 2 de 3	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44	x x x1 x1 x1	W/m2 1.2 1.2 /[1/( 1.1 )+ /[1/( 1.1 )+	= = 0.04] = 0.04] = 0.04] =	4.032 3.36 2.87 6.51 5.73	K)			kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81	x x x1 x1 x1 x1	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	4.032 3.36 2.87 6.51 5.73	<) 			kJ/K (26) (26) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55	x x x1 x1 x1 x1 x1	W/m2  1.2  1.2  /[1/( 1.1 )+  /[1/( 1.1 )+  /[1/( 1.1 )+  /[1/( 1.1 )+  /[1/( 1.1 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79	<) 			kJ/K (26) (26) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37	x x x1 x1 x1 x1 x1 x1	W/m2  1.2  1.1  1.2  1.1  1.1  1.1  1.1  1	= 0.04] = 0.04	4.032 3.36 2.87 6.51 5.73 1.91 4.79				kJ/K (26) (26) (27) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Floor Type 1	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32	x x x1 x1 x1 x1 x1 x1 x1 x1 x1	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Floor Type 1 Floor Type 2	Gros area e 1 e 2 e 3 e 4 e 5 e 6	ss (m²)	Openin m	gs <sub>1</sub> <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12	= 0.04] = 0.04	4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28)
Doors Type 1 Doors Type 2 Windows Typ Floor Type 1 Floor Type 2 Walls Type1	Gros area se 1 se 2 se 3 se 4 se 5 se 6	ss (m²)	Openin	gs <sub>1</sub> <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28)
Doors Type 1 Doors Type 2 Windows Typ Floor Type 1 Floor Type 2 Walls Type1 Walls Type2	Gros area  e 1  e 2  e 3  e 4  e 5  e 6  69.2	25 21	Openin m	gs <sub>1</sub> <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14	= 0.04] = 0.04	(VV/ 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
Doors Type 1 Doors Type 2 Windows Typ Floor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3	Gros area  e 1  e 2  e 3  e 4  e 5  e 6  69.2  73.0	25 21 6	6.16 0 8.9	gs <sub>1</sub> <sup>2</sup>	A ,n  3.36  2.8  2.72  6.18  5.44  1.81  4.55  4.37  70.32  11.98  63.09  38.21  64.7	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.12	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = = = = = = = = = = = = = = = = = =	4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29)
Doors Type 1 Doors Type 2 Windows Typ  1 Walls Type 2 Walls Type 3 Walls Type 4	Gros area  2.	25 21 6 32	6.16 0 8.9	gs <sub>12</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.15	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41 7.76				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29)
Doors Type 1 Doors Type 2 Windows Typ Wind	Gros area  2.	25 21 6 32	6.16 0 8.9 0	gs <sub>12</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32 74.82	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.15  0.15	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41 7.76 4.25 8.98				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29) (29)
Doors Type 1 Doors Type 2 Windows Typ  1 Walls Type 2 Walls Type 3 Walls Type 4	Gros area  2.	25 (m²) 21 6 32 39	6.16 0 8.9	gs <sub>12</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.15	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41 7.76				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29)







Water storage loss:	
Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel	305 (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 Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day):	1.63 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage, kWh/year (48) x (49) = b) If manufacturer's declared cylinder loss factor is not known:	0.88 (50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	0 (51)
If community heating see section 4.3	
Volume factor from Table 2a	0 (52)
Temperature factor from Table 2b	0 (53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ Enter (50) or (54) in (55)	• • • • • • • • • • • • • • • • • • • •
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	0.88 (55)
	2.29 26.41 27.29 (56)
If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m w	
	2.29 26.41 27.29 (57)
Primary circuit loss (annual) from Table 3  Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0 (58)
(modified by factor from Table H5 if there is solar water heating and a cylinder the	ermostat)
	.26 22.51 23.26 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
	0 0 0 (61)
Total heat required for water heating calculated for each month $(62)$ m = $0.85 \times (45)$	m + (46)m + (57)m + (59)m + (61)m
	3.93 205.43 220.51 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar cor	tribution 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= 226.05 199.15 208.94 187.01 183.05 163.25 156.5 172.13 171.95 19	3.93 205.43 220.51
Output from water I	neater (annual) <sub>112</sub> 2287.88 (64)
Heat gains from water heating, kWh/month $0.25 \cdot [0.85 \times (45)m + (61)m] + 0.8 \times [(45)m + (61)m] + 0.8$	<del></del>
	.11 91.17 96.95 (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	
	Oct Nov Dec
	4.49   154.49   154.49   (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	(07)
	7.02 43.2 46.06 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table	
(68)m= 431.48 435.96 424.68 400.66 370.34 341.84 322.8 318.32 329.61 35	3.63 383.95 412.44 (68)

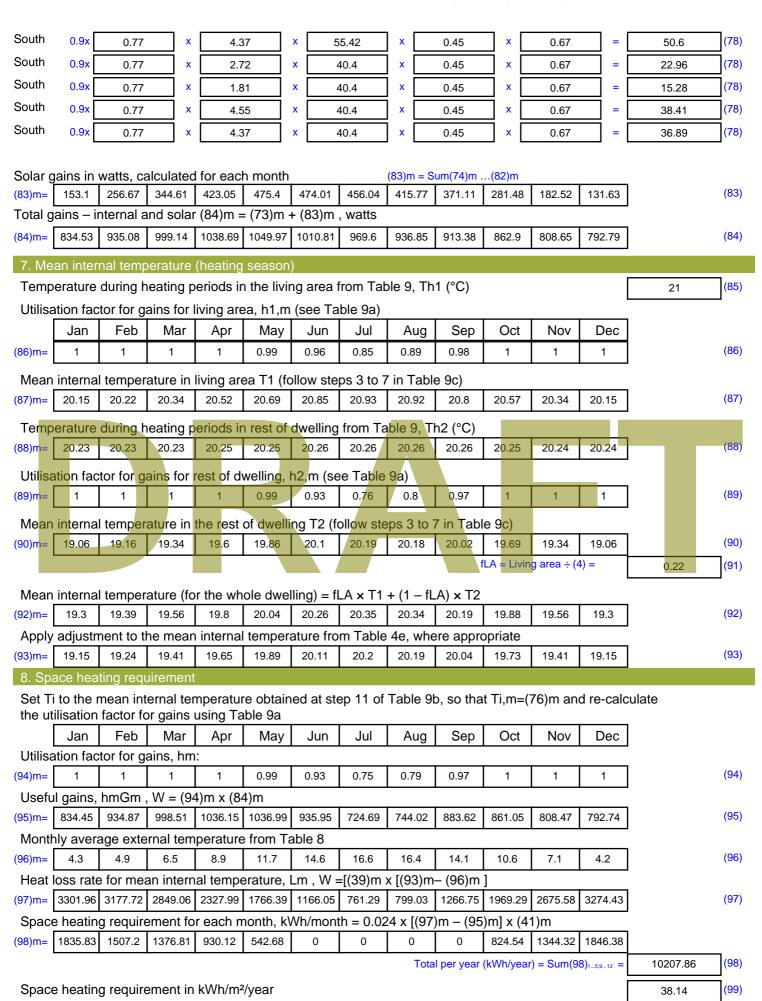


Cooking	anine	(coloulo	tod in	۱n	pendix L, eq	ot	ion L	15 or l 150	\ ala	20.00	oo Tablo	5						
Ě	8.45	38.45	38.45	T	38.45 38.4	_	38.4		, ·	.45	38.45	38.4	5	38.45	38.4	15		(69)
Pumps ar											1 33.13		_					, ,
(70)m=	3	3	3	Ť	3 3		3	3	,	3	3	3		3	3			(70)
	.a. ev	aporatio	n (nea:	L ativ	ve values) (1	—л Гаb	le 5)		<u> </u>		<u>!</u>							
(71)m= -12			-123.59	_	-123.59 -123.	_	-123.5	59 -123.59	-12	3.59	-123.59	-123.	59	-123.59	-123.	.59		(71)
Water hea	ating	gains (T	able 5		I						1							
_	32.78	130.3	125.14	_	118.12 113.	57	107.1	5 101.7	108	3.69	111.17	118.4	43	126.63	130.	31		(72)
Total inte	ernal	gains =			•		(	66)m + (67)n	า + (6	8)m -	+ (69)m + (	70)m -	<b>-</b> (7	1)m + (72)	m			
(73)m= 68	31.43	678.41	654.53	T	615.63 574.	57	536.	8 513.56	521	1.08	542.28	581.4	42	626.13	661.	16		(73)
6. Solar	gains	s:																
Solar gains	s are c	alculated u	using so	ar f	flux from Table	6a a	ind ass	sociated equa	ations	to co	onvert to the	e appli	cab	ole orientati	on.			
Orientatio			actor		Area m²			Flux Fable 6a		_	g_ Fable 6b		т,	FF able 6c			Gains	
N. d	_	able 6d		r		_	_		,	_ '	able ob	_		able oc	_	ı	(W)	7
	0.9x	0.54	=	· [	6.18	=	×	10.63	] X		0.45	_ ×	Ļ	0.67	4	=	9.63	(74)
<b>.</b>	0.9x	0.77	=	<b>к</b> [ Г	5.44	╡	×	10.63	X		0.45	→     ×	Ļ	0.67	$\dashv$	=	12.09	<u></u> (74)
	0.9x	0.54		] ]	6.18	$\dashv$	×⊨	20.32	X	H	0.45	X	F	0.67		=	18.4	](74)
	0.9x	0.77		] × ]	5.44	7	×	20.32	] X		0.45	X	F	0.67		-	23.1	(74)
	0.9x	0.54		] <b>&gt;</b>	6.18	4	x	34.53	] ×		0.45	X	F	0.67		=	31.27	<b></b>
	0.9x	0.77		] > ]	5.44	#	x	34.53	X	H	0.45	X	F	0.67		=	39.25	<b> 1</b> (74)
	0.9x	0.54		] × ]	6.18	+	<u> </u>	55.46	] X ]		0.45	X	F	0.67	_	=	50.23	<b> 1</b> (74)
	0.9x	0.77		] ×	5.44	╣	×	55.46	X		0.45	X	F	0.67	_	=	63.04	<u></u> (74)
	0.9x	0.54		\ I	6.18	╡┖	X	74.72	] X		0.45	X	Ļ	0.67	=	=	67.66	[(74)
	0.9x	0.77	=	<	5.44	=	x	74.72	] X ]		0.45	_ X	F	0.67	_	=	84.92	](74)
	0.9x	0.54	=	\ ا ،	6.18	╡	×	79.99	] X ]		0.45	×	F	0.67	$\dashv$	=	72.43	<u></u> (74)
	0.9x 0.9x	0.77	=	\ ] ر	5.44	╡	×	79.99	] X ] ,		0.45	X     J          J     J     J     J     J     J	F	0.67	_	=	90.91	$\int_{(74)}^{(74)}$
	0.9x	0.54	=	ν [ ν [	6.18 5.44	=	×	74.68	] x ] x		0.45	_ x	늗	0.67	퓜	= =	67.62	$\int_{(74)}^{(74)}$
	0.9x	0.77	=	` [ , [	6.18	╡	^ <u> </u>	74.68 59.25	] ^ ] x		0.45	$\exists \hat{x}$	H	0.67	$\dashv$	_	53.65	$\int_{(74)}^{(74)}$
	0.9x	0.34	==	` [ , [	5.44	╡	^ <u> </u>	59.25	] ^ ] x		0.45	$\exists \hat{x}$	누	0.67	=	=	67.34	](74)
	0.9x	0.77	==	` [ , [	6.18	╡	` <u> </u>	41.52	] ^ ] x		0.45	┤ ^ ×	F	0.67	=	_	37.6	](74)
	0.9x	0.77	==	` [	5.44	╡	х Г	41.52	]		0.45	$\frac{1}{x}$	H	0.67	$\dashv$	_	47.19	](74)
	0.9x	0.54	=	`	6.18	=	х Г	24.19	]		0.45	^   x	F	0.67	ᆿ	=	21.9	](74)
	0.9x	0.77	=	` [	5.44	╡	х Г	24.19	]		0.45	^   x	F	0.67	$\dashv$	_	27.49	](74)
	0.9x	0.54	=	`	6.18	╡	x	13.12	] x		0.45	x	⊨	0.67	$\dashv$	=	11.88	](74)
	0.9x	0.77	==	· [	5.44	╡	x	13.12	] x		0.45	x	H	0.67	=	=	14.91	(74)
	0.9x	0.54	_	· [	6.18	╡	x	8.86	] x	H	0.45	$\frac{1}{x}$	F	0.67	$\dashv$	=	8.03	](74)
	0.9x	0.77	<del></del>	` [ , [	5.44	╡	x	8.86	]		0.45	^   x	F	0.67	$\dashv$	=	10.08	](74)
	0.9x	0.77	==	· [	2.72	=	x	46.75	] x		0.45	x	F	0.67	$\dashv$	=	26.57	](78)
	0.9x	0.77	=	, [	1.81	╡	x 🗀	46.75	)   x	H	0.45	۲ x	H	0.67	=	=	17.68	(78)
				L		_			_			_	_					_



South	0.9x	0.77	x	4.55	x	46.75	x	0.45	x	0.67	=	44.45	(78)
South	0.9x	0.77	x	4.37	x	46.75	x	0.45	x	0.67	=	42.69	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.45	x	0.67	=	43.51	(78)
South	0.9x	0.77	X	1.81	x	76.57	x	0.45	x	0.67	=	28.96	(78)
South	0.9x	0.77	x	4.55	x	76.57	x	0.45	x	0.67	=	72.79	(78)
South	0.9x	0.77	x	4.37	x	76.57	x	0.45	x	0.67	=	69.91	(78)
South	0.9x	0.77	X	2.72	x	97.53	x	0.45	x	0.67	=	55.43	(78)
South	0.9x	0.77	X	1.81	x	97.53	x	0.45	x	0.67	=	36.89	(78)
South	0.9x	0.77	X	4.55	x	97.53	X	0.45	x	0.67	=	92.72	(78)
South	0.9x	0.77	X	4.37	x	97.53	x	0.45	x	0.67	=	89.05	(78)
South	0.9x	0.77	X	2.72	x	110.23	x	0.45	x	0.67	=	62.65	(78)
South	0.9x	0.77	X	1.81	x	110.23	x	0.45	x	0.67	=	41.69	(78)
South	0.9x	0.77	X	4.55	x	110.23	x	0.45	x	0.67	=	104.8	(78)
South	0.9x	0.77	X	4.37	x	110.23	x	0.45	x	0.67	=	100.65	(78)
South	0.9x	0.77	X	2.72	x	114.87	x	0.45	x	0.67	=	65.28	(78)
South	0.9x	0.77	X	1.81	x	114.87	x	0.45	x	0.67	=	43.44	(78)
South	0.9x	0.77	X	4.55	X	114.87	X	0.45	x	0.67	=	109.21	(78)
South	0.9x	0.77	×	4.37	X	114.87	Х	0.45	X	0.67	=	104.88	(78)
South	0.9x	0.77	x	2.72	х	110.55	x	0.45	x	0.67	=	62.83	(78)
South	0.9x	0.77	×	1.81	x	110.55	×	0.45	x	0.67	=	41.81	(78)
South	0.9x	0.77	X	4.55	X	110.55	X	0.45	x	0.67	=	105.1	(78)
South	0.9x	0.77	x	4.37	x	110.55	Х	0.45	x	0.67	=	100.94	(78)
South	0.9x	0.77	×	2.72	x	108.01	X	0.45	x	0.67	=	61.38	(78)
South	0.9x	0.77	X	1.81	x	108.01	X	0.45	x	0.67	=	40.85	(78)
South	0.9x	0.77	X	4.55	x	108.01	X	0.45	X	0.67	=	102.68	(78)
South	0.9x	0.77	X	4.37	X	108.01	X	0.45	X	0.67	=	98.62	(78)
South	0.9x	0.77	X	2.72	x	104.89	X	0.45	X	0.67	=	59.61	(78)
South	0.9x	0.77	X	1.81	X	104.89	X	0.45	X	0.67	=	39.67	(78)
South	0.9x	0.77	X	4.55	x	104.89	X	0.45	X	0.67	=	99.72	(78)
South	0.9x	0.77	X	4.37	x	104.89	X	0.45	X	0.67	=	95.78	(78)
South	0.9x	0.77	X	2.72	X	101.89	X	0.45	X	0.67	=	57.9	(78)
South	0.9x	0.77	X	1.81	x	101.89	X	0.45	X	0.67	=	38.53	(78)
South	0.9x	0.77	X	4.55	X	101.89	X	0.45	X	0.67	=	96.86	(78)
South	0.9x	0.77	X	4.37	x	101.89	X	0.45	X	0.67	=	93.03	(78)
South	0.9x	0.77	X	2.72	x	82.59	X	0.45	X	0.67	=	46.93	(78)
South	0.9x	0.77	x	1.81	x	82.59	x	0.45	x	0.67	=	31.23	(78)
South	0.9x	0.77	x	4.55	x	82.59	x	0.45	x	0.67	=	78.51	(78)
South	0.9x	0.77	x	4.37	x	82.59	x	0.45	x	0.67	=	75.41	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.45	x	0.67	=	31.49	(78)
South	0.9x	0.77	x	1.81	x	55.42	x	0.45	x	0.67	=	20.96	(78)
South	0.9x	0.77	X	4.55	X	55.42	X	0.45	X	0.67	=	52.68	(78)







On Engage requirements. Individual heating aver	to mo o implications	miero CLID)					
9a. Energy requirements – Individual heating systems Space heating:	tems including r	micro-CHP)					
Fraction of space heat from secondary/supplementation	entary system					0	(201)
Fraction of space heat from main system(s)	(2	202) = 1 - (201) =				1	(202)
Fraction of total heating from main system 1	(2	204) = (202) <b>x</b> [1 -	(203)] =			1	(204)
Efficiency of main space heating system 1						91.9	(206)
Efficiency of secondary/supplementary heating s	system, %					0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct	Nov	Dec	kWh/y	 /ear
Space heating requirement (calculated above)						•	
1835.83 1507.2 1376.81 930.12 542.68	0 0	0 0	824.54	1344.32	1846.38		
$(211)$ m = {[(98)m x (204)] } x 100 ÷ (206)			1		ı	İ	(211)
1997.63   1640.04   1498.16   1012.1   590.51	0 0	0 0 Tatal (I) (I)	897.21	1462.81	2009.12		
		Total (kWh/ye	ear) =Sum(2	(11) <sub>15,1012</sub>	F	11107.58	(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/ye	ear) =Sum(2	215) <sub>15,1012</sub>	F	0	(215)
Water heating							
Output from water heater (calculated above)	00.05 450.5	470 40 474 05	1402.02	205.42	220 54		
226.05 199.15 208.94 187.01 183.05 1 Efficiency of water heater	63.25   156.5	172.13 171.95	193.93	205.43	220.51	81.8	(216)
	81.8 81.8	81.8 81.8	89.79	90.42	90.71	01.0	(217)
Fuel for water heating, kWh/month							, ,
$(219)$ m = $(64)$ m x $100 \div (217)$ m			_		I		
(219)m= 249.3 219.82 231.05 207.69 205.38 1	99.58 191.32	210.42 210.21 Total = Sum(2	215.98	227.19	243.1	0044.00	7(040)
Annual totals		rotal = Odiff(2		Nh/year		2611.06 kWh/ye	(219)
Space heating fuel used, main system 1			N.	rvi i/ y cai		11107.58	
Water heating fuel used						2611.06	
Electricity for pumps, fans and electric keep-hot							
mechanical ventilation - balanced, extract or pos	sitive input from	outside			913.72		(230a)
·	nave input iroin	odiside					
central heating pump:		f (020-)	(000~)		30		(230c)
Total electricity for the above, kWh/year		sum of (230a)	)(230g) =			943.72	(231)
Electricity for lighting						791.38	(232)
12a. CO2 emissions – Individual heating system	s including mic	ro-CHP					
	<b>Energy</b> kWh/year		Emiss kg CO2	<b>ion fac</b> 2/kWh	tor	Emission kg CO2/y	
Space heating (main system 1)	(211) x		0.2	16	=	2399.24	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2		=	563.99	(264)
Space and water heating		(263) + (264) =					(265)
opaso and water neating	(==:): (202) 1	,, . ( <del>-0</del> i) =				2963.23	(205)

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Electricity for pumps, fans and electric keep-hot	(231)	X		0.519	=	489.79	(267)
Electricity for lighting	(232)	x		0.519	=	410.73	(268)
Total CO2, kg/year			sum of	(265)(271) =		3863.74	(272)
Dwelling CO2 Emission Rate			(272) ÷	- (4) =		14.44	(273)
El rating (section 14)						83	(274)





# **APPENDIX VIII – BE-GREEN DER WORKSHEETS (NEW-BUILD)**



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 3 - 2B4P - GF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 140.3 (1a) x 2.7 (2a) =(3a) 378.81 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)140.3 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =378.81 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.14 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind spe	l) = (21a) x (22a)m
0.18 0.17 0.17 0.15 0.15 0.13	3 0.13 0.14 0.15 0.16 0.16
Calculate effective air change rate for the applicable case	
If mechanical ventilation:  If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (eq.	0.5 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use fac	form Table (b)
	10.00
a) If balanced mechanical ventilation with heat recover (24a)m= 0.31 0.3 0.3 0.28 0.28 0.26	$(24a)$ M = $(22b)$ M + $(23b)$ × $[1 - (23c) \div 100]$ 6 0.26 0.27 0.28 0.29 0.29 (24a)
b) If balanced mechanical ventilation without heat reco	
(24b)m= 0 0 0 0 0 0 0	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
c) If whole house extract ventilation or positive input ve	, ,
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwi	
(24c)m= 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ve	ation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24	$a = 0.5 + [(22b)m^2 \times 0.5]$
(24d)m= 0 0 0 0 0 0	0 0 0 0 0 (24d)
Effective air change rate - enter (24a) or (24b) or (24c)	
(25)m= 0.31 0.3 0.3 0.28 0.28 0.26	6 0.26 0.27 0.28 0.29 0.29 (25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross Openings Net Area area (m²)	U-value A X U k-value A X k W/m2K (W/K) kJ/m²-K kJ/K
MC by Tara A	
W. I. T O	4//4// 4 4 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
Windows Type 3	$x^{1/[1/(1.1) + 0.04]} = 9.36 $ (27)
Windows Type 4 2.67	x1/[1/(1.1) + 0.04] = 2.81  (27)
Windows Type 5	$x^{1/[1/(1.1) + 0.04]} = \begin{bmatrix} 1.88 \end{bmatrix} $ (27)
Floor 139.42	x 0.11 = 15.3362 (28)
Walls Type1 99.06 27.4 71.66	x 0.12 = 8.6 (29)
Walls Type2 30.1 0 30.1	x 0.14 = 4.26 (29)
Total area of elements, m <sup>2</sup> 268.59	(31)
Party wall 25.35	x 0 = 0 (32)
Party ceiling 139.42	(32b)
* for windows and roof windows, use effective window U-value calculate ** include the areas on both sides of internal walls and partitions	sing formula 1/[(1/U-value)+0.04] as given in paragraph 3.2
Fabric heat loss, W/K = S (A x U)	(26)(30) + (32) = 57.07   (33)
Heat capacity Cm = S(A x k)	((28)(30) + (32) + (32a)(32e) = 27783.44 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium 250 (35)
For design assessments where the details of the construction are not k	
can be used instead of a detailed calculation.  Thormal bridges: S (L x V) calculated using Appendix K	
Thermal bridges: $S(L \times Y)$ calculated using Appendix K if details of thermal bridging are not known (36) = 0.05 x (31)	40.29 (36)
Total fabric heat loss	(33) + (36) = 97.35 (37)



Ventilation hea	at loss or	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= 38.4	37.96	37.53	35.36	34.93	32.76	32.76	32.33	33.63	34.93	35.8	36.66		(38)
Heat transfer of									= (37) + (37)	<u> </u>			, ,
(39)m= 135.75	135.32	134.88	132.72	132.28	130.11	130.11	129.68	130.98	132.28	133.15	134.02		
` '									Average =	Sum(39) <sub>1</sub>	12 /12=	132.61	(39)
Heat loss para	meter (F	HLP), W/	m²K					· ,	= (39)m ÷	(4)			
(40)m= 0.97	0.96	0.96	0.95	0.94	0.93	0.93	0.92	0.93	0.94	0.95	0.96		<b>—</b> (40)
Number of day	s in mor	nth (Tab	le 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	0.95	(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 occu											.92		(42)
if TFA > 13.9	-	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	A -13.9	)2)] + 0.0	0013 x (	ΓFA -13.	.9)			
if TFA £ 13.9 Annual average	•	ater usac	ae in litre	s per da	ıv Vd.av	erage =	(25 x N)	+ 36		10	3.49		(43)
Redu <mark>ce the annua</mark>	al average	hot water	usage by	5% if the a	welling is	designed t			se target o		3.43		(10)
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													
(44)m= 113.84	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.84	40.44.00	7(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1241.93	(44)
(45)m= 168.83	147.66	152.37	132.84	127.46	109.99	101,92	116.96	118.35	137.93	150.56	163.5		
If instantaneous w	rater heatir	na at point	of use (no	) hot water	· storage).	enter 0 in	boxes (46		Γotal = Su	m(45) <sub>112</sub> =	= [	1628.37	(45)
(46)m= 25.32	22.15	22.86	19.93	19.12	16.5	15.29	17.54	17.75	20.69	22.58	24.52		(46)
Water storage	-	22.00	10.00	10.12	10.0	10.20	17.04	17.70	20.00	22.00	24.02		(10)
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		250		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this in	cludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/dav):				1	.49		(48)
Temperature f					(	.,, , .					.54		(49)
Energy lost fro				ear			(48) x (49)	=			1.8		(50)
b) If manufact	urer's de	eclared o	ylinder l	oss fact									, ,
Hot water stor	-			e 2 (kWl	h/litre/da	ıy)					0		(51)
If community he Volume factor	_		on 4.3										(52)
Temperature f			2b							-	0		(52) (53)
Energy lost fro				ear			(47) x (51)	x (52) x (	53) =		0		(54)
Enter (50) or (		-	,y				, , , , , (01)	\/ \(\)	-,	-	1.8		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m				
(56)m= 24.94	22.53	24.94	24.14	24.94	24.14	24.94	24.94	24.14	24.94	24.14	24.94		(56)



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 24.94 22.53 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0	(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	m
(62)m= 217.03 191.2 200.57 179.49 175.67 156.64 150.13 165.16 165 186.13 197.21 211.7	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 217.03 191.2 200.57 179.49 175.67 156.64 150.13 165.16 165 186.13 197.21 211.7	
Output from water heater (annual) <sub>112</sub> 2195.94	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 94.7 83.93 89.23 81.49 80.95 73.89 72.45 77.45 76.67 84.43 87.38 92.93	(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):	
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	
Metabolic gains (Table 5), Watts	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       145.88	(66) (67)
Metabolic gains (Table 5), Watts         Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec         (66)m=       145.88	` '
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       145.88	` '
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 145	(67)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 145	(67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 145	(67) (68) (69)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       145.88	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         145.88	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 145.88 145	(67) (68) (69) (70) (71)

Area

m²

Flux

Table 6a

Table 6b

Table 6c

Orientation: Access Factor

Table 6d

Gains

(W)

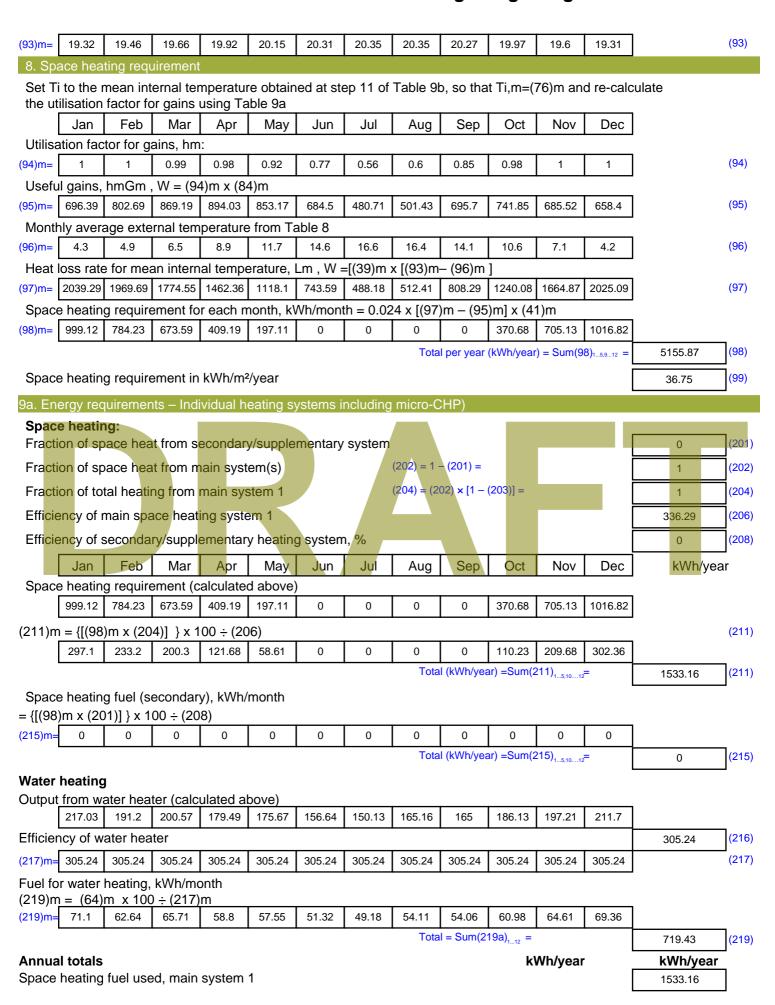


Southeast 0.0x													
Southeast 0 s	Southeast 0.9x	0.54	x	8.88	x	36.79	X	0.45	x	0.67	=	47.88	(77)
Southeast 0.5%	Southeast 0.9x	0.54	x	1.78	x	36.79	X	0.45	x	0.67	=	9.6	(77)
Southeast 0.5x	Southeast 0.9x	0.54	x	8.88	X	62.67	X	0.45	x	0.67	=	81.55	(77)
Southeast 0.5%	Southeast 0.9x	0.54	X	1.78	x	62.67	x	0.45	x	0.67	=	16.35	(77)
Southeast 0 sk	Southeast 0.9x	0.54	x	8.88	x	85.75	x	0.45	x	0.67	=	111.58	(77)
Southeast 0, 9x	Southeast 0.9x	0.54	x	1.78	x	85.75	x	0.45	x	0.67	=	22.37	(77)
Southeast 0, 9x	Southeast 0.9x	0.54	X	8.88	x	106.25	X	0.45	x	0.67	=	138.25	(77)
Southeast 0.9%	Southeast 0.9x	0.54	x	1.78	x	106.25	X	0.45	x	0.67	=	27.71	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	X	119.01	X	0.45	x	0.67	=	154.85	(77)
Southeast 0.9x	Southeast 0.9x	0.54	X	1.78	x	119.01	X	0.45	x	0.67	=	31.04	(77)
Southeast 0.9x	Southeast 0.9x	0.54	X	8.88	x	118.15	X	0.45	x	0.67	=	153.73	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	118.15	X	0.45	x	0.67	=	30.82	(77)
Southeast 0.9x	Southeast 0.9x	0.54	X	8.88	x	113.91	X	0.45	x	0.67	=	148.22	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	x	113.91	X	0.45	x	0.67	=	29.71	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	x	104.39	X	0.45	x	0.67	=	135.83	(77)
Southeast 0.9x	Southeast 0.9x	0.54	X	1.78	x	104.39	X	0.45	x	0.67	=	27.23	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	x	92.85	X	0.45	x	0.67	=	120.82	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	X	92.85	X	0.45	X	0.67	=	24.22	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	х	69.27	X	0.45	x	0.67	=	90.13	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	1.78	х	69.27	x	0.45	x	0.67	=	18.07	(77)
Southeast 0.9x	Southeast 0.9x	0.54	x	8.88	X	44.07	x	0.45	x	0.67	=	57.34	(77)
Southeast 0.9x         0.54         x         1.78         x         31.49         x         0.45         x         0.67         =         8.21         (77)           South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23	Southeast 0.9x	0.54	x	1.78	x	44.07	Х	0.45	x	0.67	=	11.49	(77)
South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23	Southeast 0.9x	0.54	x	8.88	x	31.49	X	0.45	x	0.67	=	40.97	(77)
South         0.9x         0.54         x         2.85         x         46.75         x         0.45         x         0.67         =         39.05         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.2	Southeast 0.9x	0.54	x	1.78	х	31.49	X	0.45	x	0.67	=	8.21	(77)
South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.	South 0.9x	0.54	x	2.85	x	46.75	X	0.45	x	0.67	=	39.05	(78)
South         0.9x         0.54         x         2.85         x         76.57         x         0.45         x         0.67         =         63.95         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110	South 0.9x	0.54	X	2.85	X	46.75	x	0.45	X	0.67	=	39.05	(78)
South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         11	South 0.9x	0.54	X	2.85	X	76.57	X	0.45	X	0.67	=	63.95	(78)
South         0.9x         0.54         x         2.85         x         97.53         x         0.45         x         0.67         =         81.46         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         1	South 0.9x	0.54	X	2.85	X	76.57	x	0.45	X	0.67	=	63.95	(78)
South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x	South <sub>0.9x</sub>	0.54	X	2.85	X	97.53	X	0.45	X	0.67	=	81.46	(78)
South         0.9x         0.54         x         2.85         x         110.23         x         0.45         x         0.67         =         92.07         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x	South 0.9x	0.54	X	2.85	X	97.53	X	0.45	X	0.67	=	81.46	(78)
South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x	South <sub>0.9x</sub>	0.54	X	2.85	X	110.23	X	0.45	X	0.67	=	92.07	(78)
South         0.9x         0.54         x         2.85         x         114.87         x         0.45         x         0.67         =         95.94         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         87.61         (78)           South         0.9x         0.54         x         2.85         x	South <sub>0.9x</sub>	0.54	X	2.85	X	110.23	X	0.45	X	0.67	=	92.07	(78)
South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         110.55         x         0.45         x         0.67         =         92.33         (78)           South         0.9x         0.54         x         2.85         x         108.01         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         90.21         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         87.61         (78)           South         0.9x         0.54         x         2.85         x         104.89         x         0.45         x         0.67         =         87.61         (78)	South 0.9x	0.54	X	2.85	X	114.87	X	0.45	X	0.67	=	95.94	(78)
South       0.9x       0.54       x       2.85       x       110.55       x       0.45       x       0.67       =       92.33       (78)         South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	South 0.9x	0.54	X	2.85	X	114.87	X	0.45	X	0.67	=	95.94	(78)
South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	South 0.9x	0.54	X	2.85	x	110.55	X	0.45	X	0.67	=	92.33	(78)
South       0.9x       0.54       x       2.85       x       108.01       x       0.45       x       0.67       =       90.21       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	<u>l</u>	0.54	x	2.85	x	110.55	X	0.45	x	0.67	=	92.33	(78)
South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)         South       0.9x       0.54       x       2.85       x       104.89       x       0.45       x       0.67       =       87.61       (78)	<u>l</u>	0.54	x	2.85	x	108.01	X	0.45	x	0.67	=	90.21	(78)
South 0.9x 0.54 x 2.85 x 104.89 x 0.45 x 0.67 = 87.61 (78)	<u>l</u>	0.54	x	2.85	x	108.01	X	0.45	x	0.67	=	90.21	(78)
	<u>l</u>	0.54	x	2.85	x	104.89	X	0.45	x	0.67	=	87.61	(78)
South 0.9x 0.54 x 2.85 x 101.89 x 0.45 x 0.67 = 85.1 (78)	<u>l</u>	0.54	x	2.85	x	104.89	X	0.45	x	0.67	=	87.61	(78)
	South 0.9x	0.54	X	2.85	X	101.89	X	0.45	X	0.67	=	85.1	(78)



South 0.9x	0.54	X	2.85	x	101.8	89	x	0.45	x	0.67	=	85.1	(78)
South 0.9x	0.54	X	2.85	х	82.5	i9	x	0.45	x_[	0.67	=	68.98	(78)
South 0.9x	0.54	х	2.85	x	82.5	9	x	0.45	x	0.67	=	68.98	(78)
South 0.9x	0.54	X	2.85	х	55.4	-2	x	0.45	x	0.67	=	46.29	(78)
South 0.9x	0.54	X	2.85	х	55.4	2	x	0.45	x_[	0.67	=	46.29	(78)
South 0.9x	0.54	X	2.85	x	40.4	4	x	0.45	x	0.67	=	33.74	(78)
South 0.9x	0.54	X	2.85	Х	40.4	4	x	0.45	x	0.67	-	33.74	(78)
Southwest <sub>0.9x</sub>	0.54	X	2.67	Х	36.7	9		0.45	x_[	0.67	=	28.79	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	62.6	57		0.45	x	0.67	=	49.04	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	×	85.7	<b>'</b> 5		0.45	x	0.67	=	67.1	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	106.2	25		0.45	x	0.67	=	83.14	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	119.0	01		0.45	×	0.67	=	93.12	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	Х	118.	15		0.45	x_[	0.67	=	92.45	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	113.9	91		0.45	x	0.67	=	89.13	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	104.3	39		0.45	×	0.67	=	81.68	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	Х	92.8	5		0.45	x_[	0.67	=	72.65	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	69.2	27		0.45	×	0.67	=	54.2	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	X	44.0	7		0.45	X	0.67	=	34.48	(79)
Southwest <sub>0.9x</sub>	0.54	X	2.67	×	31.4	.9		0.45	x	0.67	=	24.64	(79)
Solar gains in	watts, calc	ulated	for each i	month		(83	3)m = S	Sum(74)m	.(82)m				
		U							.(-)				
(83)m= 164.36	274.84 3	63.97	433.24				119.96	387.88	300.35	195.89	141.3		(83)
Total gains –	274.84 3 internal and	63.97 Solar	433.24 (84)m = (	73)m + (	83)m , w	ratts	119.96	387.88	300.35				
` ′	274.84 3 internal and	63.97	433.24 (84)m = (	73)m + (	83)m , w	ratts	_		<u> </u>		141.3 659.02	]	(83)
Total gains –	274.84 3 internal and 805.36 8	63.97 d solar 376.59	433.24 (84)m = ( 916.75 9	(73)m + ( 924.24   8	83)m , w	ratts	119.96	387.88	300.35				
Total gains – (84)m= 697.31	274.84 3 internal and 805.36 8 rnal temper	63.97 d solar 76.59	433.24 (84)m = ( 916.75 s (heating s	73)m + ( 924.24 8 eason)	83)m , w 86.51 8	vatts 54.23 8	119.96 333.48	387.88 816.72	300.35			21	
Total gains – (84)m= 697.31  7. Mean inte	274.84 3 internal and 805.36 8 rnal temper e during hea	solar 76.59 ature (	433.24 (84)m = ( 916.75 seriods in t	(73)m + ( 924.24 8 eason) the living	83)m , w 86.51 8: area froi	vatts 54.23 8 m Table	119.96 333.48	387.88 816.72	300.35			21	(84)
Total gains – (84)m= 697.31  7. Mean inte	274.84 3 internal and 805.36 8 rnal temper e during hea	solar 76.59 ature (	433.24 (84)m = ( 916.75 seriods in t	(73)m + ( 924.24 8 eason) the living	83)m , w 86.51 8 area froi ee Table	vatts 54.23 8 m Table	119.96 333.48	387.88 816.72	300.35	687.76		21	(84)
Total gains – (84)m= 697.31  7. Mean inte Temperature Utilisation fac	274.84 3 internal and 805.36 8 rnal temper during heactor for gain Feb	solar or6.59 rature ( ating pe	433.24 (84)m = ( 916.75 seriods in total	(73)m + ( 924.24 8 eason) the living , h1,m (s May	83)m , w 86.51 8 area from ee Table Jun	m Table 9a)	333.48 9, Th	387.88 816.72 11 (°C)	300.35 758.53	687.76	659.02	21	(84)
Total gains – (84)m= 697.31  7. Mean inte Temperature Utilisation far	274.84 3 internal and 805.36 8 rnal temper during heator for gair Feb	solar solar solar stature ( ating pens for li Mar 0.99	433.24 (84)m = ( 916.75 Seriods in total seriod seriods in total seriods in total seriods in total seriods in total seriods in total seriods in total seriods in total seriod seriods in total se	(73)m + ( 924.24 8 eason) the living , h1,m (s May 0.95	83)m , w 86.51 8 area from ee Table Jun 0.83 0	m Table 9a) Jul 0.65	119.96 333.48 9 9, Th Aug 0.69	387.88 816.72 11 (°C) Sep 0.9	300.35 758.53 Oct	8 687.76 Nov	659.02 Dec	21	(84)
Total gains – (84)m= 697.31  7. Mean inte Temperature Utilisation far  Jan (86)m= 1	274.84 3 internal and 805.36 8 rnal temper during hea ctor for gair Feb 1 al temperatu	solar solar solar stature ( ating pens for li Mar 0.99	(84)m = ( 916.75 g (heating seriods in tolerance) Apr 0.98 iving area	(73)m + ( 924.24 8 eason) the living h, h1,m (s May 0.95	83)m , w 86.51 8 area froi ee Table Jun 0.83 0	m Table 9a) Jul 0.65 3 to 7 ir	119.96 333.48 9 9, Th Aug 0.69	387.88 816.72 11 (°C) Sep 0.9	300.35 758.53 Oct	Nov 1	659.02 Dec	21	(84)
Total gains –  (84)m = 697.31  7. Mean inte Temperature Utilisation far  Jan  (86)m = 1  Mean internal	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gain Feb 1 al temperatu 20.24 2	ature (ating pens for lime Mar 0.99 ure in l	433.24 (84)m = ( 916.75 9 (heating seriods in tolerance and seriods) Apr 0.98 10.98 10.58 10.58	(73)m + ( 924.24 8 eason) the living , h1,m (s May 0.95 a T1 (follo	83)m , w 86.51 8 area froi ee Table Jun 0.83 0 ow steps 20.9 2	m Table 9a) Jul 0.65 3 to 7 ir	333.48 9 9, Th Aug 0.69 n Tabl 20.94	387.88 816.72 11 (°C) Sep 0.9 e 9c) 20.86	300.35 758.53 Oct 0.99	Nov 1	659.02 Dec 1	21	(84)
Total gains – (84)m = 697.31  7. Mean inte Temperature Utilisation far  (86)m = 1  Mean interna (87)m = 20.14	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 e during hea	ature (ating pens for lime Mar 0.99 ure in l	433.24 (84)m = ( 916.75 seriods in total	(73)m + ( 924.24 8 eason) the living , h1,m (s May 0.95 a T1 (follo 20.77	area from ee Table Jun 0.83  ow steps 20.9  2	m Table 9a) Jul 0.65 3 to 7 ir 20.95	333.48 9 9, Th Aug 0.69 n Tabl 20.94	387.88 816.72 11 (°C) Sep 0.9 e 9c) 20.86	300.35 758.53 Oct 0.99	Nov 1 20.34	659.02 Dec 1	21	(84)
Total gains –  (84)m= 697.31  7. Mean inte Temperature Utilisation far  (86)m= 1  Mean interna (87)m= 20.14  Temperature (88)m= 20.11	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 e during hea 20.11 2	solar sola solar sola sola sola sola sola sola sola sola	433.24 (84)m = ( 916.75 seriods in texting area Apr 0.98 seriods in r 20.58 seriods in r 20.13	(73)m + ( 924.24 8 924.24 8 92	area from the ee Table of the	m Table 9a) Jul 0.65 3 to 7 ir 20.95 20.14	119.96 333.48 9 9, Th Aug 0.69 1 Tabl 20.94 e 9, T 20.15	387.88 816.72 11 (°C) Sep 0.9 e 9c) 20.86 th2 (°C)	758.53 Oct 0.99	Nov 1 20.34	Dec 1 20.13	21	(84)
Total gains –  (84)m= 697.31  7. Mean inte Temperature Utilisation far  (86)m= 1  Mean interna (87)m= 20.14  Temperature	274.84 3 internal and 805.36 8 rnal temper during hea ctor for gair Feb 1 al temperatu 20.24 2 during hea 20.11 2 ctor for gair	solar sola solar sola sola sola sola sola sola sola sola	433.24 (84)m = ( 916.75 seriods in the seriod in the	(73)m + ( 924.24 8 eason) the living , h1,m (s May 0.95 a T1 (follo 20.77 rest of dw 20.13 2	83)m , w 86.51 8 area from ee Table Jun 0.83 0 ow steps 20.9 2 velling from 20.14 2	m Table 9a) Jul 0.65 3 to 7 ir 20.95  Table 9a	119.96 333.48 9 9, Th Aug 0.69 1 Tabl 20.94 e 9, T 20.15	387.88 816.72 11 (°C) Sep 0.9 e 9c) 20.86 th2 (°C)	758.53 Oct 0.99	Nov 1 20.34	Dec 1 20.13	21	(84)
Total gains –  (84)m = 697.31  7. Mean intermodule Temperature  Utilisation factors  (86)m = 1  Mean intermodule 20.14  Temperature (88)m = 20.11  Utilisation factors (89)m = 1	274.84 3 internal and 805.36 8 rnal temper during hea ctor for gair Feb 1 al temperatu 20.24 2 during hea 20.11 2 ctor for gair	solar rature (ating pens for limited pen	433.24 (84)m = ( 916.75 seriods in the seriod in the	(73)m + ( 924.24 8 eason) the living ., h1,m (s May 0.95 a T1 (follo 20.77 rest of dv 20.13 2 elling, h2	83)m , w 86.51 8 area from ee Table Jun 0.83 0 ow steps 20.9 2 velling from 20.14 2 ,m (see 10.76 0	m Table 9a) Jul 0.65 3 to 7 in 20.95  Table 9a 0.53	Aug 0.69 n Tabl 20.94 e 9, T 20.15 a)	387.88 816.72 11 (°C) Sep 0.9 1e 9c) 20.86 Th2 (°C) 20.14	Oct 0.99 20.63 0.98	Nov 1 20.34	Dec 1 20.13	21	(84) (85) (86) (87) (88)
Total gains –  (84)m = 697.31  7. Mean interconstruction factor of the f	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 e during hea 20.11 2 ctor for gair 1	solar rature (ating pons for limiting pons for limiting pons for limiting pons for limiting pons for rature in the limiting po	433.24 (84)m = ( 916.75 seriods in texting area Apr 0.98 iving area 20.58 eriods in r 20.13 est of dwee 0.98 he rest of	(73)m + ( 924.24 8 eason) the living , h1,m (s May 0.95 a T1 (follo 20.77 rest of dw 20.13 2 elling, h2 0.92	83)m , w 86.51 8 86.51 8 area from ee Table Jun 0.83 0 w steps 20.9 2 velling from 20.14 2 ,m (see 0.76 0) T2 (follo	m Table 9a) Jul 0.65 3 to 7 ir 20.95 20.14 Table 9a 0.53  Dw steps	Aug 0.69 n Tabl 20.94 e 9, T 20.15 a) 0.57	387.88  816.72  11 (°C)  Sep 0.9  10 20.86  10 20.14  0.84  7 in Table	Oct 0.99 20.63 20.13 0.98	Nov 1 20.34 20.13	Dec 1 20.13	21	(84) (85) (86) (87) (88) (89)
Total gains –  (84)m = 697.31  7. Mean intermodule Temperature  Utilisation factors  (86)m = 1  Mean intermodule 20.14  Temperature (88)m = 20.11  Utilisation factors (89)m = 1	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 e during hea 20.11 2 ctor for gair 1 al temperatu 4 during hea 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	solar rature (ating pens for limited pen	433.24 (84)m = ( 916.75 seriods in texting area Apr 0.98 iving area 20.58 eriods in r 20.13 est of dwee 0.98 he rest of	(73)m + ( 924.24 8 924.24 8 92	83)m , w 86.51 8 86.51 8 area from ee Table Jun 0.83 0 w steps 20.9 2 velling from 20.14 2 ,m (see 0.76 0) T2 (follo	m Table 9a) Jul 0.65 3 to 7 ir 20.95 20.14 Table 9a 0.53  Dw steps	Aug 0.69 n Tabl 20.94 e 9, T 20.15 a)	387.88  816.72  11 (°C)  Sep 0.9  120.86  142 (°C) 20.14  0.84  7 in Table 19.99	Oct 0.99 20.63 20.13 0.98 29c) 19.67	Nov 1 20.34 20.13	Dec 1 20.13 20.12		(84) (85) (86) (87) (88) (89)
Total gains – (84)m = 697.31  7. Mean interconduction factors Utilisation factors (86)m = 1  Mean interconduction factors (88)m = 20.14  Temperature (88)m = 20.11  Utilisation factors (89)m = 1  Mean interconduction factors (90)m = 18.94	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 ctor for gair 1 ctor for gair 1 al temperatu 1 19.09 1	solar rature (ating pens for limited pens for rature) at the solar rature (ating pens for rature) at the solar rature (ating pens for rature) at the solar rature in the solar rature (at the solar rature) at the solar rature (at the solar rature) at the solar rature (at the solar rature) at the solar rature (at the solar rature) at the solar rature in the solar rat	433.24 (84)m = ( 916.75 seriods in the seriod in the seriods in the seriods in the seriods in the seriods in the seriod in	(73)m + ( 924.24 8 eason) the living , h1,m (s May 0.95 a T1 (follo 20.77 rest of dv 20.13 2 elling, h2 0.92	83)m , w 86.51 8  area froi ee Table Jun 0.83 0  ow steps 20.9 2  velling fro 20.14 2  ,m (see 0.76 0  T2 (follo	m Table 9a) Jul 0.65 3 to 7 ir 20.95  Table 9a 0.53  Ow steps	Aug 0.69 n Tabl 20.94 e 9, T 20.15 a) 0.57 s 3 to 20.07	387.88  816.72  11 (°C)  Sep 0.9  120.86  142 (°C) 20.14  7 in Table 19.99  ft.	Oct 0.99 20.63 20.13 0.98 29c) 19.67	Nov 1 20.34 20.13	Dec 1 20.13 20.12	21	(84) (85) (86) (87) (88) (89)
Total gains –  (84)m = 697.31  7. Mean intercontrol of the following series of	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 e during hea 20.11 2 ctor for gair 1 al temperatu 19.09	solar rature (ating pens for limited pens for limited pens for limited pens for limited pens for reconstruction pens for recon	433.24 (84)m = ( 916.75 seriods in texting area Apr 0.98 iving area 20.58 eriods in r 20.13 est of dwe 0.98 he rest of 19.61	(73)m + (924.24   8 (924.24	83)m , w 86.51 8 86.51 8 area from ee Table Jun 0.83 0 ow steps 20.9 2 velling from 20.14 2 multiple from contact the second of	m Table 9a) Jul 0.65 3 to 7 ir 20.95 20.14 Table 9a 0.53 Dw steps 20.07	119.96 333.48 9 9, Th Aug 0.69 1 Tabl 20.94 e 9, T 20.15 a) 0.57 s 3 to 20.07	387.88  816.72  11 (°C)  Sep 0.9  e 9c) 20.86  120.14  7 in Table 19.99  fL  A) × T2	Oct 0.99 20.63 20.13 0.98 9c) 19.67 A = Liv	Nov 1 20.34 20.13 1 19.26 ing area ÷ (4	Dec 1 20.13 20.12 1 18.93		(84) (85) (86) (87) (88) (89) (90)
Total gains – (84)m = 697.31  7. Mean interconduction factors Utilisation factors (86)m = 1  Mean interconduction factors (88)m = 20.14  Temperature (88)m = 20.11  Utilisation factors (89)m = 1  Mean interconduction factors (90)m = 18.94	274.84 3 internal and 805.36 8 rnal temper e during hea ctor for gair Feb 1 al temperatu 20.24 2 ctor for gair 1 al temperatu 19.09 1	solar (ating pens for limited pens for l	433.24 (84)m = ( 916.75   9 (heating seriods in the seriod in the seriod	(73)m + (924.24 8 8 924.24 8 8 924.24 8 8 924.24 8 8 924.24 8 924.	83)m , w 86.51 8  area froi ee Table Jun 0.83 0  ow steps 20.9 2  velling fro 20.14 2  m (see 1) 0.76 0  T2 (follo 20.04 2  g) = fLA 20.31 2	m Table 9a) Jul 0.65 3 to 7 ir 20.95  Table 9a 0.53  w steps 20.07  x T1 +	Aug 0.69 n Tabl 20.94 e 9, T 20.15 a) 0.57 s 3 to 20.07 (1 - fl	387.88  816.72  11 (°C)  Sep 0.9  120.86  120.14  7 in Table 19.99 fL  A) × T2 20.27	300.35 758.53 Oct 0.99 20.63 20.13 0.98 9c) 19.67 A = Liv	Nov 1 20.34 20.13	Dec 1 20.13 20.12		(84) (85) (86) (87) (88) (89)







Water heating fuel used 719.43 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 392.83 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 392.83 Electricity for lighting 514.89 (232)12a. CO2 emissions – Individual heating systems including micro-CHP **Emission factor Emissions Energy** kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x (261) 795.71 0.519 Space heating (secondary) (215) x (263)0.519 (219) x Water heating 0.519 373.38 (264)(261) + (262) + (263) + (264) =Space and water heating (265)1169.09 (231) x Electricity for pumps, fans and electric keep-hot 0.519 203.88 (267)(232) x Electricity for lighting (268)0.519 267.23 Total CO2, kg/year sum of (265)...(271) = (272)1640.2  $(272) \div (4) =$ **Dwelling CO2 Emission Rate** (273)11.69 El rating (section 14) (274)88



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 8 - 4B8P - GF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 220 (1a) x 2.7 (2a) =(3a) 594 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)220 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =594 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allo	owing for shelter a	and wind spee	ed) = (21a) x (	(22a)m			
0.16 0.16 0.16		1 1 1	.12 0.12	0.13	0.14 0.14	0.15	
Calculate effective air chang	ge rate for the app	olicable case		•	•		
If mechanical ventilation:  If exhaust air heat pump using A	nnendiy N (23h) - (2	3a) × Emy (equa-	tion (N5)) other	wise (23h) -	- (23a)	L	0.5 (23a)
If balanced with heat recovery:					- (2 <i>0</i> a)	L	0.5 (23b)
a) If balanced mechanical		-			//w + (33p) ×	[1 _ (23c)	74.8 (23c)
(24a)m= 0.29 0.29 0.28		<del></del>	.25 0.24	0.25	0.26 0.27	0.28	÷ 100j (24a)
b) If balanced mechanical	İİ			<u>_</u>		1	,
(24b)m= 0 0 0	0 0		0 0	0	0 0	0	(24b)
c) If whole house extract v		tive input vent	tilation from o	utside	<u> </u>		
if $(22b)m < 0.5 \times (23b)$	•	•			× (23b)		
(24c)m = 0 0 0	0 0	0	0 0	0	0 0	0	(24c)
d) If natural ventilation or if (22b)m = 1, then (24					.5]		
(24d)m= 0 0 0	0 0	0	0 0	0	0 0	0	(24d)
Effective air change rate -	enter (24a) or (2	4b) or (24c) o	r (24d) in box	(25)	•		
(25)m= 0.29 0.29 0.28	0.27 0.26	0.25 0.	.25 0.24	0.25	0.26 0.27	0.28	(25)
3. Heat losses and heat los	ss parameter:					_	
ELEMENT Gross area (m²)	Openings m <sup>2</sup>	Net Area A ,m²	U-valu W/m2	K	A X U (W/K)	k-value kJ/m²-K	A X k kJ/K
Windows Type 1		6.74	x1/[1/( 1.1 )+		7.1		(27)
Windows Type 2		0.88	x1/[1/( 1.1 )+		0.93		(27)
Windows Type 3		0.88	x1/[1/( 1.1 )+	0.04] =	0.93		(27)
Windows Type 4		11.41	x1/[1/( 1.1 )+	0.04] =	12.02		(27)
Windows Type 5		0.88	x1/[1/( 1.1 )+	0.04] =	0.93		(27)
Windows Type 6		4.1	x1/[1/( 1.1 )+				
Windows Type 7			] ^ ` ` /	0.04] =	4.32		(27)
		1.54	x1/[1/( 1.1 )+	<u> </u>	1.62		(27) (27)
Windows Type 8		1.54 2.68	J 1	0.04] =			
Windows Type 8 Floor			x1/[1/( 1.1 )+	0.04] =	1.62		(27)
• •	49.54	2.68	x1/[1/( 1.1 )+ x1/[1/( 1.1 )+	0.04] =	1.62		(27)
Floor	49.54	2.68	x1/[1/( 1.1 )+ x1/[1/( 1.1 )+ x 0.11	0.04] = 0.04] = 0.04] = 0.04]	1.62 2.82 24.2		(27) (27) (28)
Floor Walls Type1 115.69		2.68 220 66.16	x1/[1/( 1.1 )+ x1/[1/( 1.1 )+ x 0.11 x 0.12	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	1.62 2.82 24.2 7.94		(27) (27) (28) (29)
Floor Walls Type1 115.69 Walls Type2 57.78		2.68 220 66.16 57.78	x1/[1/( 1.1 )+ x1/[1/( 1.1 )+ x 0.11 x 0.12	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	1.62 2.82 24.2 7.94		(27) (27) (28) (29) (29)
Floor Walls Type1 115.69 Walls Type2 57.78 Total area of elements, m²		2.68 220 66.16 57.78 393.47	x1/[1/(1.1)+ x1/[1/(1.1)+ x 0.11 x 0.12 x 0.14	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	1.62 2.82 24.2 7.94 8.18		(27) (27) (28) (29) (29) (31)
Floor Walls Type1 115.69 Walls Type2 57.78 Total area of elements, m² Party wall	0 se effective window U	2.68  220  66.16  57.78  393.47  35.24  220  -value calculated	x1/[1/(1.1)+ x1/[1/(1.1)+ x 0.11 x 0.12 x 0.14 x 0	0.04] = 0.04] =	1.62 2.82 24.2 7.94 8.18	n paragraph	(27) (27) (28) (29) (29) (31) (32)
Floor Walls Type1 115.69 Walls Type2 57.78 Total area of elements, m² Party wall Party ceiling * for windows and roof windows, us	0 se effective window United to finternal walls and positions.	2.68  220  66.16  57.78  393.47  35.24  220  -value calculated	x1/[1/(1.1)+ x1/[1/(1.1)+ x 0.11 x 0.12 x 0.14 x 0	0.04] =	1.62 2.82 24.2 7.94 8.18	n paragraph	(27) (27) (28) (29) (29) (31) (32)
Floor Walls Type1 115.69 Walls Type2 57.78 Total area of elements, m² Party wall Party ceiling * for windows and roof windows, us ** include the areas on both sides	o se effective window Uniternal walls and portains and po	2.68  220  66.16  57.78  393.47  35.24  220  -value calculated	x1/[1/(1.1)+ x1/[1/(1.1)+ x 0.11 x 0.12 x 0.14 x 0	0.04] =	1.62 2.82 24.2 7.94 8.18		(27) (27) (28) (29) (29) (31) (32) (32b)
Floor Walls Type1 115.69 Walls Type2 57.78 Total area of elements, m² Party wall Party ceiling * for windows and roof windows, us ** include the areas on both sides of the si	0 se effective window Uniternal walls and poor (A x U)	2.68  220  66.16  57.78  393.47  35.24  220  -value calculated artitions	x1/[1/(1.1)+ x1/[1/(1.1)+ x 0.11 x 0.12 x 0.14 x 0	0.04] =	1.62 2.82 24.2 7.94 8.18 0 9+0.04] as given i	)(32e) = [	(27) (27) (28) (29) (31) (32) (32b) 3.2

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)59.02 if details of thermal bridging are not known (36) =  $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)151.53 Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)$ m x (5)Feb Mar Jul Sep Dec .lan Apr May Jun Aug Oct Nov (38)m =56.56 55.94 55.31 52.19 51.57 48.44 48.44 47.82 49.69 51.57 52.82 54.06 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =208.1 207.47 206.85 203.72 203.1 199.98 199.98 199.35 201.22 203.1 204.35 205.6 Average = Sum(39)<sub>1...12</sub> /12= (39)203.57 Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m  $\div$  (4)0.92 (40)m =0.95 0.94 0.94 0.93 0.91 0.91 0.91 0.91 0.92 0.93 0.93 (40)Average =  $Sum(40)_{1...12}/12=$ 0.93 Number of days in month (Table 1a) Jan Feb Mar Jun Apr May Jul Aug Sep Oct Nov Dec (41)31 28 31 30 31 30 31 31 30 31 30 31 (41)m =4. Water heating energy requirement: Assumed occupancy, N (42)3.03 if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)106.11 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) 116.72 112.48 108.24 103.99 95.5 99.75 103.99 108.24 112.48 116.72 (44)m =99.75 95.5 (44)Total =  $Sum(44)_{1...12}$  = 1273.36 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 =173.1 151.39 156.22 136.2 130.69 112.77 104.5 119.92 121.35 141.42 154.37 167.64 (45)Total =  $Sum(45)_{1...12}$  = 1669.58 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.96 22.71 23.43 20.43 16.92 21.21 23.16 25.15 (46)19.6 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 305 (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): 1.63 (48)Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year  $(48) \times (49) =$ 0.88 (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 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)



Energy lost from water storag Enter (50) or (54) in (55)	e, kWh/year		(	(47) x (51)	) x (52) x (	53) =		0		(54) (55)
Water storage loss calculated	for each month		(	((56)m = (	55) × (41)r	n	0.	00		(55)
(56)m= 27.29 24.65 27.29	26.41 27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(56)
If cylinder contains dedicated solar si								_	 lix H	(00)
(57)m= 27.29 24.65 27.29	26.41 27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(57)
Primary circuit loss (annual) f	rom Table 3							0		(58)
Primary circuit loss calculated	I for each month	(59)m = $(5)$	58) ÷ 36	5 × (41)	m					
(modified by factor from Ta		solar wate	er heatin	g and a	cylinde	thermo	stat)	•	•	
(59)m= 23.26 21.01 23.26	22.51 23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss calculated for each	h month (61)m =	(60) ÷ 36	55 × (41)ı	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	month (	(62)m =	0.85 × (	45)m +	(46)m +	(57)m +	(59)m + (61)m	1
(62)m= 223.65 197.05 206.77	185.12 181.24	161.69	155.05	170.47	170.27	191.97	203.29	218.19		(62)
Solar DHW input calculated using Ap	pendix G or Appendi	x H (negativ	e quantity)	) (enter '0	' if no sola	contribut	on to wate	er heating)	•	
(add additional lines if FGHR	S and/or WWHR	S applies,	see App	oendix (	G)					
(63)m= 0 0 0	0 0	0	0	0	0	0	0	0		(63)
Output from water heater										
(64)m= 223.65 197.05 206.77	185.12 181.24	161.69	155.05	170.47	170.27	191.97	203.29	218.19		
				Outp	out from wa	ater heate	(annual)₁	12	2264.74	(64)
Heat gains from water heating	g, kWh/month 0.2	25 [0.85 ;	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	]	
(65)m= 97.99 86.86 92.38	84.42 83.89	76.63	75.40	00.04						
(50)	01.12	70.03	75.19	80.31	79.48	87.46	90.46	96.18		(65)
include (57)m in calculation		<del>                                     </del>							eating	(65)
	of (65)m only if	<del>                                     </del>							eating	(65)
include (57)m in calculation	of (65)m only if 5 and 5a):	<del>                                     </del>							peating	(65)
include (57)m in calculation 5. Internal gains (see Table	of (65)m only if 5 and 5a):	<del>                                     </del>							eating	(65)
include (57)m in calculation 5. Internal gains (see Table Metabolic gains (Table 5), Wa	of (65)m only if of the state o	cylinder is	in the d	lwelling	or hot w	ater is fr	om com	munity h	eating	(65)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar	of (65)m only if (5 and 5a):  atts  Apr May  151.4 151.4	Jun 151.4	Jul 151.4	Aug 151.4	Sep	oct	om com	munity h	neating	
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4	of (65)m only if (5 and 5a):  atts  Apr May  151.4 151.4	Jun 151.4	Jul 151.4	Aug 151.4	Sep	oct	om com	munity h	eating	
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A	of (65)m only if (5 and 5a):  atts  Apr May  151.4 151.4  Appendix L, equa  19.09 14.27	Jun 151.4 tion L9 or	Jul 151.4 L9a), als	Aug 151.4 so see	Sep 151.4 Table 5	Oct 151.4	Nov	Dec	neating	(66)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22	of (65)m only if of 5 and 5a):  atts Apr May 151.4 151.4 Appendix L, equa 19.09 14.27 in Appendix L, ec	Jun 151.4 tion L9 or	Jul 151.4 L9a), als	Aug 151.4 so see	Sep 151.4 Table 5	Oct 151.4	Nov	Dec	neating	(66)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated	of (65)m only if (5 and 5a):  atts  Apr May  151.4 151.4  Appendix L, equa  19.09 14.27  in Appendix L, ed  361.84 334.46	Jun 151.4 tion L9 or 12.05 quation L1 308.72	Jul 151.4 L9a), als 13.02 3 or L13 291.52	Aug 151.4 so see 16.92 Ba), also	Sep 151.4 Table 5 22.72 see Tal 297.67	Oct 151.4  28.84  ole 5 319.36	Nov 151.4 33.66	Dec 151.4	eating	(66) (67)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53	of (65)m only if (5 and 5a):  atts  Apr May  151.4 151.4  Appendix L, equa  19.09 14.27  in Appendix L, ed  361.84 334.46	Jun 151.4 tion L9 or 12.05 quation L1 308.72	Jul 151.4 L9a), als 13.02 3 or L13 291.52	Aug 151.4 so see 16.92 Ba), also	Sep 151.4 Table 5 22.72 see Tal 297.67	Oct 151.4  28.84  ole 5 319.36	Nov 151.4 33.66	Dec 151.4	neating	(66) (67)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A	of (65)m only if (5 and 5a):  atts Apr May 151.4 151.4 Appendix L, equa 19.09 14.27 in Appendix L, ed 361.84 334.46 Appendix L, equa 38.14 38.14	Jun 151.4 tion L9 or 12.05 quation L1 308.72	Jul 151.4 L9a), als 13.02 13 or L13 291.52 or L15a),	Aug 151.4 so see 16.92 3a), also 287.48 , also se	Sep 151.4 Table 5 22.72 see Tal 297.67 ee Table	Oct 151.4  28.84  ole 5 319.36	Nov 151.4 33.66 346.75	Dec 151.4 35.89 372.48	neating	(66) (67) (68)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14	of (65)m only if (5 and 5a):  atts Apr May 151.4 151.4 Appendix L, equa 19.09 14.27 in Appendix L, ed 361.84 334.46 Appendix L, equa 38.14 38.14	Jun 151.4 tion L9 or 12.05 quation L1 308.72	Jul 151.4 L9a), als 13.02 13 or L13 291.52 or L15a),	Aug 151.4 so see 16.92 3a), also 287.48 , also se	Sep 151.4 Table 5 22.72 see Tal 297.67 ee Table	Oct 151.4  28.84  ole 5 319.36	Nov 151.4 33.66 346.75	Dec 151.4 35.89 372.48	eating	(66) (67) (68)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14  Pumps and fans gains (Table	of (65)m only if a  total states  Apr May  151.4 151.4  Appendix L, equa  19.09 14.27  in Appendix L, ed  361.84 334.46  Appendix L, equa  38.14 38.14  5a)  0 0	Jun 151.4 tion L9 or 12.05 quation L1 308.72 ation L15 or 38.14	Jul 151.4 L9a), als 13.02 3 or L13 291.52 or L15a), 38.14	Aug 151.4 so see 16.92 3a), also 287.48 , also se 38.14	Sep 151.4 Table 5 22.72 see Tal 297.67 ee Table 38.14	Oct 151.4  28.84  ole 5 319.36 5 38.14	Nov 151.4 33.66 346.75	Dec 151.4 35.89 372.48	neating	(66) (67) (68) (69)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14  Pumps and fans gains (Table  (70)m= 0 0 0	of (65)m only if a state   Apr	Jun 151.4 tion L9 or 12.05 quation L1 308.72 ation L15 or 38.14  0 ble 5)	Jul 151.4 L9a), als 13.02 13 or L13 291.52 or L15a), 38.14	Aug 151.4 so see 16.92 Ba), also 287.48 , also se 38.14	Sep 151.4 Table 5 22.72 see Tal 297.67 ee Table 38.14	Oct 151.4  28.84  ole 5 319.36 5 38.14	Nov 151.4 33.66 346.75	Dec 151.4 35.89 372.48 0	neating	(66) (67) (68) (69)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14  Pumps and fans gains (Table  (70)m= 0 0 0  Losses e.g. evaporation (negative control of the color of t	of (65)m only if a state   Apr May   151.4	Jun 151.4 tion L9 or 12.05 quation L1 308.72 ation L15 or 38.14  0 ble 5)	Jul 151.4 L9a), als 13.02 13 or L13 291.52 or L15a), 38.14	Aug 151.4 so see 16.92 Ba), also 287.48 , also se 38.14	Sep 151.4 Table 5 22.72 see Tal 297.67 ee Table 38.14	Oct 151.4  28.84  ole 5 319.36 5 38.14	Nov 151.4 33.66 346.75 38.14	Dec 151.4 35.89 372.48 0	neating	(66) (67) (68) (69)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14  Pumps and fans gains (Table  (70)m= 0 0 0  Losses e.g. evaporation (neg.  (71)m= -121.12 -121.12 -121.12	of (65)m only if a state   Apr	Jun 151.4 tion L9 or 12.05 quation L1 308.72 ation L15 or 38.14  0 ble 5)	Jul 151.4 L9a), als 13.02 13 or L13 291.52 or L15a), 38.14	Aug 151.4 so see 16.92 Ba), also 287.48 , also se 38.14	Sep 151.4 Table 5 22.72 see Tal 297.67 ee Table 38.14	Oct 151.4  28.84  ole 5 319.36 5 38.14	Nov 151.4 33.66 346.75 38.14	Dec 151.4 35.89 372.48 0	neating	(66) (67) (68) (69)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14  Pumps and fans gains (Table  (70)m= 0 0 0  Losses e.g. evaporation (neg.  (71)m= -121.12 -121.12 -121.12  Water heating gains (Table 5)	of (65)m only if a state   Apr	Jun 151.4 tion L9 or 12.05 quation L1 308.72 ation L15 or 38.14  0 ble 5) -121.12	Jul 151.4 L9a), als 13.02 3 or L13 291.52 or L15a), 38.14	Aug 151.4 so see 16.92 Ba), also 287.48 , also se 38.14	Sep 151.4 Table 5 22.72 See Tal 297.67 ee Table 38.14  0 -121.12	Oct 151.4  28.84  ole 5 319.36 5 38.14  0  -121.12	Nov 151.4 33.66 346.75 38.14 0	Dec 151.4 35.89 372.48 0 -121.12	neating	(66) (67) (68) (69) (70)
include (57)m in calculation  5. Internal gains (see Table  Metabolic gains (Table 5), Wa  Jan Feb Mar  (66)m= 151.4 151.4 151.4  Lighting gains (calculated in A  (67)m= 34.92 31.01 25.22  Appliances gains (calculated  (68)m= 389.68 393.72 383.53  Cooking gains (calculated in A  (69)m= 38.14 38.14 38.14  Pumps and fans gains (Table  (70)m= 0 0 0  Losses e.g. evaporation (neg.  (71)m= -121.12 -121.12 -121.12  Water heating gains (Table 5)  (72)m= 131.71 129.26 124.17	of (65)m only if a  total same same same same same same same same	Jun 151.4 tion L9 or 12.05 quation L1 308.72 ation L15 or 38.14  0 ble 5) -121.12	Jul 151.4 L9a), als 13.02 13 or L13 291.52 or L15a), 38.14	Aug 151.4 so see 16.92 Ba), also 287.48 , also se 38.14	Sep 151.4 Table 5 22.72 See Tal 297.67 ee Table 38.14  0 -121.12	Oct 151.4  28.84  ole 5 319.36 5 38.14  0  -121.12	Nov 151.4 33.66 346.75 38.14 0	Dec 151.4 35.89 372.48 0 -121.12	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 Facto Table 6d	or	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.	9x 0.77	X	6.74	x	10.63	x	0.45	x	0.67	=	14.97	(74)
North 0.	9x 0.77	X	11.41	x	10.63	X	0.45	X	0.67	=	50.7	(74)
North 0.	9x 0.77	X	2.68	x	10.63	x	0.45	x	0.67	=	5.95	(74)
North 0.	9x 0.77	x	6.74	х	20.32	x	0.45	x	0.67	=	28.62	(74)
North 0.	9x 0.77	X	11.41	x	20.32	X	0.45	x	0.67	=	96.89	(74)
North 0.	9x 0.77	X	2.68	x	20.32	x	0.45	x	0.67	=	11.38	(74)
North 0.	9x 0.77	X	6.74	x	34.53	x	0.45	X	0.67	=	48.63	(74)
North 0.	9x 0.77	X	11.41	x	34.53	x	0.45	x	0.67	=	164.64	(74)
North 0.	9x 0.77	X	2.68	x	34.53	x	0.45	x	0.67	=	19.34	(74)
North 0.	9x 0.77	X	6.74	x	55.46	x	0.45	x	0.67	=	78.11	(74)
North 0.	9x 0.77	X	11.41	X	55.46	X	0.45	x	0.67	=	264.45	(74)
North 0.	9x 0.77	X	2.68	x	55.46	x	0.45	x	0.67	=	31.06	(74)
North 0.	9x 0.77	X	6.74	X	74.72	X	0.45	X	0.67	=	105.22	(74)
North 0.	9x 0.77	X	11.41	X	74.72	X	0.45	X	0.67	=	356.24	(74)
North 0.	9x 0.77	X	2.68	x	74.72	X	0.45	X	0.67	=	41.84	(74)
North 0.	9x 0.77	X	6.74	X	79.99	X	0.45	X	0.67	=	112.64	(74)
North 0.	9x 0.77	X	11.41	x	79.99	x	0.45	x	0.67	=	381.37	(74)
North 0.	9x 0.77	X	2.68	х	79.99	x	0.45	x	0.67	=	44.79	(74)
North 0.	9x 0.77	X	6.74	X	74.68	x	0.45	x	0.67	=	105.16	(74)
North 0.	9x 0.77	X	11.41	x	74.68	Х	0.45	x	0.67	=	356.06	(74)
North 0.	9x 0.77	X	2.68	x	74.68	X	0.45	X	0.67	=	41.82	(74)
North 0.	9x 0.77	x	6.74	х	59.25	x	0.45	x	0.67	=	83.43	(74)
North 0.	9x 0.77	X	11.41	x	59.25	x	0.45	x	0.67	=	282.49	(74)
North 0.	9x 0.77	X	2.68	X	59.25	x	0.45	x	0.67	=	33.18	(74)
North 0.	9x 0.77	X	6.74	X	41.52	X	0.45	X	0.67	=	58.47	(74)
North 0.	9x 0.77	X	11.41	X	41.52	X	0.45	X	0.67	=	197.95	(74)
	9x 0.77	X	2.68	X	41.52	X	0.45	X	0.67	=	23.25	(74)
	9x 0.77	X	6.74	X	24.19	X	0.45	X	0.67	=	34.06	(74)
	9x 0.77	X	11.41	X	24.19	x	0.45	X	0.67	=	115.34	(74)
	9x 0.77	X	2.68	X	24.19	X	0.45	X	0.67	=	13.55	(74)
	9x 0.77	X	6.74	X	13.12	x	0.45	X	0.67	=	18.47	(74)
	9x 0.77	X	11.41	X	13.12	X	0.45	X	0.67	=	62.54	(74)
	9x 0.77	X	2.68	X	13.12	X	0.45	X	0.67	=	7.35	(74)
	9x 0.77	X	6.74	X	8.86	x	0.45	X	0.67	=	12.48	(74)
	9x 0.77	X	11.41	X	8.86	x	0.45	X	0.67	=	42.27	(74)
	9x 0.77	X	2.68	x	8.86	х	0.45	x	0.67	=	4.96	(74)
Northeast <sub>0.</sub>		X	0.88	X	11.28	x	0.45	x	0.67	=	4.15	(75)
Northeast <sub>0.</sub>		X	0.88	x	22.97	X	0.45	X	0.67	=	8.45	(75)
Northeast 0.	9x 0.77	X	0.88	X	41.38	X	0.45	X	0.67	=	15.22	(75)



Northeast 0.9x	0.77	x	0.88	x	67.96	x	0.45	x	0.67	l <sub>=</sub>	24.99	(75)
Northeast 0.9x	****	l x	0.88	x	91.35	l x	0.45	x	0.67		33.59	](75)
Northeast 0.9x		X	0.88	x	97.38	l ^	0.45	x	0.67		35.81	](75)
Northeast <sub>0.9x</sub>	****	x	0.88	l x	91.1	l x	0.45	x	0.67	!   _	33.5	](75)
Northeast 0.9x		x	0.88	x	72.63	l x	0.45	x	0.67	!   _	26.71	](75)
Northeast 0.9x		x	0.88	l ^	50.42	X	0.45	x	0.67	!   _	18.54	](75)
Northeast 0.9x	0	x	0.88	x	28.07	X	0.45	x	0.67	!   _	10.32	](75)
Northeast <sub>0.9x</sub>	****	x	0.88	l X	14.2	X	0.45	X	0.67	!   =	5.22	」`
Northeast <sub>0.9x</sub>		x	0.88	X	9.21	X	0.45	X	0.67	!   =	3.39	」、 / 【(75)
South 0.9x		X	0.88	X	46.75	X	0.45	x	0.67	   =	24.11	(78)
South 0.9x	0.54	х	4.1	х	46.75	х	0.45	x	0.67	=	28.09	<del> </del> (78)
South 0.9x	0.54	х	1.54	х	46.75	X	0.45	X	0.67	=	42.2	(78)
South 0.9x	0.54	х	0.88	x	76.57	x	0.45	x	0.67	=	39.49	(78)
South 0.9x	0.54	х	4.1	x	76.57	х	0.45	x	0.67	j =	46	(78)
South 0.9x	0.54	х	1.54	x	76.57	x	0.45	x	0.67	j =	69.11	(78)
South 0.9x	0.54	х	0.88	x	97.53	x	0.45	x	0.67	j =	50.31	(78)
South 0.9x	0.54	x	4.1	x	97.53	х	0.45	x	0.67	j =	58.6	(78)
South 0.9x	0.54	х	1.54	X	97.53	Х	0.45	X	0.67	=	88.04	(78)
South 0.9x	0.54	х	0.88	х	110.23	х	0.45	x	0.67	=	56.86	(78)
South 0.9x	0.54	x	4.1	х	110.23	×	0.45	x	0.67	=	66.23	(78)
South 0.9x	0.54	x	1.54	x	110.23	x	0.45	x	0.67	=	99.5	(78)
South 0.9x	0.54	x	0.88	x	114.87	Х	0.45	x	0.67	=	59.25	(78)
South 0.9x	0.54	x	4.1	x	114.87	X	0.45	x	0.67	=	69.01	(78)
South 0.9x	0.54	x	1.54	х	114.87	X	0.45	X	0.67	=	103.68	(78)
South 0.9x	0.54	x	0.88	x	110.55	X	0.45	x	0.67	=	57.02	(78)
South 0.9x	0.54	X	4.1	X	110.55	X	0.45	X	0.67	=	66.41	(78)
South 0.9x	0.54	х	1.54	X	110.55	X	0.45	X	0.67	=	99.78	(78)
South 0.9x	0.54	X	0.88	x	108.01	X	0.45	X	0.67	=	55.71	(78)
South 0.9x	0.54	х	4.1	x	108.01	X	0.45	X	0.67	=	64.89	(78)
South 0.9x	0.54	x	1.54	x	108.01	X	0.45	X	0.67	=	97.49	(78)
South 0.9x	0.54	х	0.88	х	104.89	X	0.45	X	0.67	=	54.1	(78)
South 0.9x		х	4.1	х	104.89	X	0.45	X	0.67	=	63.02	(78)
South 0.9x		X	1.54	X	104.89	Х	0.45	X	0.67	=	94.68	(78)
South 0.9x		X	0.88	X	101.89	X	0.45	X	0.67	=	52.55	(78)
South 0.9x		X	4.1	X	101.89	X	0.45	X	0.67	=	61.21	(78)
South 0.9x		X	1.54	x	101.89	X	0.45	X	0.67	=	91.96	(78)
South 0.9x		X	0.88	X	82.59	X	0.45	X	0.67	=	42.6	(78)
South 0.9x		X	4.1	X	82.59	X	0.45	X	0.67	=	49.61	(78)
South 0.9x		X	1.54	X	82.59	X	0.45	X	0.67	=	74.54	(78)
South 0.9x		X	0.88	X	55.42	X	0.45	X	0.67	=	28.58	(78)
South 0.9x	0.54	X	4.1	X	55.42	X	0.45	X	0.67	=	33.29	(78)



South 0.9x	0.54	X	1.54	X	55.42	X	0.45	X	0.67	=	50.02	(78)
South 0.9x	0.54	x	0.88	x	40.4	X	0.45	x	0.67	=	20.84	(78)
South 0.9x	0.54	X	4.1	X	40.4	X	0.45	x	0.67	=	24.27	(78)
South 0.9x	0.54	X	1.54	X	40.4	X	0.45	x	0.67	=	36.46	(78)
Northwest <sub>0.9x</sub>	0.77	x	0.88	X	11.28	x	0.45	x	0.67	=	4.15	(81)
Northwest 0.9x	0.77	x	0.88	X	22.97	x	0.45	x	0.67		8.45	(81)
Northwest 0.9x	0.77	x	0.88	X	41.38	x	0.45	x	0.67		15.22	(81)
Northwest 0.9x	0.77	x	0.88	X	67.96	x	0.45	×	0.67		24.99	(81)
Northwest 0.9x	0.77	x	0.88	X	91.35	x	0.45	x	0.67		33.59	(81)
Northwest 0.9x	0.77	X	0.88	X	97.38	x	0.45	×	0.67	=	35.81	(81)
Northwest 0.9x	0.77	x	0.88	X	91.1	x	0.45	x	0.67	=	33.5	(81)
Northwest 0.9x	0.77	x	0.88	X	72.63	x	0.45	x	0.67	=	26.71	(81)
Northwest 0.9x	0.77	x	0.88	X	50.42	x	0.45	X	0.67	=	18.54	(81)
Northwest 0.9x	0.77	x	0.88	X	28.07	x	0.45	x	0.67	=	10.32	(81)
Northwest 0.9x	0.77	x	0.88	X	14.2	x	0.45	x	0.67	=	5.22	(81)
Northwest 0.9x	0.77	X	0.88	i x	9.21	x	0.45	×	0.67		3.39	(81)
		_								<u>-</u>		<u></u>
Solar gains in v	vatts, calcu	lated	for each mor	nth		(83)m	Sum(74)m	(82)m				
(83)m= 174.33		9.97	646.18 802.		33.64 788.13	664.	31 522.47	350.34	1 210.7	148.06		(83)
Total gains – in	iternal and	solar	(84)m = $(73)$	m + (	83)m , watts						4	
(84)m= 799.05	930.8 106	1.32	1212.78 1332	33 1	329.26 1262.15	1145	.08 1021.67	884.52	2 785.18	<b>75</b> 4.12		(84)
7. Mean interr	nal tempera	ture (	heating seas	on)								
Temperature of					area from Tab	ole 9	Th1 (°C)	_			21	(85)
Utilisation fact		٠.	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			,						` ′
Jan				, (0								
		/lar i	Apr I Ma	av T	Jun Jul	Aı	Ja Sep	Oct	Nov	Dec	]	
(86)m=   1		<i>l</i> lar 1	Apr Ma	<del>´   -</del>	Jun Jul 0.84 0.67	At 0.7	ug Sep 5 0.95	Oct	Nov 1	Dec 1	]	(86)
` '	1	1	0.99 0.96	3	0.84 0.67	0.7	5 0.95		+			(86)
Mean internal	1 temperatur	e in li	0.99 0.96 iving area T1	(follo	0.84 0.67 ow steps 3 to 7	0.7	5 0.95 able 9c)	1	1	1		, ,
Mean internal (87)m= 20.07	1 temperatur 20.15 20	1 e in li	0.99 0.90 0.90 0.90 0.90 0.90 0.90 0.90	(follo	0.84 0.67 ow steps 3 to 7 20.9 20.94	0.7 in T 20.9	able 9c) 20.81		1			(86) (87)
Mean internal (87)m= 20.07  Temperature (	temperatur 20.15 20 during heat	e in li	0.99 0.90 0.90 0.90 0.90 0.90 0.90 0.90	(folio	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta	0.7 in T 20.9 able 9	able 9c) 20.81 20, Th2 (°C)	20.54	20.26	20.06		(87)
Mean internal (87)m= 20.07	temperatur 20.15 20 during heat	1 e in li	0.99 0.90 0.90 0.90 0.90 0.90 0.90 0.90	(folio	0.84 0.67 ow steps 3 to 7 20.9 20.94	0.7 in T 20.9	able 9c) 20.81 20, Th2 (°C)	1	20.26	1		, ,
Mean internal (87)m= 20.07  Temperature (	1 temperatur 20.15 20 during heat 20.13 20	1 e in li	0.99 0.90 0.90 0.90 0.90 0.90 0.90 0.90	(folice 5 of dw	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16	0.77 in T 20.99 able 9	able 9c) 20.81 20, Th2 (°C)	20.54	20.26	20.06		(87)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13	temperatur 20.15 20 during heat 20.13 20 tor for gains	1 e in li	0.99 0.90 0.90 0.90 0.90 0.90 0.90 0.90	(folic 5 of dw 5 2 g, h2	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16	0.77 in T 20.99 able 9	able 9c) 20.81 20, Th2 (°C) 16 20.16	20.54	20.26	20.06		(87)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact	temperatur 20.15 20 during heat 20.13 20 tor for gains	e in li	0.99 0.96 iving area T1 20.53 20.7 eriods in rest 20.15 20.1 est of dwellin 0.99 0.94	of dw 5 2 g, h2	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16  ,m (see Table  0.77 0.56	0.7 in T 20.9 able 9 20.7 9a) 0.6	able 9c) 20.81  7, Th2 (°C) 20.16  4  0.92	20.54	20.26	20.06		(87)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1	temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur	e in li	0.99 0.96 iving area T1 20.53 20.7 eriods in rest 20.15 20.1 est of dwellin 0.99 0.94	of dw 5 2 g, h2	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16  ,m (see Table  0.77 0.56	0.7 in T 20.9 able 9 20.7 9a) 0.6	able 9c) 20.81 20.16 20.16 4 0.92 to 7 in Table	20.54	20.26	20.06		(87)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal	temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur	e in ling per 1.13 for re	0.99 0.90 0.90 0.90 0.90 0.90 0.99 0.90 0	of dw 5 2 g, h2	0.84 0.67  ow steps 3 to 7 20.9 20.94  velling from Ta 20.16 20.16  mm (see Table 0.77 0.56  T2 (follow ste	0.7 in T 20.9 able 9 20.7 9a) 0.6 eps 3	able 9c) 20.81  7, Th2 (°C) 20.16  4  0.92  to 7 in Table 29  19.95	20.54 20.15 1 e 9c)	20.26	1 20.06 20.14 1 18.84	0.15	(87) (88) (89)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85	1 temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur 18.98 19	e in ling per ling pe	0.99 0.96 iving area T1 20.53 20.7 eriods in rest 20.15 20.1 est of dwellin 0.99 0.94 he rest of dw 19.55 19.8	(folic) 5  of dw 5  g, h2 4  elling 6	0.84 0.67  ow steps 3 to 7 20.9 20.94  velling from Ta 20.16 20.16  m (see Table 0.77 0.56  T2 (follow ste 20.05 20.09	0.7 in T 20.9 able 9 20.1 9a) 0.6 eps 3 20.0	5 0.95  able 9c)  20.81  0, Th2 (°C)  16 20.16  4 0.92  to 7 in Table  19.95	20.54 20.15 1 e 9c)	20.26	1 20.06 20.14 1 18.84	0.15	(87) (88) (89) (90)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85	temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur 18.98 19	e in ling per 13 ing per 14 ing per 15 ing p	0.99	of dw 5 2 g, h2 elling 6 2	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16  m (see Table  0.77 0.56  T2 (follow ste  20.05 20.09  g) = fLA × T1	0.7 in T 20.9 able 9 20.0 9a) 0.6 eps 3 20.0	able 9c) 20.81 20.81 20.16 20.16 4 0.92 to 7 in Table 19.95 fi - fLA) × T2	20.54  20.15  1  e 9c)  19.56  LA = Liv	1 20.26 20.14 1 19.16 ring area ÷ (4	1 20.06 20.14 1 18.84 4) =	0.15	(87) (88) (89) (90) (91)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85  Mean internal (92)m= 19.03	1 temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur 18.98 19 temperatur 19.15 19	e in ling per in the in	0.99	(folic) 5	0.84 0.67  ow steps 3 to 7 20.9 20.94  velling from Ta 20.16 20.16  m (see Table 0.77 0.56  T2 (follow ste 20.05 20.09  g) = fLA × T1 20.18 20.22	0.7 in T 20.9 able 9 20.1 9a) 0.6 eps 3 20.0 + (1 20.2	able 9c) 20.81  7, Th2 (°C) 16 20.16  4 0.92  to 7 in Table 19 19.95  ft  - fLA) × T2 21 20.08	20.54  20.15  1  e 9c)  19.56  LA = Liv	1 20.26 20.14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 20.06 20.14 1 18.84	0.15	(87) (88) (89) (90)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85  Mean internal (92)m= 19.03  Apply adjustm	1  temperatur 20.15 20  during heat 20.13 20  tor for gains 1  temperatur 18.98 19  temperatur 19.15 19  nent to the r	e in ling per 1.13 for re in to 1.21 re (for nean	0.99	of dw 5 2 g, h2 elling 6 2	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16  ,m (see Table  0.77 0.56  T2 (follow ste  20.05 20.09  g) = fLA × T1  20.18 20.22  ure from Table	0.7 in T 20.9 able 9 20.0 9a) 0.6 eps 3 20.0 + (1 - 20.2 + 4e, 1)	able 9c) 20.81 20.81 20.16 20.16 4 0.92 to 7 in Table 19.95 fl  - fLA) × T2 21 20.08 where appro	20.54  20.15  1  e 9c)  19.56  LA = Liv	1 20.26 20.14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 20.06 20.14 1 18.84 4) =	0.15	(87) (88) (89) (90) (91) (92)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85  Mean internal (92)m= 19.03  Apply adjustm (93)m= 19.03	1 temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur 18.98 19 temperatur 19.15 19 tempera	e in ling per ling pe	0.99	of dw 5 2 g, h2 elling 6 2	0.84 0.67  ow steps 3 to 7 20.9 20.94  velling from Ta 20.16 20.16  m (see Table 0.77 0.56  T2 (follow ste 20.05 20.09  g) = fLA × T1 20.18 20.22	0.7 in T 20.9 able 9 20.1 9a) 0.6 eps 3 20.0 + (1 20.2	able 9c) 20.81 20.81 20.16 20.16 4 0.92 to 7 in Table 19.95 fl  - fLA) × T2 21 20.08 where appro	20.54  20.15  1  e 9c)  19.56  LA = Liv	1 20.26 20.14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 20.06 20.14 1 18.84 4) =	0.15	(87) (88) (89) (90) (91)
Mean internal (87)m= 20.07  Temperature (88)m= 20.13  Utilisation fact (89)m= 1  Mean internal (90)m= 18.85  Mean internal (92)m= 19.03  Apply adjustm	temperatur 20.15 20 during heat 20.13 20 tor for gains 1 temperatur 18.98 19 temperatur 19.15 19 nent to the r 19.15 19 ing requirer	e in ling per in ling per in the in t	0.99 0.96 iving area T1 20.53 20.7 eriods in rest 20.15 20.1 est of dwellin 0.99 0.96 he rest of dw 19.55 19.8 r the whole d 19.69 19.9 internal temp	of dw of dw	0.84 0.67  ow steps 3 to 7  20.9 20.94  velling from Ta  20.16 20.16  ,m (see Table  0.77 0.56  T2 (follow ste  20.05 20.09  g) = fLA × T1  20.18 20.22  ure from Table  20.18 20.22	0.7 in T 20.9 able 9 20.0 9a) 0.6 eps 3 20.0 + (1 - 20.2 + 4e, 1) 20.2	able 9c) abl	20.54  20.15  1  e 9c)  19.56  LA = Liv	1 20.26 20.14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 20.06 20.14 1 18.84 4) =		(87) (88) (89) (90) (91) (92)

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Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

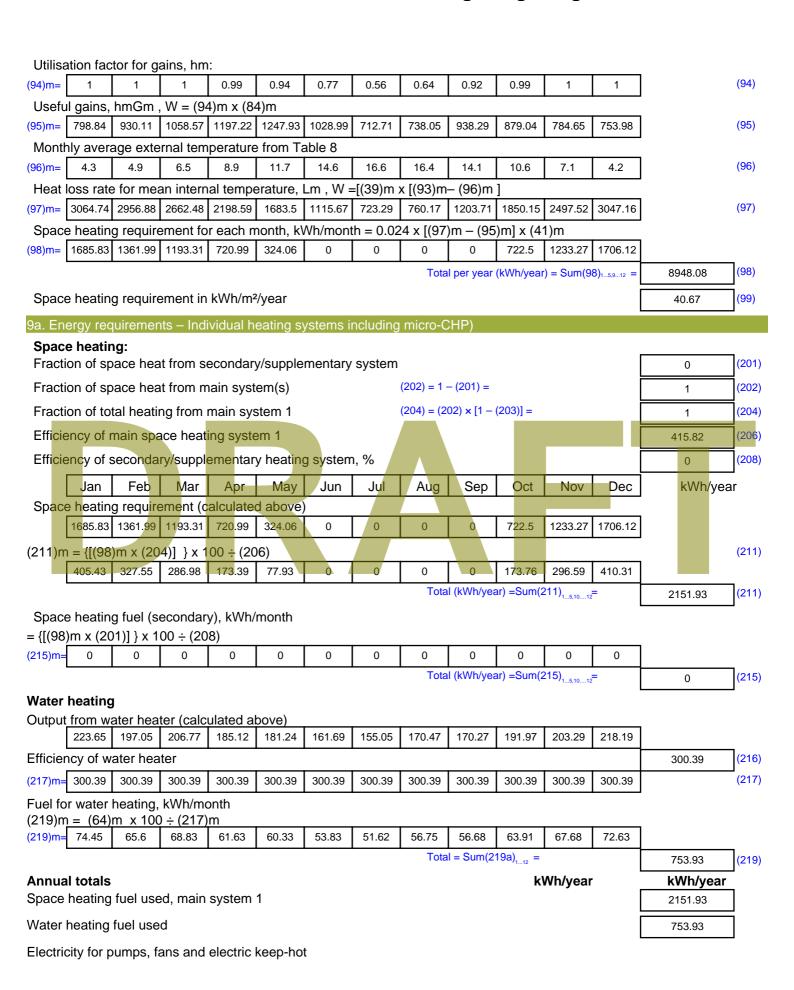
Mar

the utilisation factor for gains using Table 9a

Feb

Jan







(261)

(263)

(264)

(265)

(267)

(268)

(272)(273)

### **DER WorkSheet: New dwelling design stage**

mechanical ventilation - balanced, extract or positive input from outside (230a) 679.39 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 679.39 Electricity for lighting (232) 616.65

12a. CO2 emissions – Individual heating systems including micro-CHF	12a.	CO2 emissions –	Individual heating s	vstems including	micro-CHP
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	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.519 =	1116.85
Space heating (secondary)	(215) x	0.519 =	0 (2
Water heating	(219) x	0.519	391.29
Space and water heating	(261) + (262) + (263) + (264) =		1508.14
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	352.6
Electricity for lighting	(232) x	0.519 =	320.04
Total CO2, kg/year	sum	of (265)(271) =	2180.79
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	9.91 (2

El rating (section 14)

(274) 89



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 10 - 1B2P - MF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.7 (2a) =(3a) 53 143.1 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)53 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =143.1 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18



Adjusted infiltr	ration rate	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	]	
Calculate effe		•	rate for t	he appli	cable ca	ise						-	
If mechanic			o dia N. 70	10l-) (00-		(' /I	\(\f\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		) (00-)			0.5	(23a)
If exhaust air h		0		, ,	,	. `	,, .	,	) = (23a)			0.5	(23b)
If balanced wit		•	•	ŭ		,		,				73.1	(23c)
a) If balance	_	ı —		<b>.</b>		<del>- ` ` </del>	<del>- ^ `</del>	ŕ	<del></del>	<del>`                                    </del>	<del>- ` '</del>	) ÷ 100] 1	(0.4-)
(24a)m= 0.3	0.29	0.29	0.27	0.27	0.26	0.26	0.25	0.26	0.27	0.28	0.28	]	(24a)
b) If balance	1	ı —		ı —		<del>,                                    </del>	<del>, ``</del>	ŕ	<del>,                                    </del>	<del>' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' </del>	1 .	1	(O.4F.)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole h if (22b)r	nouse ext m < 0.5 ×			•	•				.5 × (23k	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
d) If natural	ventilation	on or wh	ole hous	e positiv	ve input	ventilatio	on from	oft	!	!	ļ.	J	
,	m = 1, the			•					0.5]			_	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	r change	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.3	0.29	0.29	0.27	0.27	0.26	0.26	0.25	0.26	0.27	0.28	0.28		(25)
3. Heat losse	es and he	eat loss	paramete	er:						_	_		_
ELEMENT	Gros area	SS	Openin	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value		A X k d/K
Windows Type		(111)			1.68		/[1/( 1.1 )+		1.77	,	110/111	,	(27)
Windows Type					1.00		,	7	1.77				( )
11	~ <b>_</b>				1 68	v1	/[1/( 1.1 )+	0.041 -	1 77				(27)
Windows Type	A 3				1.68	<del>-</del> <b>-</b> 7.	/[1/( 1.1 )+ /[1/( 1 1 )+		1.77				(27)
Windows Type					6.66	x1	/[1/( 1.1 )+	0.04] =	7.02				(27)
Windows Type	e 4				3.36	x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+	0.04] =	7.02				(27) (27)
Windows Type	e 4 e 5				6.66 3.36 2.6	x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] =	7.02 3.54 2.74				(27) (27) (27)
Windows Type Windows Type Walls Type1	e 4	55	15.96	8	3.36	x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] =	7.02				(27) (27) (27) (29)
Windows Type Windows Type Walls Type1 Walls Type2	e 4 e 5 47.5 3.78	8	15.90	8	6.66 3.36 2.6	x1 x1 x1 7 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04] = 0.04] =	7.02 3.54 2.74				(27) (27) (27)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.55	x1 x1 x1 7 x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] =	7.02 3.54 2.74 3.79				(27) (27) (27) (29)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.57 3.78	x1 x1 x1 7 x x x 3	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] =	7.02 3.54 2.74 3.79				(27) (27) (27) (29) (29)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.57 3.78 51.33	x1 x1 x1 x1 x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = 0.04] = 0.04] = = = = =	7.02 3.54 2.74 3.79 0.53				(27) (27) (27) (29) (29) (31) (32)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e	e 4 e 5 47.5 3.78	8		8	6.66 3.36 2.6 31.57 3.78 51.33 39.56	x1 x1 x1 x x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = 0.04] = 0.04] = = = = =	7.02 3.54 2.74 3.79 0.53				(27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor	e 4 e 5 47.5 3.78 elements	B, m²	0	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calcul	x1 x1 x1 x x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] = = = = = =	7.02 3.54 2.74 3.79 0.53	as given in	paragrapl	h 3.2	(27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and	e 4 e 5 47.5 3.78 elements d roof winders on both	, m²	0 effective winternal wall	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calcul	x1 x1 x1 x x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53	as given in	paragrapl	1	(27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are	e 4 e 5  47.5  3.78 elements  d roof windows on both ss, W/K =	sows, use esides of ir	0 effective winternal wall	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calcul	x1 x1 x1 x x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12 0.14	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	as given in (2) + (32a).			(27) (27) (29) (29) (31) (32) (32a)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat los	e 4 e 5  47.5  3.78 elements  d roof winders on both ss, W/K = Cm = S(	ows, use esides of in S (A x k)	0 effective wi nternal wall	indow U-va	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calculatitions	x1 x1 x1 x1 x x1 x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12 0.14	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a).		21.16	(27) (27) (27) (29) (29) (31) (32) (32a) (32b)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat los Heat capacity	e 4 e 5  47.5  3.78 elements  d roof winders on both ss, W/K = Cm = S( s parame	ows, use esides of ires S (A x k) ter (TMF)	offective winternal walk U)  P = Cm : tails of the	indow U-va Is and pan	6.66  3.36  2.6  31.5;  3.78  51.3;  39.56  53.9;  53.9;  h kJ/m²K	x1 x1 x1 x1 x x x x x x x x x x x x x x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a). :: Medium	(32e) =	21.16	(27) (27) (27) (29) (29) (31) (32) (32a) (32b)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat look Heat capacity Thermal mass For design assess	e 4 e 5  47.5  3.78 elements  d roof winder as on both ss, W/K = Cm = S( s parame as ments where ad of a determine a determine where ad of a determine	ows, use esides of interest (TMF) ere the detailed calculary	offective winternal walk  U)  P = Cm -  tails of the ulation.	indow U-va ls and pan - TFA) ir construct	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  alue calculatitions  n kJ/m²K	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a). :: Medium	(32e) =	21.16	(27) (27) (27) (29) (29) (31) (32) (32a) (32b)
Windows Type Windows Type Walls Type1 Walls Type2 Total area of e Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat los Heat capacity Thermal mass For design asses can be used inste	e 4 e 5  47.5  3.78 elements  d roof winder as on both ss, W/K = Cm = S( es parame essments where ad of a determine the set of a determine the determine the set of a determine the set of a determine the set	ows, use esides of ir = S (A x k) ter (TMF) ere the detailed calco	offective winternal walk  O  = Cm ÷ tails of the ulation. culated to	Tridow U-ve ls and pan TFA) ir construct using Ap	6.66  3.36  2.6  31.57  3.78  51.33  39.56  53.93  53.93  alue calculatitions  h kJ/m²K	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04]	7.02 3.54 2.74 3.79 0.53 0	2) + (32a). :: Medium	(32e) =	21.16 8029.37 250	(27) (27) (29) (29) (31) (32) (32a) (32b) (33) (34) (35)



Vantilation boo	et loop or	aloulotod	l monthly	,				(28)m	_ 0 22 % /	(25)m v (5)			
Ventilation hea	Feb	Mar			Jun	Jul	Aug	Sep	Oct	(25)m x (5) Nov	Dec		
(38)m= 14.03	13.88	13.73	Apr 12.97	May 12.82	12.07	12.07	Aug 11.92	12.37	12.82	13.13	13.43		(38)
Heat transfer of			12.01	12.02	12.01	12.01	11.02		= (37) + (	<u> </u>	10.10		(==)
(39)m= 42.89	42.74	42.59	41.83	41.68	40.93	40.93	40.78	41.23	41.68	41.98	42.29		
(39)111= 42.09	42.74	42.09	41.00	41.00	40.93	40.93	40.76			Sum(39) <sub>1</sub>	<u> </u>	41.8	(39)
Heat loss para	meter (H	HLP), W/	m²K						= (39)m ÷				(::/
(40)m= 0.81	0.81	0.8	0.79	0.79	0.77	0.77	0.77	0.78	0.79	0.79	0.8		
Number of day	s in moi	nth (Tab	le 1a)						Average =	Sum(40) <sub>1</sub>	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. Water heat	ting ener	rgy requi	rement:								kWh/ye	ear:	
Assumed occu	ıpancv. İ	N								1	78		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	A -13.9	)2)] + 0.0	0013 x (	ΓFA -13.				( /
if TFA £ 13.9 Annual average	•	otor upoc	no in litro	o por de	,, \/d o,,	orogo –	(25 v NI)	. 26				1	(40)
Reduce the annua									se target o		5.44		(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 T	Table 1 <mark>c x</mark>	(43)						
(44)m= 84.08	81.03	77.97	74.91	71.85	68.8	68.8	71.85	74.91	77.97	81.03	84.08		
Ener <mark>gy cont</mark> ent of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	917.29	(44)
(45)m= 124.7	109.06	112.54	98.11	94.14	81.24	75.28	86.38	87.42	101.88	111.2	120.76		
			. ,						Total = Su	m(45) <sub>112</sub> =	-	1202.71	(45)
If instantaneous w		·	,		· · ·	1	, ,	, ,	î	i	1	l	
(46)m= 18.7 Water storage	16.36	16.88	14.72	14.12	12.19	11.29	12.96	13.11	15.28	16.68	18.11		(46)
Storage volum		includin	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	` ,		•			•					100		( )
Otherwise if no Water storage	stored			•			` '	ers) ente	er '0' in (	(47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/day):				0.	99		(48)
Temperature fa					,	• ,					54		(49)
Energy lost fro				ear			(48) x (49)	) =			53		(50)
b) If manufact	urer's de	eclared o	ylinder l	oss fact									, ,
Hot water stora	-			e 2 (kW	h/litre/da	ıy)					0		(51)
If community h Volume factor	•		on 4.3								1	1	(50)
Temperature fa			2h								0		(52) (53)
·				oor			(47) x (51)	v (52) v (	53) -				
Energy lost fro Enter (50) or (		-	, KVVII/YE	zai			( <del>+1)</del> X (31,	, A (JZ) X (	00 <i>)</i> =		0 53		(54) (55)
Water storage	, , ,	,	or each	month			((56)m = (	55) × (41):	m				(30)
(56)m= 16.57	14.97	16.57	16.04	16.57	16.04	16.57	16.57	16.04	16.57	16.04	16.57		(56)
(00)	,	. 0.07	.0.04	1 .0.07	1 .0.0-	1 .0.07	1 . 0.07	1 .0.0-	1 .0.07	1 .0.0-			(-3)



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 16.57 14.97 16.57 16.04 16.57 16.04 16.57 16.04 16.57 16.04 16.57	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) $\div$ 365 x (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	า
(62)m= 164.53 145.04 152.37 136.66 133.98 119.79 115.11 126.22 125.97 141.71 149.75 160.6	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 164.53   145.04   152.37   136.66   133.98   119.79   115.11   126.22   125.97   141.71   149.75   160.6	_
Output from water heater (annual) <sub>112</sub> 1671.74	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 73.33 65.05 69.29 63.46 63.17 57.85 56.9 60.59 59.91 65.74 67.82 72.02	(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):	
5. Internal gains (see Table 5 and 5a).	
Metabolic gains (Table 5), Watts	
Metabolic gains (Table 5), Watts	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>(66) (67)</td>	(66) (67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	` '
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>` '</td>	` '
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>(67)</td>	(67)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67) (68)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93       11.42       13.32       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       <	(67) (68)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93 <td>(67) (68) (69)</td>	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93       14.2       13.32       14.2       14.2       13.32       14.2       14.2       14.2       14.2       15.02       15.06       150.63	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       88.93       11.42       13.32       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       14.2       <	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         14.2         14.2	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93         14.2         14.2         14.2         14.2         14.2         14.2         14.2 <t< td=""><td>(67) (68) (69) (70) (71)</td></t<>	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         88.93	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70) (71) (72)

Flux

Table 6a Table 6b Table 6c

Orientation: Access Factor Area Table 6d m²

Gains

(W)

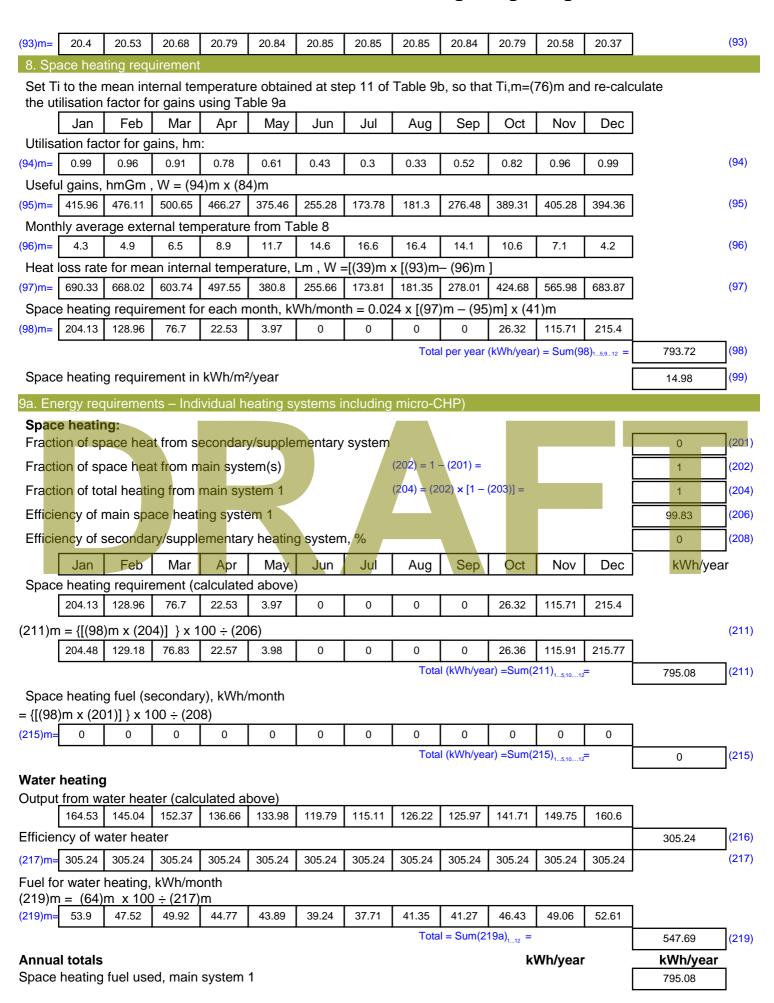


Southeast 0.9x	0.54	X	6.66	x	36.79	x	0.45	X	0.67	=	35.91	(77)
Southeast 0.9x	0.77	X	2.6	x	36.79	x	0.45	x	0.67	=	19.99	(77)
Southeast 0.9x	0.54	X	6.66	X	62.67	x	0.45	x	0.67	=	61.16	(77)
Southeast 0.9x	0.77	X	2.6	x	62.67	X	0.45	x	0.67	=	34.05	(77)
Southeast 0.9x	0.54	X	6.66	x	85.75	x	0.45	x	0.67	=	83.68	(77)
Southeast 0.9x	0.77	X	2.6	x	85.75	x	0.45	x	0.67	=	46.58	(77)
Southeast 0.9x	0.54	X	6.66	x	106.25	x	0.45	X	0.67	=	103.69	(77)
Southeast 0.9x	0.77	X	2.6	x	106.25	x	0.45	X	0.67	=	57.72	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	x	119.01	x	0.45	X	0.67	=	116.14	(77)
Southeast 0.9x	0.77	X	2.6	x	119.01	x	0.45	x	0.67	=	64.65	(77)
Southeast 0.9x	0.54	X	6.66	x	118.15	x	0.45	X	0.67	=	115.3	(77)
Southeast <sub>0.9x</sub>	0.77	X	2.6	x	118.15	x	0.45	X	0.67	=	64.18	(77)
Southeast 0.9x	0.54	X	6.66	x	113.91	x	0.45	x	0.67	=	111.16	(77)
Southeast <sub>0.9x</sub>	0.77	X	2.6	x	113.91	x	0.45	X	0.67	=	61.88	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	x	104.39	x	0.45	X	0.67	=	101.87	(77)
Southeast 0.9x	0.77	X	2.6	x	104.39	x	0.45	x	0.67	=	56.71	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	x	92.85	x	0.45	X	0.67	=	90.61	(77)
Southeast 0.9x	0.77	X	2.6	X	92.85	X	0.45	X	0.67	=	50.44	(77)
Southeast 0.9x	0.54	x	6.66	х	69.27	] x	0.45	X	0.67	=	67.6	(77)
Southeast 0.9x	0.77	x	2.6	x	69.27		0.45	x	0.67	=	37.63	(77)
Southeast <sub>0.9x</sub>	0.54	X	6.66	X	44.07	x	0.45	x	0.67	] =	43.01	(77)
Southeast 0.9x	0.77	x	2.6	x	44.07	Х	0.45	x	0.67	=	23.94	(77)
Southeast 0.9x	0.54	x	6.66	x	31.49	X	0.45	x	0.67	=	30.73	(77)
Southeast <sub>0.9x</sub>	0.77	X	2.6	х	31.49	X	0.45	x	0.67	=	17.11	(77)
South 0.9x	0.77	X	1.68	x	46.75	x	0.45	X	0.67	=	16.41	(78)
South 0.9x	0.77	X	1.68	X	76.57	x	0.45	X	0.67	=	26.88	(78)
South 0.9x	0.77	X	1.68	X	97.53	X	0.45	x	0.67	] =	34.24	(78)
South 0.9x	0.77	X	1.68	X	110.23	x	0.45	X	0.67	=	38.69	(78)
South 0.9x	0.77	X	1.68	X	114.87	X	0.45	X	0.67	=	40.32	(78)
South 0.9x	0.77	X	1.68	X	110.55	X	0.45	X	0.67	=	38.8	(78)
South 0.9x	0.77	X	1.68	X	108.01	X	0.45	X	0.67	=	37.91	(78)
South 0.9x	0.77	X	1.68	X	104.89	X	0.45	X	0.67	=	36.82	(78)
South 0.9x	0.77	X	1.68	X	101.89	X	0.45	X	0.67	=	35.76	(78)
South 0.9x	0.77	X	1.68	X	82.59	x	0.45	x	0.67	=	28.99	(78)
South 0.9x	0.77	x	1.68	x	55.42	x	0.45	x	0.67	=	19.45	(78)
South 0.9x	0.77	X	1.68	x	40.4	x	0.45	x	0.67	=	14.18	(78)
Southwest <sub>0.9x</sub>	0.77	x	3.36	x	36.79	]	0.45	x	0.67	=	25.83	(79)
Southwest <sub>0.9x</sub>	0.77	×	3.36	x	62.67	]	0.45	x	0.67	] =	44	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.36	x	85.75	]	0.45	x	0.67	] =	60.2	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.36	x	106.25	]	0.45	x	0.67	] =	74.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.36	X	119.01		0.45	X	0.67	=	83.55	(79)



Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	11	18.15		0.45	x	0.67	=	82.95	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	11	13.91		0.45	x	0.67	=	79.97	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	10	04.39		0.45	x	0.67	=	73.29	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	X	9	2.85		0.45	x	0.67	=	65.19	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	x	6	9.27		0.45	x	0.67	=	48.63	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	X	4	4.07		0.45	x	0.67	=	30.94	(79)
Southwest <sub>0.9x</sub>	0.77	X	3.3	6	X	3	1.49		0.45	x	0.67	=	22.11	(79)
West 0.9x	0.77	X	1.6	8	x	1	9.64	X	0.45	x	0.67	=	6.89	(80)
West 0.9x	0.77	X	1.6	8	X	3	8.42	X	0.45	x	0.67	=	13.49	(80)
West 0.9x	0.77	X	1.6	8	X	6	3.27	X	0.45	x	0.67	=	22.21	(80)
West 0.9x	0.77	X	1.6	8	X	9	2.28	X	0.45	x	0.67	=	32.39	(80)
West 0.9x	0.77	X	1.6	8	X	11	13.09	X	0.45	x	0.67	=	39.7	(80)
West 0.9x	0.77	X	1.6	8	x	11	15.77	x	0.45	x	0.67	=	40.64	(80)
West 0.9x	0.77	X	1.6	8	x	11	10.22	x	0.45	x	0.67	=	38.69	(80)
West 0.9x	0.77	X	1.6	8	x	9	4.68	x	0.45	x	0.67	=	33.23	(80)
West 0.9x	0.77	X	1.6	8	x	7	3.59	x	0.45	x	0.67	=	25.83	(80)
West 0.9x	0.77	X	1.6	8	x	4	5.59	x	0.45	x	0.67	=	16	(80)
West 0.9x	0.77	X	1.6	8	X	2	4.49	X	0.45	X	0.67	=	8.6	(80)
West 0.9x	0.77	X	1.6	8	Х	1	6.15	x	0.45	x	0.67	_	5.67	(80)
Solar gains in	wotto colo		C	41										
Colai gairis in	walls, calc	ulated	tor eacr	n montr				(83)m	= Sum(74)m.	(8 <mark>2)m</mark>			,	
(83)m= 105.03	179.57 2	46.92	307.09	344.36	34	41.87	329.61	( <mark>83)m</mark> 301		(82)m 198.85	125.94	89.79	]	(83)
(83)m= 105.03 Total gains –	179.57 2 internal and	46.92 I solar	307.09 (84)m =	344.36 : (73)m	3 <sup>2</sup> + (8	33)m	329.61 watts	301	.92 267.83	198.85				
(83)m= 105.03	179.57 2 internal and	46.92	307.09	344.36	3 <sup>2</sup> + (8		329.61		.92 267.83	, ,		89.79 398.65	]	(83) (84)
(83)m= 105.03 Total gains –	179.57 2 internal and 494.95 5	46.92 I solar 52.28	307.09 (84)m = 596.41	344.36 : (73)m 617.65	34 + (8	33)m	329.61 watts	301	.92 267.83	198.85			]	
(83)m= 105.03 Total gains – (84)m= 422.11	179.57 2 internal and 494.95 5 rnal temper	46.92 I solar 52.28 ature (	307.09 (84)m = 596.41 (heating	344.36 : (73)m 617.65 seasor	34 + (8 59	33)m 99.48	329.61 watts 576.89	301 554	.1 528.12	198.85			21	
(83)m= 105.03 Total gains – (84)m= 422.11 7. Mean inte	179.57 2 internal and 494.95 5 rnal temper during hea	solar 52.28 ature (	307.09 (84)m = 596.41 (heating eriods in	344.36 (73)m 617.65 seasor the livi	34 + (8 59	33)m 99.48 area f	329.61 watts 576.89	301 554	.1 528.12	198.85			21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain	solar 52.28 ature (	307.09 (84)m = 596.41 (heating eriods in	344.36 (73)m 617.65 seasor the livi	34 + (8 59 ing (se	33)m 99.48 area f	329.61 watts 576.89	301 554 ole 9	.1 528.12	198.85	5 421.07		21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb	46.92 solar 52.28 ature ( ating po	307.09 (84)m = 596.41 (heating eriods in twing are	344.36 (73)m 617.65 seasor the livi	34 + (8 59 ing and (se	33)m 99.48 area f ee Ta	329.61 watts 576.89 rom Tab	301 554 ole 9	.1 528.12  Th1 (°C)  ug Sep	198.85 475.35	5 421.07	398.65	21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac	179.57 2 internal and 494.95 5 rnal temper during head ctor for gain Feb 0.97	solar solar 52.28 ature ( ating pos as for li Mar 0.91	307.09 (84)m = 596.41 (heating eriods in Apr 0.79	344.36 = (73)m 617.65 seasor the livi ea, h1,m May 0.62	34+ (86 55)	33)m 99.48 area f ee Ta Jun	32 <mark>9.61 , watts 576.8</mark> 9 from Tab ble 9a) Jul 0.31	301 554 ole 9 A	.1   528.12   Th1 (°C)   Sep   4   0.54	198.85 475.35 Oct	5 421.07 Nov	398.65 Dec	21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac Jan (86)m= 0.99	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97	solar solar 52.28 ature ( ating pos as for li Mar 0.91	307.09 (84)m = 596.41 (heating eriods in Apr 0.79	344.36 = (73)m 617.65 seasor the livi ea, h1,m May 0.62	34+ (8 550))));;ing :: (so ollows)	33)m 99.48 area f ee Ta Jun	32 <mark>9.61 , watts 576.8</mark> 9 from Tab ble 9a) Jul 0.31	301 554 ole 9 A	.1   528.12   Th1 (°C)   ug   Sep   4   0.54   fable 9c)	198.85 475.35 Oct	5 421.07 Nov	398.65 Dec	21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97 al temperatu 20.66	solar solar 52.28 ature ( ating possible for li Mar 0.91 ure in 1	307.09 (84)m = 596.41 (heating eriods in Apr 0.79 iving are 20.91	344.36 = (73)m 617.65 season the livi ea, h1,m May 0.62 ea T1 (f	34+ (8 59 59 59 59 59 59 59 59 59 59 59 59 59	33)m 39.48 area f ee Ta Jun 0.44 w ste	329.61 watts 576.89 rom Tak ble 9a) Jul 0.31 os 3 to 7 20.96	301 554 ble 9 0.3 ' in T 20.	267.83  1.1   528.12  Th1 (°C)  1.2   Sep   1.4   0.54  1.3   320.96   1.4   20.96	198.85 475.35 Oct 0.83	Nov 0.97	398.65  Dec 0.99	21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna (87)m= 20.54	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97 al temperatu 20.66	solar solar 52.28 ature ( ating possible for li Mar 0.91 ure in 1	307.09 (84)m = 596.41 (heating eriods in Apr 0.79 iving are 20.91	344.36 = (73)m 617.65 season the livi ea, h1,m May 0.62 ea T1 (f	34+ (8 550) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1)	33)m 39.48 area f ee Ta Jun 0.44 w ste	329.61 watts 576.89 rom Tak ble 9a) Jul 0.31 os 3 to 7 20.96	301 554 ble 9 0.3 ' in T 20.	Th1 (°C)  Sep 4 0.54  Table 9c) 96 20.96  9, Th2 (°C)	198.85 475.35 Oct 0.83	Nov 0.97	398.65  Dec 0.99	21	(84)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac Jan (86)m= 0.99 Mean interna (87)m= 20.54 Temperature (88)m= 20.25	179.57 2 internal and 494.95 5 rnal temper during head ctor for gain Feb 0.97 al temperatu 20.66	solar solar sting positing pos	307.09 (84)m = 596.41 (heating eriods in Apr 0.79 iving are 20.91 eriods in 20.26	344.36 = (73)m 617.65 seasor in the livities, h1,m May 0.62 ea T1 (for 20.95 in rest of 20.27	34+ (8 55) 1) 550 1) (c) 0llo 2 2	area fee Ta Jun 0.44 w ste 0.96 relling	329.61 watts 576.89 from Tab ble 9a) Jul 0.31 os 3 to 7 20.96 from Ta	301 554 554 Al 0.3 7 in T 20.	Th1 (°C)  Sep 4 0.54  Table 9c) 96 20.96  9, Th2 (°C)	198.85 475.35 Oct 0.83	Nov 0.97	Dec 0.99 20.51	21	(84) (85) (86) (87)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac Jan (86)m= 0.99  Mean interna (87)m= 20.54  Temperature	179.57 2 internal and 494.95 5 rnal temper during head ctor for gain Feb 0.97 al temperatu 20.66	solar solar sting positing pos	307.09 (84)m = 596.41 (heating eriods in Apr 0.79 iving are 20.91 eriods in 20.26	344.36 = (73)m 617.65 seasor in the livities, h1,m May 0.62 ea T1 (for 20.95 in rest of 20.27	34+ (8 55) ing: (c) (c) (d) (d) (d) (d) (d) (d) (d) (d) (d) (d	area fee Ta Jun 0.44 w ste 0.96 relling	329.61 watts 576.89 from Tab ble 9a) Jul 0.31 os 3 to 7 20.96 from Ta	301 554 554 Al 0.3 7 in T 20.	267.83  1.1   528.12  Th1 (°C)  1.2   Sep  1.4   0.54  1.5   0.54	198.85 475.35 Oct 0.83	Nov 0.97	Dec 0.99 20.51	21 ]	(84) (85) (86) (87)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fact (86)m= 0.99  Mean internat (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fact (89)m= 0.98	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97 0 al temperatu 20.66 :: during hea 20.25 2 ctor for gain 0.96	solar solar solar sture ( atting points for li Mar 0.91 ure in l 20.8 atting points at	307.09 (84)m = 596.41 (heating eriods in ving are 20.79 eriods in 20.26 est of dv 0.76	344.36 = (73)m 617.65 seasor the liviting, May 0.62 ea T1 (for 20.95) or rest of 20.27 welling, 0.57	34+ (85 50 50 50 50 50 50 50 50 50 50 50 50 50	area f ee Ta Jun 0.44 w ste 10.96 relling 10.28 m (se	329.61 watts 576.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26	301 554 ble 9 0.3 ' in T 20. ble 9 20. 9a)	267.83  1.1 528.12  Th1 (°C)  1.2 Sep  1.4 0.54  1.5 Sep  1.5 Sep  1.6 O.54  1.7 O.54  1.8 O.54	198.85 475.35 Oct 0.83 20.9 20.27	Nov 0.97 20.71	398.65  Dec 0.99  20.51	21 ]	(84) (85) (86) (87) (88)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation face [86)m= 0.99  Mean internation (87)m= 20.54  Temperature (88)m= 20.25  Utilisation face (89)m= 0.98  Mean internation face)	179.57 2 internal and 494.95 5 rnal temper during head ctor for gain Feb 0.97 6 during head 20.66 2 during head 20.25 2 ctor for gain 0.96 1	solar solar sture ( atting points for line Mar 0.91 ure in l 20.8 atting points 20.25 as for r	307.09 (84)m = 596.41 (heating eriods in 7.79 (heating are 20.91 eriods in 20.26 est of do 0.76 (he rest of the re	344.36 = (73)m 617.65 seasor the livities, h1,m May 0.62 ea T1 (fr 20.95 n rest of 20.27 welling, 0.57 of dwell	3-4 (8-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	area fee Ta Jun 0.44 w ste 0.96 relling 0.28 m (se 0.39	329.61 watts 576.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26	301 554 Al 0.3 7 in T 20. ble 9 20. 9a) 0.2	Th1 (°C)  Sep 4 0.54  Table 9c) 96 20.96  0, Th2 (°C) 28 20.27	198.85 475.35 Oct 0.83 20.9 20.27	Nov 0.97 20.71 20.26	398.65  Dec 0.99  20.51	21 ]	(84) (85) (86) (87) (88)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fact (86)m= 0.99  Mean interna (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fact (89)m= 0.98  Mean interna	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97 0 al temperatu 20.66 :: during hea 20.25 2 ctor for gain 0.96	solar solar solar sting positing	307.09 (84)m = 596.41 (heating eriods in ving are 20.79 eriods in 20.26 est of dv 0.76	344.36 = (73)m 617.65 seasor the liviting, May 0.62 ea T1 (for 20.95) or rest of 20.27 welling, 0.57	3-4 (8-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	area f ee Ta Jun 0.44 w ste 10.96 relling 10.28 m (se	329.61 watts 576.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26	301 554 ble 9 0.3 ' in T 20. ble 9 20. 9a)	Th1 (°C)  Sep 4 0.54  Sable 9c) 96 20.96  9, Th2 (°C) 28 20.27  9 0.48  to 7 in Table 22 20.21	198.85 475.36 Oct 0.83 20.9 20.27 0.79 e 9c) 20.15	Nov 0.97 20.71 20.26	398.65  Dec 0.99  20.51  20.26  0.99	21	(84) (85) (86) (87) (88) (89) (90)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac  (86)m= 0.99  Mean interna (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fac (89)m= 0.98  Mean interna (90)m= 19.63	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97 6 al temperatu 20.66 2 ctor for gain 0.96 al temperatu 19.81	solar solar solar sture ( atting policy for li Mar 0.91 ure in l 20.8 as for r 0.9 ure in t 20.9	307.09 (84)m = 596.41 (heating eriods in ving are 20.79 iving are 20.91 eriods in 20.26 est of dv 0.76 he rest of 20.15	344.36  (73)m 617.65  seasor the livities, h1,m May 0.62 ea T1 (fr 20.95 n rest of 20.27 welling, 0.57 of dwell 20.2	3-4 (8 55) ing : (0) collooling : (2) h2, (1) ing : (2)	area f ee Ta Jun 0.44 w ste 0.96 relling 0.28 m (se 0.39 T2 (fc	329.61 watts 576.89 from Table 9a) Jul 0.31 0.31 0.26 from Ta 20.28 e Table 0.26 ollow ste 20.22	301 554 ble 9 0.3 7 in T 20. ble 9 20. 9a) 0.2 eps 3 20.	Th1 (°C)  Sep 4 0.54  Table 9c) 96 20.96  9, Th2 (°C) 28 20.27  9 0.48  to 7 in Table 22 20.21	198.85 475.36 Oct 0.83 20.9 20.27 0.79 e 9c) 20.15	Nov 0.97 20.71 20.26 0.96	398.65  Dec 0.99  20.51  20.26  0.99		(84) (85) (86) (87) (88) (89)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean interpreture Utilisation factors (86)m= 0.99  Mean internations (87)m= 20.54  Temperature (88)m= 20.25  Utilisation factors (89)m= 0.98  Mean internations (90)m= 19.63	179.57 2 internal and 494.95 5 rnal temper during head ctor for gain Feb 0.97 6 during head 20.66 2 ctor for gain 0.96 1 19.81	solar solar solar string posit	307.09 (84)m = 596.41 (heating eriods in Apr 0.79 iving are 20.91 eriods in 20.26 est of do 0.76 he rest of 20.15	344.36 = (73)m 617.65 seasor the livities, h1,m May 0.62 ea T1 (ff 20.95 n rest of 20.27 welling, 0.57 of dwell 20.2	3-4 (8   59   10   10   10   10   10   10   10   1	area f ee Ta Jun 0.44 w ste 0.96 relling 0.28 m (se 0.39 T2 (fc 0.22	329.61 watts 576.89 from Table 9a) Jul 0.31 0s 3 to 7 20.96 from Ta 20.28 e Table 0.26 bllow ste 20.22	301 554 Al 0.3 7 in T 20. ble 9 20. 9a) 0.2 eps 3 20. + (1	92 267.83  .1 528.12  Th1 (°C)  ug Sep .4 0.54  able 9c)  96 20.96  2, Th2 (°C)  28 20.27  9 0.48  to 7 in Table  22 20.21  f  - fLA) × T2	198.85 475.35  Oct 0.83  20.9  20.27  0.79  e 9c) 20.15  LA = Liv	Nov 0.97 20.71 20.26 0.96	398.65  Dec 0.99  20.51  20.26  0.99  19.6		(84) (85) (86) (87) (88) (89) (90) (91)
(83)m= 105.03 Total gains – (84)m= 422.11  7. Mean inte Temperature Utilisation fac  (86)m= 0.99  Mean interna (87)m= 20.54  Temperature (88)m= 20.25  Utilisation fac (89)m= 0.98  Mean interna (90)m= 19.63	179.57 2 internal and 494.95 5 rnal temper during hea ctor for gain Feb 0.97 6 1 temperatu 20.66 2 ctor for gain 0.96 1 19.81 1 al temperatu 20.53 2	solar solar	307.09 (84)m = 596.41 (heating eriods in ving are 20.91 eriods in 20.26 est of do 0.76 he rest of 20.15  r the who 20.79	344.36  (73)m 617.65  seasor the livities, h1,m May 0.62 ea T1 (fr 20.95 n rest of 20.27 welling, 0.57 of dwell 20.2	3-4 (8 55 55 55 55 55 55 55 55 55 55 55 55 55	area f ee Ta Jun 0.44 w ste 0.96 elling 0.28 m (se 0.39 T2 (fc 0.22	329.61 , watts 576.89  rom Table 9a)  Jul 0.31  0.31  0.5 3 to 7  20.96  from Ta 20.28  e Table 0.26  bllow ste 20.22  A × T1 20.85	301 554 A 0.3 7' in T 20. 9a) 0.2 eps 3 20. + (1 20.	Th1 (°C)  Sep 4 0.54  Sable 9c) 96 20.96  0, Th2 (°C) 28 20.27  9 0.48  to 7 in Table 22 20.21  f	198.85 475.35  Oct 0.83  20.9  20.27  0.79  e 9c) 20.15  LA = Liv	Nov 0.97 20.71 20.26 0.96 19.89 ring area ÷ (4	398.65  Dec 0.99  20.51  20.26  0.99		(84) (85) (86) (87) (88) (89) (90)







Water heating fuel used 547.69 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 198.59 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 198.59 Electricity for lighting 244.06 (232)12a. CO2 emissions – Individual heating systems including micro-CHP **Emission factor Emissions Energy** kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x (261) 412.64 0.519 Space heating (secondary) (215) x (263)0.519 (219) x Water heating 0.519 284.25 (264)(261) + (262) + (263) + (264) =Space and water heating (265)696.89 (231) x Electricity for pumps, fans and electric keep-hot 0.519 103.07 (267)(232) x Electricity for lighting (268)0.519 126.67 Total CO2, kg/year sum of (265)...(271) = (272)926.63  $(272) \div (4) =$ **Dwelling CO2 Emission Rate** (273)17.48 El rating (section 14) (274)87



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 15 - 3B6P - MF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor (1a) x 2.7 (2a) =(3a) 169 456.3 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)169 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =456.3 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration	rate (allow	ing for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.16 0.1		0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effective If mechanical ver	•	rate for t	he appli	cable ca	se	-	-	-	-	-		(220)
If exhaust air heat pu		endix N. (2	23b) = (23a	a) × Fmv (e	eguation (I	N5)) . othe	rwise (23b	) = (23a)			0.5	(23a) (23b)
If balanced with heat								, (===,			74.8	(23c)
a) If balanced me	-	-	_					2b)m + (	23b) <b>x</b> [	1 – (23c)		(230)
(24a)m= 0.29 0.2		0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28		(24a)
b) If balanced me	chanical v	entilation	without	heat red	covery (N	иV) (24t	m = (22)	2b)m + (2	23b)	I	l	
(24b)m= 0 0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house if (22b)m < 0			•	-				5 × (23h	. <u> </u>	•	•	
(24c)m= 0 0	<del></del>	0	0	0	0	0	0	0	0	0		(24c)
d) If natural venti	!			<u> </u>		<u> </u>	<u> </u>					, ,
if (22b)m = 1								0.5]			_	
(24d)m = 0 0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air char	ge rate - e	nter (24a	) or (24b	o) or (24	c) or (24	d) in bo	x (25)				•	
(25)m= 0.29 0.2	9 0.28	0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28		(25)
3. Heat losses and	heat loss	paramet	er:									
	Gross rea (m²)	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-l		A X k J/K
Win <mark>dows</mark> Type 1												
				3.6	x1.	/[1/( 1.1 )+	0.04] =	3.79				(27)
Windows Type 2				3.6	_	/ <mark>[1/( 1.1 )</mark> + /[1/( 1.1 )+		3.79 2.53				(27) (27)
Windows Type 2 Windows Type 3					x1		0.04] =					
				2.4	x1 x1	/[1/( 1.1 )+	0.04] = [	2.53				(27)
Windows Type 3				2.4 9.36	x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+	[0.04] = [0.04] = [0.04] = [0.04] = [0.04]	2.53 9.86				(27) (27)
Windows Type 3 Windows Type 4				2.4 9.36 2.4	x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	[0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04]	2.53 9.86 2.53				(27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5				2.4 9.36 2.4 1.78	x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix}$	2.53 9.86 2.53 1.88				(27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6				2.4 9.36 2.4 1.78 1.05	x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.53 9.86 2.53 1.88 1.11				(27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8	86.43	27.6	4	2.4 9.36 2.4 1.78 1.05	x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.53 9.86 2.53 1.88 1.11				(27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1	86.43 27.27	27.6	4	2.4 9.36 2.4 1.78 1.05 1.05	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.53 9.86 2.53 1.88 1.11 1.11 3.79				(27) (27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = 0.04] = 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05				(27) (27) (27) (27) (27) (27) (27) (29)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = 0.04] = 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05				(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of elements	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86				(27) (27) (27) (27) (27) (27) (27) (27)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of elements	27.27		4	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86				(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of elements Party wall Party floor	27.27  nts, m²	0 effective wi	indow U-va	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calcul	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86	as given in	paragraph		(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of element Party wall Party floor Party ceiling * for windows and roof windows and windows and roof windows and windows and windows and windows and windows and windows and windows and win	27.27  nts, m²  vindows, use on the sides of i	0 effective w	indow U-va	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calcul	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12	0.04] = [ 0.04]	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86	as given in	paragraph	7 3.2	(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of element Party wall Party floor Party ceiling * for windows and roof with include the areas on the second	27.27  nts, m²  vindows, use of the sides of	0 effective w	indow U-va	2.4 9.36 2.4 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calcul	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{array}{c} 0.04 \\ 0.$	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86				(27) (27) (27) (27) (27) (27) (27) (29) (31) (32) (32a) (32a)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Windows Type 8 Walls Type1 Walls Type2 Total area of element Party wall Party floor Party ceiling * for windows and roof windows and windows and roof windows and roof windows and windows and windows and windows and windows and windows and windows and windows and windows and windows and windows and window	orindows, use of its of its idea of its id	effective winternal wal	indow U-va	2.4 9.36 1.78 1.05 1.05 3.6 58.79 27.27 113.7 52.38 175.4 175.8 alue calculatitions	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	/[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	$\begin{array}{c} 0.04 \\ 0.$	2.53 9.86 2.53 1.88 1.11 1.11 3.79 7.05 3.86 0	2) + (32a).		40.04	(27) (27) (27) (27) (27) (27) (27) (29) (29) (31) (32) (32a) (32b)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)17.05 if details of thermal bridging are not known (36) =  $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)57.09 Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)$ m x (5)Oct Feb Mar Jul Sep Dec .lan Apr May Jun Aug Nov (38)m =43.45 42.97 42.49 40.09 39.61 37.21 37.21 36.73 38.17 39.61 40.57 41.53 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =100.54 100.06 99.58 97.18 96.7 94.3 94.3 93.82 95.26 96.7 97.66 98.62 Average =  $Sum(39)_{1...12}/12=$ (39)97.06 Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m  $\div$  (4)0.57 0.56 0.59 0.59 0.59 0.58 0.56 0.56 0.56 0.57 0.58 0.58 (40)m =(40)Average =  $Sum(40)_{1...12}/12=$ 0.57 Number of days in month (Table 1a) Jan Feb Mar Jun Apr May Jul Aug Sep Oct Nov Dec (41)31 28 31 30 31 30 31 31 30 31 30 31 (41)m =4. Water heating energy requirement: Assumed occupancy, N (42)2.96 if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 (43)104.53 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) 114.98 110.8 106.62 102.44 94.08 94.08 98.26 102.44 106.62 110.8 114.98 (44)m =98.26 (44)Total =  $Sum(44)_{1...12}$  = 1254.35 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) 170.52 149.13 111.09 165.13 (45)m =153.89 134.17 128.74 102.94 118.13 119.54 139.31 152.07 (45)Total =  $Sum(45)_{1...12}$  = 1644.65 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.58 22.37 23.08 20.13 19.31 15.44 17.72 17.93 20.9 22.81 24.77 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 305 (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): 1.63 (48)Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year  $(48) \times (49) =$ 0.88 (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 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)



Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53) =	0 (54 0.88 (55
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$	0.88 (55)
(56)m= 27.29 24.65 27.29 26.41 27.29 26.		26.41 27.29 (56
If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $(56)$ m x		· ·
(57)m= 27.29 24.65 27.29 26.41 27.29 26.	41 27.29 27.29 26.41 27.29	26.41 27.29 (57
Primary circuit loss (annual) from Table 3		0 (58
Primary circuit loss calculated for each month (59)n	$n = (58) \div 365 \times (41) m$	
(modified by factor from Table H5 if there is solar	water heating and a cylinder thermo	ostat)
(59)m= 23.26 21.01 23.26 22.51 23.26 22.	51 23.26 23.26 22.51 23.26	22.51 23.26 (59
Combi loss calculated for each month (61)m = (60)	÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0	0 0 0 0	0 0 (61
Total heat required for water heating calculated for	each month $(62)$ m = $0.85 \times (45)$ m +	(46)m + (57)m + (59)m + (61)m
(62)m= 221.06 194.79 204.44 183.09 179.29 160	0.01 153.49 168.68 168.46 189.86	200.99 215.68 (62
Solar DHW input calculated using Appendix G or Appendix H (no	egative quantity) (enter '0' if no solar contribut	ion to water heating)
(add additional lines if FGHRS and/or WWHRS app	lies, see Appendix G)	
(63)m= 0 0 0 0 0	0 0 0 0	0 0 (63
Output from water heater		
(64)m= 221.06 194.79 204.44 183.09 179.29 160	1.01     153.49     168.68     168.46     189.86	200.99 215.68
	Output from water heate	r (annual) <sub>112</sub> 2239.82 (64
Heat gains from water heating, kWh/month 0.25 / [0	$0.85 \times (45) \text{m} + (61) \text{m} + 0.8 \times (46) \text{m}$	+ (57)m + (59)m 1
		. (61)111 1 (66)111 ]
(65)m= 97.14 86.11 91.61 83.75 83.24 76.		89.7 95.35 (65
(65)m= 97.14 86.11 91.61 83.75 83.24 76. include (57)m in calculation of (65)m only if cylind	07 74.67 79.72 78.88 86.76	89.7 95.35 (65
	07 74.67 79.72 78.88 86.76	89.7 95.35 (65
include (57)m in calculation of (65)m only if cylind	07 74.67 79.72 78.88 86.76	89.7 95.35 (65
include (57)m in calculation of (65)m only if cylind 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	07 74.67 79.72 78.88 86.76	89.7 95.35 (65
include (57)m in calculation of (65)m only if cylind  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is fi	89.7 95.35 (65 om community heating
include (57)m in calculation of (65)m only if cylind  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is formula   un	89.7 95.35 (65 om community heating
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July  (66)m= 148.06 148.06 148.06 148.06 148.06 148.06	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is for the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is formula in the dwelling or hot water is for the dwelling or hot water is	89.7 95.35 (65 om community heating
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July  (66)m= 148.06	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is formulated by the dwelling or hot water is f	89.7 95.35 (65 om community heating Nov Dec 148.06 148.06 (66
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May June (66)m= 148.06 1	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is find th	89.7 95.35 (65 om community heating Nov Dec 148.06 148.06 (66
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May June (66)m= 148.06 1	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is formula in the dwel	89.7 95.35 (65  com community heating    Nov   Dec
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July (66)m= 148.06 1	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is full formula in the dwelling or hot water is full formula in the dwelling or hot water is full formula in the dwelling or hot water is full full formula in the dwelling or hot water is full full formula in the dwelling or hot water is full full full for L48.06 148	89.7 95.35 (65  com community heating    Nov   Dec
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jec  (66)m= 148.06 148.06 148.06 148.06 148.06 148.06 148.06  Lighting gains (calculated in Appendix L, equation L  (67)m= 32.26 28.65 23.3 17.64 13.19 11.  Appliances gains (calculated in Appendix L, equation (68)m= 340.53 344.06 335.16 316.2 292.27 269  Cooking gains (calculated in Appendix L, equation I	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is full formula in the dwelling or hot water is full formula in the dwelling or hot water is full formula in the dwelling or hot water is full full formula in the dwelling or hot water is full full formula in the dwelling or hot water is full full full for L48.06 148	89.7 95.35 (65 om community heating Nov Dec 148.06 148.06 (66 31.1 33.16 (67 303.01 325.5 (68
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July (66)m= 148.06 1	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is formulated by the dwelling or hot water is f	89.7 95.35 (65 om community heating Nov Dec 148.06 148.06 (66 31.1 33.16 (67 303.01 325.5 (68
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July (66)m= 148.06 148.06 148.06 148.06 148.06 148  Lighting gains (calculated in Appendix L, equation L (67)m= 32.26 28.65 23.3 17.64 13.19 11.  Appliances gains (calculated in Appendix L, equation (68)m= 340.53 344.06 335.16 316.2 292.27 269  Cooking gains (calculated in Appendix L, equation I (69)m= 37.81 37.81 37.81 37.81 37.81 37.81 37.81	O7         74.67         79.72         78.88         86.76           der is in the dwelling or hot water is filled.         In the dwelling or hot water is filled.           un         Jul         Aug         Sep         Oct           3.06         148.06         148.06         148.06         148.06           4.9 or L9a), also see Table 5         13         12.03         15.64         20.99         26.65           5.78         254.76         251.22         260.13         279.08           2.15 or L15a), also see Table 5         81         37.81         37.81         37.81           37.81         37.81         37.81         37.81	89.7 95.35 (65 om community heating Nov Dec 148.06 148.06 (66 31.1 33.16 (67 303.01 325.5 (68 37.81 37.81 (69
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan	O7         74.67         79.72         78.88         86.76           der is in the dwelling or hot water is filled.         In the dwelling or hot water is filled.           un         Jul         Aug         Sep         Oct           3.06         148.06         148.06         148.06         148.06           4.9 or L9a), also see Table 5         13         12.03         15.64         20.99         26.65           5.78         254.76         251.22         260.13         279.08           2.15 or L15a), also see Table 5         81         37.81         37.81         37.81           37.81         37.81         37.81         37.81	89.7 95.35 (65 om community heating Nov Dec 148.06 148.06 (66 31.1 33.16 (67 303.01 325.5 (68 37.81 37.81 (69
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is find th	89.7       95.35         Om community heating         Nov       Dec         148.06       148.06         31.1       33.16         303.01       325.5         37.81       37.81         69         0       0         70
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is find th	89.7       95.35         Om community heating         Nov       Dec         148.06       148.06         31.1       33.16         303.01       325.5         37.81       37.81         69         0       0         70
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is find th	89.7       95.35         om community heating         Nov       Dec         148.06       148.06         31.1       33.16         303.01       325.5         (68         37.81       37.81         0       0         -118.45       -118.45         124.58       128.15
include (57)m in calculation of (65)m only if cylinds  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May July (66)m= 148.06 1	07 74.67 79.72 78.88 86.76  der is in the dwelling or hot water is fill  un Jul Aug Sep Oct  1.06 148.06 148.06 148.06 148.06  1.9 or L9a), also see Table 5  1.13 12.03 15.64 20.99 26.65  1.78 254.76 251.22 260.13 279.08  1.15 or L15a), also see Table 5  1.81 37.81 37.81 37.81 37.81  0 0 0 0  0 0  1.66 100.36 107.15 109.56 116.61  1.66 100.36 107.15 109.56 116.61	89.7       95.35         om community heating         Nov       Dec         148.06       148.06         31.1       33.16         303.01       325.5         (68         37.81       37.81         0       0         -118.45       -118.45         124.58       128.15

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



Orientation	: Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.	9x 0.77	X	3.6	x	10.63	x	0.45	x	0.67	=	8	(74)
North 0.	9x 0.77	X	2.4	x	10.63	х	0.45	х	0.67	=	5.33	(74)
North 0.	9x 0.77	X	3.6	х	10.63	х	0.45	х	0.67	=	8	(74)
North 0.	9x 0.77	x	3.6	x	20.32	х	0.45	x	0.67	] =	15.29	(74)
North 0.	9x 0.77	x	2.4	x	20.32	х	0.45	х	0.67	] =	10.19	(74)
North 0.	9x 0.77	X	3.6	х	20.32	х	0.45	х	0.67	=	15.29	(74)
North 0.	9x 0.77	X	3.6	х	34.53	х	0.45	х	0.67	=	25.97	(74)
North 0.	9x 0.77	X	2.4	x	34.53	x	0.45	x	0.67	=	17.32	(74)
North 0.	9x 0.77	X	3.6	x	34.53	x	0.45	х	0.67	=	25.97	(74)
North 0.	9x 0.77	X	3.6	x	55.46	x	0.45	x	0.67	=	41.72	(74)
North 0.	9x 0.77	X	2.4	x	55.46	x	0.45	x	0.67	=	27.81	(74)
North 0.	9x 0.77	X	3.6	x	55.46	x	0.45	x	0.67	=	41.72	(74)
North 0.	9x 0.77	X	3.6	x	74.72	x	0.45	x	0.67	=	56.2	(74)
North 0.	9x 0.77	X	2.4	x	74.72	x	0.45	x	0.67	=	37.47	(74)
North 0.	9x 0.77	X	3.6	x	74.72	x	0.45	x	0.67	=	56.2	(74)
North 0.	9x 0.77	X	3.6	X	79.99	X	0.45	X	0.67	] =	60.16	(74)
North 0.	9x 0.77	x	2.4	x	79.99	х	0.45	x	0.67		40.11	(74)
North 0.	9x 0.77	] x	3.6	х	79.99	×	0.45	x	0.67	=	60.16	(74)
North 0.	9x 0.77	x	3.6	x	74.68	x	0.45	x	0.67	=	56.17	(74)
North 0.	9x 0.77	] x	2.4	x	74.68	х	0.45	x	0.67	=	37.45	(74)
North 0.	9x 0.77	] x	3.6	x	74.68	X	0.45	x	0.67	=	56.17	(74)
North 0.	9x 0.77	x	3.6	х	59.25	x	0.45	x	0.67	=	44.56	(74)
North 0.	9x 0.77	X	2.4	x	59.25	x	0.45	х	0.67	=	29.71	(74)
North 0.	9x 0.77	X	3.6	x	59.25	x	0.45	X	0.67	=	44.56	(74)
North 0.	9x 0.77	X	3.6	X	41.52	X	0.45	X	0.67	=	31.23	(74)
North 0.	9x 0.77	X	2.4	x	41.52	X	0.45	X	0.67	=	20.82	(74)
North 0.	9x 0.77	X	3.6	X	41.52	X	0.45	X	0.67	=	31.23	(74)
North 0.	9x 0.77	X	3.6	x	24.19	x	0.45	x	0.67	=	18.19	(74)
North 0.	9x 0.77	X	2.4	X	24.19	X	0.45	X	0.67	=	12.13	(74)
North 0.	9x 0.77	X	3.6	X	24.19	X	0.45	X	0.67	=	18.19	(74)
North 0.	9x 0.77	X	3.6	X	13.12	X	0.45	X	0.67	=	9.87	(74)
North 0.	9x 0.77	X	2.4	x	13.12	x	0.45	x	0.67	=	6.58	(74)
North 0.	9x 0.77	X	3.6	X	13.12	X	0.45	X	0.67	=	9.87	(74)
North 0.	9x 0.77	X	3.6	X	8.86	X	0.45	X	0.67	=	6.67	(74)
North 0.	9x 0.77	X	2.4	x	8.86	x	0.45	x	0.67	=	4.45	(74)
North 0.	9x 0.77	x	3.6	x	8.86	x	0.45	x	0.67	=	6.67	(74)
Northeast <sub>0.</sub>	9x 0.77	x	1.05	x	11.28	x	0.45	x	0.67	=	2.48	(75)
Northeast <sub>0.</sub>	9x 0.77	x	1.05	x	22.97	x	0.45	x	0.67	=	5.04	(75)
Northeast <sub>0.</sub>	9x 0.77	X	1.05	X	41.38	X	0.45	X	0.67	=	9.08	(75)



Northoast a a		1		1		1		1		1		7,75
Northeast 0.9x	0	X	1.05	X	67.96	X	0.45	X	0.67	] = 	14.91	(75)
Northeast 0.9x		X	1.05	X	91.35	X	0.45	X	0.67	] = 1	20.04	<u> </u> (75)
Northeast 0.9x		X	1.05	X	97.38	X	0.45	X	0.67	=	21.36	<u> </u> (75)
Northeast 0.9x		X	1.05	X	91.1	X	0.45	X	0.67	=	19.99	<u> </u> (75)
Northeast 0.9x		X	1.05	X	72.63	X	0.45	X	0.67	=	15.93	(75)
Northeast 0.9x	****	X	1.05	X	50.42	X	0.45	X	0.67	=	11.06	(75)
Northeast 0.9x	••••	X	1.05	X	28.07	X	0.45	X	0.67	=	6.16	(75)
Northeast 0.9x		X	1.05	X	14.2	X	0.45	X	0.67	=	3.11	(75)
Northeast 0.9x		X	1.05	X	9.21	X	0.45	X	0.67	=	2.02	(75)
Southeast 0.9x		X	1.78	X	36.79	X	0.45	X	0.67	<u> </u>	13.68	(77)
Southeast 0.9x	0.77	X	1.78	X	62.67	X	0.45	X	0.67	=	23.31	(77)
Southeast 0.9x	0.77	X	1.78	X	85.75	X	0.45	X	0.67	=	31.89	(77)
Southeast 0.9x	0.77	X	1.78	X	106.25	X	0.45	X	0.67	=	39.52	(77)
Southeast 0.9x	0.77	X	1.78	X	119.01	x	0.45	X	0.67	=	44.26	(77)
Southeast 0.9x	0.77	X	1.78	X	118.15	x	0.45	X	0.67	=	43.94	(77)
Southeast 0.9x	0.77	X	1.78	X	113.91	x	0.45	x	0.67	=	42.36	(77)
Southeast 0.9x	0.77	X	1.78	X	104.39	x	0.45	x	0.67	=	38.82	(77)
Southeast 0.9x	0.77	X	1.78	X	92.85	Х	0.45	X	0.67	=	34.53	(77)
Southeast 0.9x	0.77	x	1.78	x	69.27	x	0.45	x	0.67	=	25.76	(77)
Southeast 0.9x	0.77	x	1.78	х	44.07	x	0.45	x	0.67	=	16.39	(77)
Southeast 0.9x	0.77	x	1.78	x	31.49	x	0.45	x	0.67	=	11.71	(77)
South 0.9x	0.54	x	9.36	x	46.75	Х	0.45	x	0.67	=	64.12	(78)
South 0.9x	0.77	x	2.4	x	46.75	X	0.45	x	0.67	=	46.89	(78)
South 0.9x	0.54	x	9.36	x	76.57	x	0.45	x	0.67	=	105.01	(78)
South 0.9x	0.77	X	2.4	x	76.57	x	0.45	x	0.67	=	76.79	(78)
South 0.9x	0.54	X	9.36	X	97.53	x	0.45	x	0.67	=	133.77	(78)
South 0.9x	0.77	X	2.4	x	97.53	x	0.45	x	0.67	=	97.82	(78)
South 0.9x	0.54	X	9.36	X	110.23	x	0.45	x	0.67	=	151.19	(78)
South 0.9x	0.77	X	2.4	x	110.23	x	0.45	x	0.67	=	110.56	(78)
South 0.9x	0.54	X	9.36	x	114.87	x	0.45	x	0.67	=	157.55	(78)
South 0.9x	0.77	X	2.4	x	114.87	x	0.45	x	0.67	=	115.21	(78)
South 0.9x	0.54	X	9.36	x	110.55	x	0.45	x	0.67	=	151.62	(78)
South 0.9x	0.77	X	2.4	x	110.55	x	0.45	x	0.67	=	110.87	(78)
South 0.9x	0.54	X	9.36	x	108.01	x	0.45	x	0.67	<b>=</b>	148.14	(78)
South 0.9x	0.77	X	2.4	x	108.01	x	0.45	x	0.67	<b>=</b>	108.33	(78)
South 0.9x	0.54	x	9.36	x	104.89	x	0.45	x	0.67	] =	143.86	(78)
South 0.9x	0.77	x	2.4	x	104.89	x	0.45	x	0.67	] =	105.2	(78)
South 0.9x	0.54	x	9.36	x	101.89	x	0.45	x	0.67	=	139.74	(78)
South 0.9x	0.77	X	2.4	x	101.89	x	0.45	x	0.67	j =	102.18	(78)
South 0.9x	0.54	X	9.36	x	82.59	x	0.45	x	0.67	j =	113.27	(78)
South 0.9x	0.77	X	2.4	x	82.59	x	0.45	x	0.67	=	82.83	(78)
		_		1		ı		1		•		_



South	0.9x 0.54	X	9.3	36	x	55.	.42	x	0.45	x	0.67		• [	76.01	(78)
South	0.9x 0.77	X	2.4	4	x	55.	.42	х	0.45	x	0.67		• [	55.58	(78)
South	0.9x 0.54	X	9.3	36	x	40	).4	x	0.45	x	0.67		• [	55.41	(78)
South	0.9x 0.77	X	2.4	4	x	40	).4	х	0.45	x	0.67		• [	40.52	(78)
Northwest	t <sub>0.9x</sub> 0.77	x	1.0	)5	x	11.	.28	х	0.45	×	0.67		۰	2.48	(81)
Northwest	t <sub>0.9x</sub> 0.77	X	1.0	)5	X	22.	.97	х	0.45	x	0.67	<u> </u>	Ē	5.04	(81)
Northwest	t 0.9x 0.77	x	1.0	)5	X	41.	.38	х	0.45	x	0.67	<u> </u>	Ē	9.08	(81)
Northwest	t <sub>0.9x</sub> 0.77	X	1.0	)5	X	67.	.96	х	0.45	x	0.67		• Ē	14.91	(81)
Northwest	t <sub>0.9x</sub> 0.77	x	1.0	)5	x	91.	.35	х	0.45	x	0.67	_ =	· ┌	20.04	(81)
Northwest	t 0.9x	X	1.0	)5	x	97.	.38	х	0.45	x	0.67		• [	21.36	(81)
Northwest	t <sub>0.9x</sub> 0.77	x	1.0	)5	x	91	.1	х	0.45	×	0.67		۰	19.99	(81)
Northwest	t <sub>0.9x</sub> 0.77	x	1.0	)5	x	72.	.63	х	0.45	x	0.67	╡ =	• 🗖	15.93	(81)
Northwest	t <sub>0.9x</sub> 0.77	x	1.0	)5	X	50.	.42	x	0.45	x	0.67		• [	11.06	(81)
Northwest	t <sub>0.9x</sub> 0.77	X	1.0	)5	x	28.	.07	х	0.45	x	0.67		Ē	6.16	(81)
Northwest	t <sub>0.9x</sub> 0.77	X	1.0	)5	x	14	1.2	х	0.45	x	0.67		· [	3.11	(81)
Northwest	t <sub>0.9x</sub> 0.77	X	1.0	)5	x	9.2	21	х	0.45	x	0.67		• [	2.02	(81)
Solar gair	ns in watts, ca	alculated	for eacl	h month				(83)m	Sum(74)m .	(82)m					
(83)m= 15	50.97 255.95	350.9	442.33	506.96	50	09.59	488.59	438.	59 381.85	282.69	180.51	129.46	3		(83)
Total gair	ns – internal <mark>a</mark>	nd solar	(84)m =	= (73)m	+ (8	33)m , v	watts								
(84)m = 72	21.74 824.23	899.9	959.9	991.72	Ta	63.58	923,15	000	04 000 04	770 4	700.00	600.60	$\Box$		(84)
(• ')'''		000.0	555.5	331.72	100	00.00	923.13	880.	01 839.94	772.4	706.63	683.69	"		()
` '	n internal temp					00.00	923.13	880.	01   839.94	772.4	706.63	003.08	²	_	(0.1)
7. Mean	internal temp	erature	(hea <mark>ting</mark>	seasor	1)					772.4	706.63	003.08	* <u></u>	21	(85)
7. Mean Tempera	ature during h	erature eating p	(heating eriods ir	seasor the livi	i) ing	area fro	om Tab			772.4	706.63	683.68		21	
7. Mean Tempera Utilisatio		erature eating p	(heating eriods ir	seasor the livi	ing n (se	area fro	om Tab	ole 9,		Oct		Dec		21	
7. Mean Tempera Utilisatio	ature during h	erature eating p ains for	(heating eriods ir iving are	seasor the livi	n) ing n (s	area fro	om Tab	ole 9,	Th1 (°C)			_		21	
7. Mean Tempera Utilisatio	ature during hon factor for gauge Jan Feb	eating p ains for Mar 0.99	(heating eriods ir iving are Apr 0.97	seasor the livi ea, h1,m May	n) ing n (se	area fro ee Tab Jun	om Tab le 9a) Jul 0.45	Au 0.4	Th1 (°C)  ug Sep 9 0.76	Oct	Nov	Dec		21	(85)
7. Mean Tempera Utilisatio	ature during hon factor for gauge Jan Feb 1 1 nternal tempera	erature eating p ains for I Mar 0.99	(heating eriods ir iving are Apr 0.97	seasor the livi ea, h1,m May	n) ing n (se	area fro ee Tab Jun 0.62	om Tab le 9a) Jul 0.45	Au 0.4	Th1 (°C)  ug Sep 9 0.76  able 9c)	Oct	Nov	Dec		21	(85)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2	pature during hon factor for gas Jan Feb 1 1  atternal tempera 20.53 20.6	eating pains for I Mar 0.99 ature in I	(heating eriods ir iving are 0.97	season the livi ea, h1,m May 0.85 ea T1 (f	ollo	area from the control of the control	om Tab le 9a) Jul 0.45 s 3 to 7 20.97	O.4  7 in T	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96	Oct 0.98	Nov 1	Dec		21	(86)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2	ature during hon factor for gauge Jan Feb 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	eating p ains for l Mar 0.99 ature in l 20.71 eating p	(heating eriods ir iving are 0.97	seasor the livi ea, h1,m May 0.85 ea T1 (f 20.94	ollo	area from the second of the se	om Tab le 9a) Jul 0.45 s 3 to 7 20.97	Ole 9,  Au  0.4  7 in T  20.9	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  9, Th2 (°C)	Oct 0.98	Nov 1	Dec 1 20.52		21	(86)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2 Tempera (88)m= 2	Jan Feb 1 1  Internal temperature during here 20.53 20.6  Fature during here 20.43 20.44	eating p ains for l Mar 0.99 ature in l 20.71 eating p 20.44	criods ir Apr 0.97 living are 20.85 eriods ir 20.45	season the living the hand the	ng (se ollo	area from the control of the control	om Tab le 9a) Jul 0.45 s 3 to 7 20.97 rom Ta	Au 0.4 7 in T 20.9 able 9	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  9, Th2 (°C)	Oct 0.98	Nov 1	Dec		21	(86)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2  Tempera (88)m= 2  Utilisatio	pature during hon factor for gas Jan Feb 1 1  Internal tempera 20.53 20.6  Pature during hon factor for gas The factor for gas The factor for gas The factor for gas The factor for gas The factor for gas The factor for gas	eating p ains for I Mar 0.99 ature in I 20.71 eating p 20.44	criods ir iving are 0.97 living are 20.85 eriods ir 20.45	season the livi ea, h1,m May 0.85 ea T1 (f 20.94 or rest of 20.46 welling,	ollo 2 h2,	area from the control of the control	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Ta	0.4 7 in T 20.9 20.4 9a)	Th1 (°C)  ug Sep 9 0.76  able 9c)  97 20.96  9, Th2 (°C)  47 20.46	Oct 0.98 20.85	Nov 1 20.66	Dec 1 20.52 20.44		21	(85) (86) (87) (88)
7. Mean Tempera Utilisatio (86)m=  Mean in: (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m=	Jan Feb 1 1  atternal tempera 20.53 20.6  rature during h 20.43 20.44  on factor for ga 1 1	eating p ains for I Mar 0.99 ature in I 20.71 eating p 20.44 ains for r 0.99	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of do 0.96	season the living the living the sea for the living the season of the living the season of the seaso	ollo 2 h2,	area from the control of the control	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Ta 20.47	Au 0.4  7 in T 20.9  20.4  9a) 0.4	Th1 (°C)  ug Sep 9 0.76  table 9c)  97 20.96  9, Th2 (°C)  47 20.46	Oct 0.98 20.85 20.46	Nov 1	Dec 1 20.52		21	(86)
7. Mean Tempera Utilisatio (86)m=  Mean in: (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m=  Mean in:	Jan Feb 1 1  Internal temperators during head on factor for game and temperators at the factor for game at the factor for game at temperators	eating p ains for l Mar 0.99 ature in l 20.71 eating p 20.44 ains for r 0.99 ature in t	criods ir 20.85 eriods ir 20.45 eriods ir 20.45 eriods ir 20.45	season the living, hay 0.85 ea T1 (for 20.94 or rest of 20.46 welling, 0.82 of dwell	ollo 2 h2,	area from the control of the control	om Table 9a)  Jul 0.45 s 3 to 7 20.97 rom Ta 20.47 e Table 0.4 low ste	Au 0.44  ' in T 20.9  ble 9,  10.4  20.9  0.4  20.9	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  9, Th2 (°C) 47 20.46  3 0.71  to 7 in Table	Oct 0.98 20.85 20.46 0.97 e 9c)	Nov 1 20.66 20.45	Dec 1 20.52 20.44		21	(85) (86) (87) (88)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m=  Mean in	Jan Feb 1 1  atternal tempera 20.53 20.6  rature during h 20.43 20.44  on factor for ga 1 1	eating p ains for I Mar 0.99 ature in I 20.71 eating p 20.44 ains for r 0.99	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of do 0.96	season the living the living the sea for the living the season of the living the season of the seaso	ollo 2 h2,	area from the control of the control	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Ta 20.47	Au 0.4  7 in T 20.9  20.4  9a) 0.4	Th1 (°C)  ug Sep 9 0.76  table 9c) 97 20.96 9, Th2 (°C) 47 20.46  3 0.71 to 7 in Table 43 20.41	Oct 0.98 20.85 20.46 0.97 e 9c) 20.27	Nov 1 20.66 20.45	Dec 1 20.52 20.44 1 1 19.77			(85) (86) (87) (88) (89)
7. Mean Tempera Utilisatio (86)m=  Mean in: (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m=  Mean in:	Jan Feb 1 1  Internal temperators during head on factor for game and temperators at the factor for game at the factor for game at temperators	eating p ains for l Mar 0.99 ature in l 20.71 eating p 20.44 ains for r 0.99 ature in t	criods ir 20.85 eriods ir 20.45 eriods ir 20.45 eriods ir 20.45	season the living, hay 0.85 ea T1 (for 20.94 or rest of 20.46 welling, 0.82 of dwell	ollo 2 h2,	area from the control of the control	om Table 9a)  Jul 0.45 s 3 to 7 20.97 rom Ta 20.47 e Table 0.4 low ste	Au 0.44  ' in T 20.9  ble 9,  10.4  20.9  0.4  20.9	Th1 (°C)  ug Sep 9 0.76  table 9c) 97 20.96 9, Th2 (°C) 47 20.46  3 0.71 to 7 in Table 43 20.41	Oct 0.98 20.85 20.46 0.97 e 9c) 20.27	Nov 1 20.66 20.45	Dec 1 20.52 20.44 1 1 19.77		0.24	(85) (86) (87) (88)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2 Tempera (88)m= 2 Utilisatio (89)m= Mean in (90)m= 1	Jan Feb 1 1  Internal temperators during head on factor for game and temperators at the factor for game at the factor for game at temperators	eating p ains for l Mar 0.99 ature in l 20.71 eating p 20.44 ains for r 0.99 ature in t 20.06	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of do 0.96 the rest 20.27	season the living the living the sea from the living the season of the living the season of the seas	ollo 2 h2,	area from the control of the control	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Table 0.4 low stee 20.42	Au 0.4 7 in T 20.9 20.4 9a) 0.4 eps 3	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  9, Th2 (°C) 47 20.46  3 0.71  to 7 in Table 43 20.41	Oct 0.98 20.85 20.46 0.97 e 9c) 20.27	Nov 1 20.66 20.45	Dec 1 20.52 20.44 1 1 19.77			(85) (86) (87) (88) (89)
7. Mean Tempera Utilisatio (86)m=  Mean in: (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m=  Mean in: (90)m= 1	pature during hon factor for gas  Jan Feb  1 1  Internal tempera  20.53 20.6  Pature during hon factor for gas  1 1  Internal tempera  1 1  Internal tempera  19.78 19.89	eating p ains for l Mar 0.99 ature in l 20.71 eating p 20.44 ains for r 0.99 ature in t 20.06	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of do 0.96 the rest 20.27	season the living the living the sea from the living the season of the living the season of the seas	n) ng (sollo) 2 h2, (iing) 2	area from the property of the	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Table 0.4 low stee 20.42	Au 0.4 7 in T 20.9 20.4 9a) 0.4 eps 3	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  9, Th2 (°C) 47 20.46  3 0.71  to 7 in Table 43 20.41	Oct 0.98 20.85 20.46 0.97 e 9c) 20.27	Nov 1 20.66 20.45	Dec 1 20.52 20.44 1 1 19.77			(85) (86) (87) (88) (89)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m= 1  Mean in (90)m= 1	ature during hon factor for gazan Jan Feb  1 1  Internal temperature during hon factor for gazan factor for	eating pains for long mature in long pains for rough ature in to 20.44 ains for rough ature in to 20.06	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of do 0.96 the rest 20.27 er the who 20.41	season the living the	ollo ollo properties of the second se	area from the control of the control	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Table 0.4 low stee 20.42 A × T1 20.56	Au 0.4  ' in T 20.9  ble 9,  ' in T 20.9  construction of the service of the serv	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  9, Th2 (°C) 47 20.46  3 0.71  to 7 in Table 43 20.41	Oct 0.98 20.85 20.46 0.97 e 9c) 20.27 LA = Liv	Nov 1 20.66 20.45 1 20 ing area ÷ (4	Dec 1 20.52 20.44 1 19.77			(85) (86) (87) (88) (89) (90) (91)
7. Mean Tempera Utilisatio (86)m=  Mean in: (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m=  Mean in: (90)m= 1  Mean in: (92)m= 1  Apply ac	ternal temperature during hon factor for gastature during hon	eating pains for long mature in long pains for rough ature in to 20.44 ains for rough ature in to 20.06	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of do 0.96 the rest 20.27 er the who 20.41	season the living the	ng (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 3) h2, (sollo 4) h2,	area from a from a	om Table 9a) Jul 0.45 s 3 to 7 20.97 rom Table 0.4 low stee 20.42 A × T1 20.56	Au 0.4  ' in T 20.9  ble 9,  ' in T 20.9  construction of the service of the serv	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  0, Th2 (°C) 47 20.46  3 0.71  to 7 in Table 43 20.41  — fLA) × T2 56 20.55  where approximates a processor of the control of th	Oct 0.98 20.85 20.46 0.97 e 9c) 20.27 LA = Liv	Nov 1 20.66 20.45 1 20 ing area ÷ (4	Dec 1 20.52 20.44 1 19.77			(85) (86) (87) (88) (89) (90) (91)
7. Mean Tempera Utilisatio (86)m=  Mean in (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m= 1  Mean in (90)m= 1  Mean in (92)m= 1  Apply ac (93)m= 1	Jan Feb  Jan Feb  1 1  Internal temperations at the second	erature eating p ains for I Mar 0.99 ature in I 20.71 eating p 20.44 ains for r 0.99 ature in t 20.06 ature (fo 20.22 ne mean 20.22	criods ir one of the rest one of the rest one of the wh on	season the livi ea, h1,m May 0.85 ea T1 (fi 20.94 n rest of 20.46 welling, 0.82 of dwell 20.39 ole dwe 20.52 temper	ng (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 2) h2, (sollo 3) h2, (sollo 4) h2,	area from	om Table  Jul  0.45  s 3 to 7  20.97  rom Ta  20.47  a Table  0.4  low ste  20.42  A × T1  20.56	Au 0.44 (1 - 20.9 4e, 1 - 20.9	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  0, Th2 (°C) 47 20.46  3 0.71  to 7 in Table 43 20.41  — fLA) × T2 56 20.55  where approximates a processor of the control of th	Oct 0.98  20.85  20.46  0.97  e 9c)  20.27  LA = Livery part of the private of th	Nov 1 20.66 20.45 1 20 ing area ÷ (4	Dec 1 20.52 20.44 1 19.77 4) =			(85) (86) (87) (88) (89) (90) (91)
7. Mean Tempera Utilisatio (86)m=  Mean in: (87)m= 2  Tempera (88)m= 2  Utilisatio (89)m= 1  Mean in: (90)m= 1  Mean in: (92)m= 1  Apply ac (93)m= 1  8. Space Set Ti to	ternal temperature during hon factor for gastare during hon factor for gastare during hon factor for gastare temperature during hon factor for gastare temperature during hon factor for gastare temperature during hon factor for gastare during hon	erature eating p ains for I Mar 0.99 ature in I 20.71 eating p 20.44 ains for r 0.99 ature in t 20.06  ature (fo 20.22 ne mean 20.22 uirement ernal ten	cheating eriods ir iving are 20.85 eriods ir 20.45 eest of drough the rest 20.27 er the who 20.41 internal 20.41 enperature	season the livi ea, h1,m May 0.85 ea T1 (fi 20.94 n rest of 20.46 welling, 0.82 of dwell 20.39 ole dwe 20.52 temper 20.52 re obtain	h2,  (colling 2)  h2,  (colling 2)  ratu  2	area from a from a fro	om Table 20.56	Au 0.44  O.4  O.4  O.4  O.4  O.4  O.4  O.4	Th1 (°C)  ug Sep 9 0.76  able 9c) 97 20.96  0, Th2 (°C) 47 20.46  3 0.71  to 7 in Table 43 20.41  — fLA) x T2 56 20.55  where approximates a series of the content of the c	Oct 0.98  20.85  20.46  0.97  e 9c)  20.27  LA = Livery 20.41	Nov 1 20.66 20.45 1 20 ing area ÷ (4 20.16	Dec 1 20.52 20.44 1 19.77 1) =		0.24	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

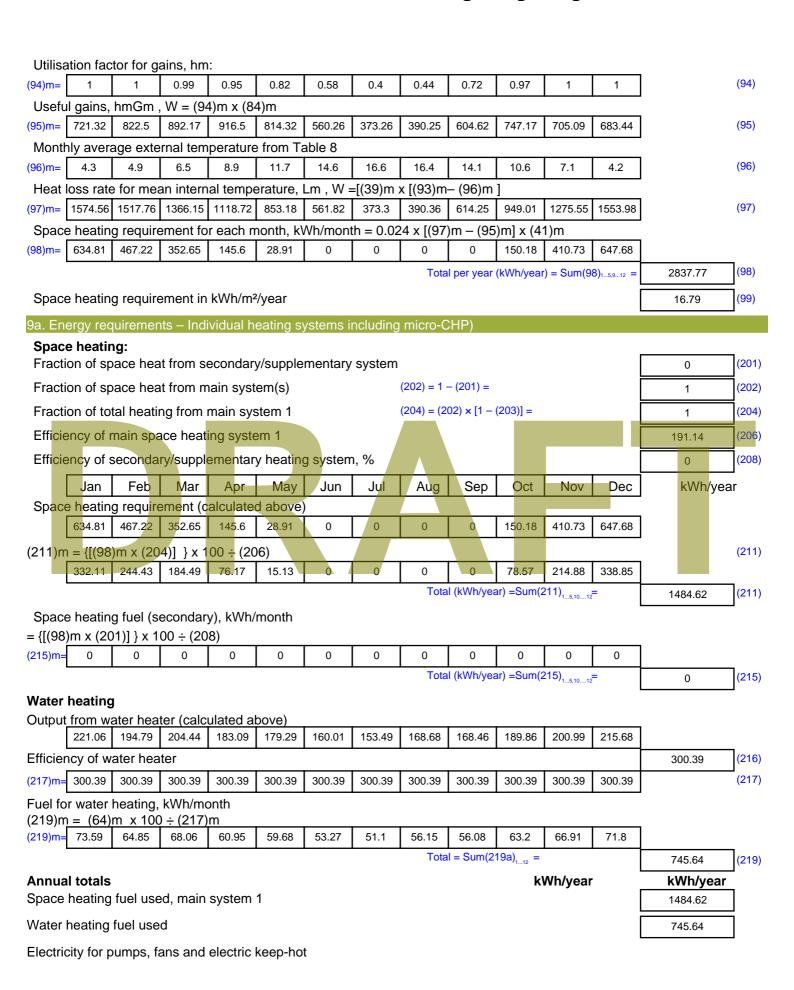
Dec

Mar

Jan

Feb







**Emissions** kg CO2/year

770.52

0

386.99

1157.51

270.86

295.69

(261)

(263)

(264)

(265)

(267)

(268)

(272)

### **DER WorkSheet: New dwelling design stage**

mechanical ventilation - balanced, extract or positive input from outside (230a) 521.89 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 521.89 Electricity for lighting (232) 569.73

12a. CO2 emissions – Individual heating systems including micro-CHF	12a.	CO2 emissions –	Individual heating s	vstems including	micro-CHP
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	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh
Space heating (main system 1)	(211) x	0.519 =
Space heating (secondary)	(215) x	0.519 =
Water heating	(219) x	0.519 =
Space and water heating	(261) + (262) + (263) + (264) =	
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =
Electricity for lighting	(232) x	0.519 =
Total CO2, kg/year	sum	of (265)(271) =
Dwelling CO2 Emission Rate	(272	) ÷ (4) =

1724.06  $(272) \div (4) =$ (273) 10.2 (274) 89

El rating (section 14)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 23 - 2B4P - MF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 97.32 (1a) x 2.7 (2a) =(3a) 262.76 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)97.32 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =262.76 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) =	: (21a) x (22a)m
0.16	0.12 0.13 0.14 0.14 0.15
Calculate effective air change rate for the applicable case	
If mechanical ventilation:	0.5 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (	(200)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from	n Table 4h) = 73.95 (23c)
a) If balanced mechanical ventilation with heat recovery (MV	
(24a)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25	0.25 0.26 0.27 0.27 0.28 (24a)
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 (24b)
c) If whole house extract ventilation or positive input ventilation if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (23b)$	
(24c)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilati if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m =	
(24d)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24	ld) in box (25)
(25)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25	0.25 0.26 0.27 0.27 0.28 (25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross area (m²) Openings Net Area A ,m²	U-value A X U k-value A X k W/m2K (W/K) kJ/m²-K kJ/K
Windows Type 1 2.85 x1	/[1/(1.1) + 0.04] = 3 (27)
Windows Type 2	/[1/( 1.1 )+ 0.04] = 3 (27)
Windows Type 3	/[1/(1.1) + 0.04] = 9.36 (27)
Windows Type 4 2.67 x1	/[1/(1.1) + 0.04] = 2.81 (27)
Windows Type 5	$/[1/(1.1) + 0.04] = \boxed{1.88} \tag{27}$
Walls Type1 92.42 27.4 65.02 x	0.12 = 7.8 (29)
Walls Type2 29.89 0 29.89 x	0.14 = 4.23 (29)
Total area of elements, m <sup>2</sup>	(31)
Party wall 23.22 x	0 = 0 (32)
Party floor 97.32	(32a)
Party ceiling 97.32	(32b)
* for windows and roof windows, use effective window U-value calculated using ** include the areas on both sides of internal walls and partitions	
Fabric heat loss, W/K = S (A x U)	(26)(30) + (32) = 40.9 (33)
Heat capacity Cm = S(A x k)	((28) (20) + (22) + (220) (220) -
	((28)(30) + (32) + (32a)(32e) = 14501 (34)
Thermal mass parameter (TMP = $Cm \div TFA$ ) in $kJ/m^2K$	((26)(30) + (32) + (324)(32e) = 14501  Indicative Value: Medium 250 (35)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K  For design assessments where the details of the construction are not known p  can be used instead of a detailed calculation.	Indicative Value: Medium 250 (35)
For design assessments where the details of the construction are not known p	Indicative Value: Medium 250 (35)
For design assessments where the details of the construction are not known p can be used instead of a detailed calculation.	Indicative Value: Medium  250 (35)  recisely the indicative values of TMP in Table 1f



entilation 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		
3)m= 25.39	25.11	24.84	23.46	23.18	21.8	21.8	21.52	22.35	23.18	23.73	24.28		(38
eat transfer o	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
9)m= 84.64	84.36	84.09	82.7	82.43	81.05	81.05	80.77	81.6	82.43	82.98	83.53		
								,	Average =	Sum(39) <sub>1</sub> .	12 /12=	82.63	(39
eat loss para		<del> </del>					ı	·	= (39)m ÷	•			
0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86		<b>—</b> ,,,
umber of day	s in moi	nth (Tab	le 1a)					/	Average =	Sum(40) <sub>1.</sub>	12 /12=	0.85	(40
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
. Water heat	ting ene	rgy requi	rement:								kWh/ye	ar:	
ssumed occu											71		(4
if TFA > 13.9 if TFA £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	A -13.9	)2)] + 0.0	013 x (	ΓFA -13.	.9)	_		
nual averag	•	ater usad	ae in litre	s per da	ıv Vd.av	erage =	(25 x N)	+ 36		98	.64		(4
edu <mark>ce the annua</mark>	al average	hot water	usage by	5% if the a	welling is	designed t			se target o				(
t more that 125	litres per <sub>l</sub>	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t 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)						
)m= 108.5	104.56	100.61	96.67	92.72	88.78	88.78	92.72	96.67	100.61	104.56	108.5		_
ergy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1183.69	(4
5)m= 160.91	140.73	145.22	126.61	121.48	104.83	97.14	111.47	112.8	131.46	143.5	155.83		
									Γotal = Su	m(45) <sub>112</sub> =	-	1552	(4
nstantaneous w		ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)	) to (61)					
m= 24.14	21.11	21.78	18.99	18.22	15.72	14.57	16.72	16.92	19.72	21.53	23.37		(4
ater storage		includin	na anv sa	مامت مت ۸۸									
	io (iiti 00)			1121 OI VI	/WHRS:	storage	within sa	me ves	sel		255		(4
•	eating a					•	within sa	ıme ves	sel		255		(4
community h	-	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)				255		(4
community h	stored	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)				255		(4
community herwise if no atternation storage	stored loss:	ind no ta hot wate	nk in dw er (this in	elling, e cludes i	nter 110 nstantan	litres in neous co	(47)			47)	255 49		
community herwise if no ater storage If manufact	o stored loss: urer's de	ind no ta hot wate eclared l	nk in dw er (this in	elling, e cludes i	nter 110 nstantan	litres in neous co	(47)			47)			(4
community herwise if no ater storage If manufact mperature for the storage in the	o stored loss: urer's de actor fro	nd no ta hot wate eclared le m Table storage	onk in dwer (this in oss facto 2b , kWh/ye	elling, e cludes i or is kno ear	nter 110 nstantan wn (kWh	litres in neous co n/day):	(47)	ers) ente		1.	49		(4
community herwise if no ater storage If manufact mperature for the ater storage in the	o stored loss: urer's de actor fro om water urer's de	nd no ta hot wate eclared le m Table storage eclared d	onk in dw er (this in oss facto 2b , kWh/ye	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		1. 0.	49 54 .8		(4 (4
community herwise if no ater storage of the storage	o stored loss: urer's de actor fro om water urer's de age loss	nd no ta hot wate eclared lem Table storage eclared of factor fr	onk in dw er (this in oss facto 2b , kWh/ye cylinder l om Tabl	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		1. 0.	49 54		(4 (4 (5
community herwise if no ater storage If manufact imperature for a lergy lost from the lergy lost from the lergy lost from the lergy lost water storage community here.	o stored loss: urer's de actor fro om water urer's de age loss neating s	eclared lem Table storage eclared of factor fraces sections	onk in dw er (this in oss facto 2b , kWh/ye cylinder l om Tabl	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		47)  1.  0.  0	49 54 .8		(4 (4 (5
community herwise if no ater storage of the storage	o stored loss: urer's de actor fro water urer's de age loss leating s from Ta	hot water eclared I m Table storage eclared of factor from the section	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		47)  1. 0. 0	49 54 .8		(4 (4 (5 (5
community herwise if no ater storage of the imperature for the imperature for the imperature of the imperature for the imperature for the imperature for the imperature for the imperature for the imperature for the imperature for the imperature for the imperature of the imperature for the imperature for the imperature of the imperature	o stored loss: curer's de actor fro sage loss leating s from Ta actor fro	nnd no ta hot wate eclared I m Table storage eclared of factor from ee section ble 2a m Table	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto e 2 (kWl	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boild (48) x (49)	ers) ente	er 'O' in (	47)  1.  0.  0	49 54 .8 0		(4) (4) (5) (5) (5)
community he community he community he cater storage of the cater storag	o stored loss: curer's de actor fro m water age loss aeating s from Ta actor fro	eclared lem Table storage factor frace section ble 2a m Table storage	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto e 2 (kWl	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente	er 'O' in (	47)  1. 0. 0	49 54 .8 0		(44 (4 (5 (5 (5 (5 (5 (5
community he herwise if no ater storage of the manufact of the manufact of water storage of the manufact of water storage of the manufact of the manufact of the manufact of the manufact of the manufact of the manufact of the manufact of the manufact of the manufactor of the manufac	o stored loss: curer's de actor fro meating seating seator from Tactor from water (54) in (5	hot water eclared I m Table storage eclared of factor from the section ble 2a m Table storage	onk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3 2b , kWh/ye	relling, e cludes i or is kno ear oss fact e 2 (kWl	nter 110 nstantan wn (kWh	litres in neous co n/day): known:	(47) ombi boild (48) x (49)	ers) ente	er 'O' in (	47)  1. 0. 0	49 54 .8 0		(44 (44 (55 (55 (55 (55 (55



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= 24.94 22.53 24.94 24.14 24.94 24.14 24.94 24.14 24.94 24.14 24.94 (67)m= 24.94 24.14 24.94 24.14 24.94	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (59)m= 23.26 21.01 23.26 22.51 23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 209.11 184.27 193.43 173.26 169.69 151.48 145.35 159.68 159.45 179.67 190.15 204.04	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 209.11 184.27 193.43 173.26 169.69 151.48 145.35 159.68 159.45 179.67 190.15 204.04	
Output from water heater (annual) <sub>112</sub> 2119.58	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]	
(65)m= 92.07 81.63 86.85 79.42 78.96 72.18 70.86 75.63 74.83 82.27 85.03 90.38	(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):	
5. Internal gains (see Table 5 and 5a).	
Metabolic gains (Table 5), Watts	
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(66)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	` /
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	` /
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         135.66	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 135.66 135	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 135.66 135	(67) (68) (69) (70) (71)

Flux

Table 6a

Table 6b

Table 6c

Area

m²

Orientation: Access Factor

Table 6d

Gains

(W)

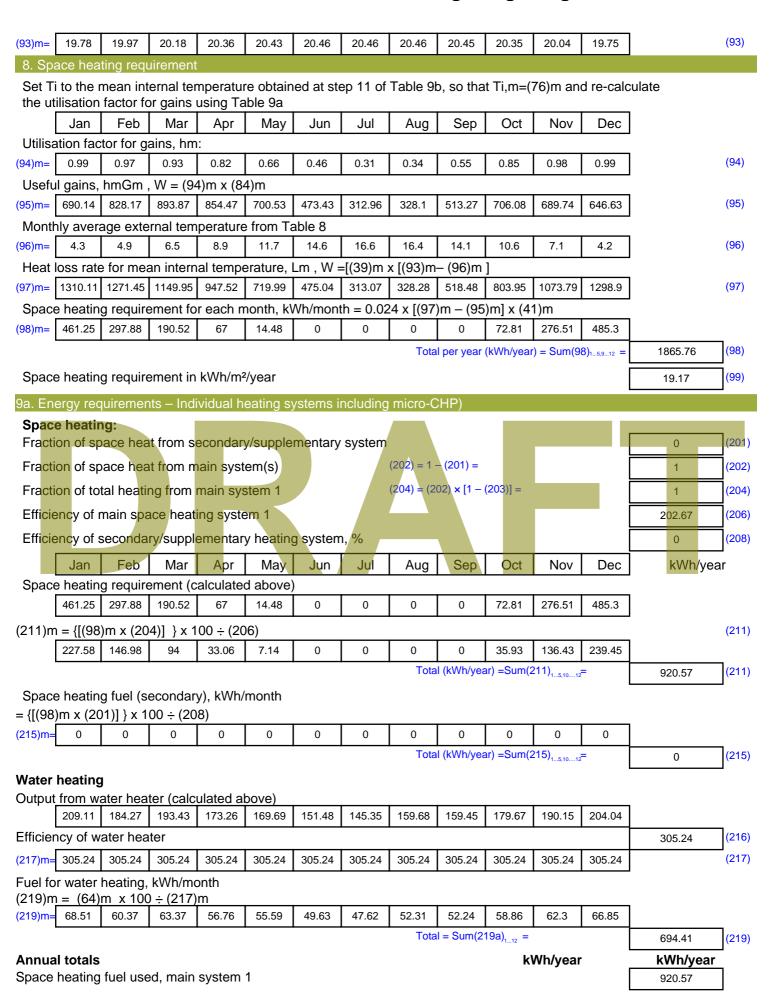


Southeast 0.9x	0.77	X	8.88	X	36.79	X	0.45	x	0.67	=	68.27	(77)
Southeast 0.9x	0.77	x	1.78	x	36.79	X	0.45	x	0.67	=	13.68	(77)
Southeast 0.9x	0.77	X	8.88	X	62.67	X	0.45	x	0.67	=	116.28	(77)
Southeast 0.9x	0.77	X	1.78	x	62.67	x	0.45	x	0.67	=	23.31	(77)
Southeast 0.9x	0.77	X	8.88	x	85.75	x	0.45	x	0.67	=	159.1	(77)
Southeast 0.9x	0.77	X	1.78	x	85.75	x	0.45	x	0.67	=	31.89	(77)
Southeast 0.9x	0.77	X	8.88	x	106.25	X	0.45	x	0.67	=	197.14	(77)
Southeast 0.9x	0.77	X	1.78	x	106.25	X	0.45	x	0.67	=	39.52	(77)
Southeast 0.9x	0.77	X	8.88	X	119.01	X	0.45	x	0.67	=	220.81	(77)
Southeast 0.9x	0.77	X	1.78	X	119.01	X	0.45	x	0.67	=	44.26	(77)
Southeast 0.9x	0.77	X	8.88	X	118.15	X	0.45	x	0.67	=	219.21	(77)
Southeast 0.9x	0.77	X	1.78	X	118.15	X	0.45	x	0.67	=	43.94	(77)
Southeast 0.9x	0.77	X	8.88	x	113.91	x	0.45	x	0.67	=	211.35	(77)
Southeast 0.9x	0.77	X	1.78	x	113.91	X	0.45	x	0.67	=	42.36	(77)
Southeast 0.9x	0.77	X	8.88	x	104.39	x	0.45	x	0.67	=	193.68	(77)
Southeast 0.9x	0.77	x	1.78	x	104.39	x	0.45	x	0.67	=	38.82	(77)
Southeast 0.9x	0.77	X	8.88	x	92.85	X	0.45	x	0.67	=	172.28	(77)
Southeast 0.9x	0.77	X	1.78	X	92.85	X	0.45	X	0.67	=	34.53	(77)
Southeast <sub>0.9x</sub>	0.77	x	8.88	х	69.27	x	0.45	x	0.67	=	128.52	(77)
Southeast <sub>0.9x</sub>	0.77	x	1.78	х	69.27	×	0.45	x	0.67	=	25.76	(77)
Southeast 0.9x	0.77	x	8.88	X	44.07	x	0.45	x	0.67	=	81.77	(77)
Southeast 0.9x	0.77	x	1.78	x	44.07	х	0.45	x	0.67	=	16.39	(77)
Southeast 0.9x	0.77	x	8.88	x	31.49	X	0.45	x	0.67	=	58.42	(77)
Southeast 0.9x	0.77	x	1.78	х	31.49	X	0.45	x	0.67	=	11.71	(77)
South 0.9x	0.77	X	2.85	x	46.75	X	0.45	x	0.67	=	55.68	(78)
South 0.9x	0.77	X	2.85	X	46.75	X	0.45	x	0.67	=	55.68	(78)
South 0.9x	0.77	X	2.85	x	76.57	X	0.45	x	0.67	=	91.19	(78)
South 0.9x	0.77	X	2.85	x	76.57	x	0.45	x	0.67	=	91.19	(78)
South 0.9x	0.77	X	2.85	X	97.53	X	0.45	x	0.67	=	116.16	(78)
South 0.9x	0.77	X	2.85	X	97.53	X	0.45	x	0.67	=	116.16	(78)
South 0.9x	0.77	X	2.85	X	110.23	X	0.45	x	0.67	=	131.28	(78)
South 0.9x	0.77	X	2.85	X	110.23	X	0.45	x	0.67	=	131.28	(78)
South 0.9x	0.77	X	2.85	x	114.87	X	0.45	x	0.67	=	136.81	(78)
South 0.9x	0.77	X	2.85	x	114.87	X	0.45	x	0.67	=	136.81	(78)
South 0.9x	0.77	X	2.85	x	110.55	x	0.45	x	0.67	=	131.66	(78)
South 0.9x	0.77	x	2.85	x	110.55	x	0.45	x	0.67	=	131.66	(78)
South 0.9x	0.77	x	2.85	x	108.01	x	0.45	x	0.67	=	128.64	(78)
South 0.9x	0.77	x	2.85	x	108.01	x	0.45	x	0.67	=	128.64	(78)
South 0.9x	0.77	x	2.85	x	104.89	x	0.45	x	0.67	=	124.92	(78)
South 0.9x	0.77	x	2.85	x	104.89	x	0.45	x	0.67	=	124.92	(78)
South 0.9x	0.77	x	2.85	x	101.89	x	0.45	x	0.67	=	121.34	(78)
•												-



South 0.9x	0.77	X	2.85	x	10	01.89	X	0.45	X	0.67	=	121.34	(78)
South 0.9x	0.77	X	2.85	x	8	82.59		0.45	X	0.67	=	98.36	(78)
South 0.9x	0.77	X	2.85	x	8	2.59	X	0.45	X	0.67	=	98.36	(78)
South 0.9x	0.77	X	2.85	x	5	5.42	X	0.45	X	0.67	=	66	(78)
South 0.9x	0.77	X	2.85	x	5	5.42	X	0.45	X	0.67	=	66	(78)
South 0.9x	0.77	X	2.85	X	4	40.4	x	0.45	X	0.67	=	48.11	(78)
South 0.9x	0.77	X	2.85	x	4	40.4	X	0.45	X	0.67	=	48.11	(78)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	3	6.79		0.45	X	0.67	=	41.05	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	6	2.67		0.45	X	0.67	=	69.93	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	8	5.75		0.45	X	0.67	=	95.68	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	10	06.25		0.45	X	0.67	=	118.55	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	1	19.01		0.45	X	0.67	=	132.78	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	1	18.15		0.45	X	0.67	=	131.82	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	1	13.91		0.45	X	0.67	=	127.09	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	10	04.39		0.45	X	0.67	=	116.47	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	9	2.85	]	0.45	x	0.67	=	103.6	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	×	6	9.27		0.45	X	0.67	=	77.28	(79)
Southwest <sub>0.9x</sub>	0.77	X	2.67	X	4	4.07		0.45	X	0.67	=	49.17	(79)
Southwest <sub>0.9x</sub>	0.77	x	2.67	×	3	1.49		0.45	x	0.67	=	35.13	(79)
Sola <mark>r gains in</mark>	watts, calc	culated	for each	month			(83)m	= Sum(74)m	(8 <mark>2)m</mark>			,	
(83)m= 234.36		518.99			558.29	638.08	598	.83 553.09	428.28	279.33	201.49		(83)
Total gains – i	nternal an	d solar	(84)m = (	(73)m +	(83)m	, watts							
` '	nternal an		(84)m = (	(73)m +			598 960		428.28 827.58		201.49 650.55	]	(83)
Total gains – i	nternal and	d solar 963.59	(84)m = ( 1037.98	(73)m + 1066.7 1	(83)m	, watts							
Total gains – i (84)m= 696.19	nternal and 851.55	d solar 963.59 rature (	(84)m = ( 1037.98 (heating s	(73)m + 1066.7 1 season)	(83)m 029.57	993.86	960	.92 927.77				21	
Total gains – i (84)m= 696.19  7. Mean inter	851.55 9 mal tempe	d solar 963.59 rature (	(84)m = ( 1037.98 (heating seriods in the	(73)m + 1066.7 1 season) the living	(83)m 029.57 area f	993.86 from Tab	960	.92 927.77				21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature	851.55 9 mal tempe	d solar 963.59 rature (	(84)m = ( 1037.98 (heating seriods in the	(73)m + 1066.7 1 season) the living	(83)m 029.57 area f	993.86 from Tab	960 ole 9	.92 927.77		706.95		21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac	nternal and 851.55 smal tempe during heator for gain	d solar 963.59 rature ( ating po	(84)m = (1037.98) (heating seriods in fiving area	(73)m + 1066.7 1 season) the living	(83)m 029.57 area f	993.86 from Tabble 9a)	960 ole 9	92 927.77 Th1 (°C)	827.58	706.95	650.55	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation face Jan	nternal and 851.55 (strain temper during heater for gail Feb 0.98	orature (ating pens for limited Mar 0.94	(84)m = (heating seriods in this in the seriods in the seriods area and the seriods in the seriod in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriods in the seriod in the seriods in the seriods in the seriods in the seriod in the ser	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69	(83)m 029.57 area f see Ta Jun 0.5	993.86 from Tab ble 9a) Jul 0.36	960 ole 9 A	92 927.77  Th1 (°C)  ug Sep  99 0.6	827.56 Oct	706.95 Nov	650.55 Dec	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m= 0.99	nternal and 851.55 smal temper during heater for gain Feb 0.98 stemperate	orature (ating pens for limited Mar 0.94	(84)m = (1037.98) (heating seriods in riving area Apr 0.85)	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follows)	(83)m 029.57 area f see Ta Jun 0.5	993.86 from Tab ble 9a) Jul 0.36	960 ole 9 A	92 927.77  Th1 (°C)  ug Sep 9 0.6  Table 9c)	827.56 Oct	Nov 0.98	650.55 Dec	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna (87)m= 20.41	nternal and 851.55 strail temperator for gain Feb 0.98 strain temperator temperator for gain feb 0.98 strain temperator for gain feb 0.98 stra	rature ( ating points for li Mar 0.94 ture in l 20.72	(84)m = (1037.98) (heating seriods in receiving area 20.87)	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follo	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96	993.86 from Tak ble 9a) Jul 0.36 ps 3 to 7	960 Die 9 A 0.3 7 in T 20.	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95	Oct 0.88	Nov 0.98	050.55 Dec 1	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna	nternal and 851.55 strail temperator for gain Feb 0.98 strain temperator temperator for gain feb 0.98 strain temperator for gain feb 0.98 stra	rature ( ating points for li Mar 0.94 ture in l 20.72	(84)m = (heating seriods in fiving area 20.87 eriods in five area 20.87	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follow) rest of do	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96	993.86 from Tak ble 9a) Jul 0.36 ps 3 to 7	960 Die 9 A 0.3 7 in T 20.	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95  9, Th2 (°C)	Oct 0.88	Nov 0.98	050.55 Dec 1	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna (87)m= 20.41  Temperature (88)m= 20.19	rnal tempe during head ctor for gain Feb 0.98 lt temperate 20.56 during head 20.2	orature (ating points for limited in limited	(84)m = (1037.98) (heating seriods in fiving area 20.87) eriods in fiving area 20.87	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follow) 20.94 rest of do 20.21	(83)m 029.57 area 1 see Ta Jun 0.5 ow ste 20.96 welling 20.23	993.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table 9a)	9600 A A 0.37 in T 20.	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95  9, Th2 (°C)	Oct 0.88	Nov 0.98	Dec 1 20.38	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fact  Utilisati	rnal tempe during head ctor for gain Feb 0.98 lt temperate 20.56 during head 20.2	orature (ating points for limited in limited	(84)m = (1037.98) (heating seriods in fiving area 20.87) eriods in fiving area 20.87	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follow) 20.94 rest of do 20.21	(83)m 029.57 area 1 see Ta Jun 0.5 ow ste 20.96 welling 20.23	993.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table 9a)	9600 A A 0.37 in T 20.	92 927.77  Th1 (°C)  ug Sep 9 0.6  Table 9c) 96 20.95  9, Th2 (°C) 23 20.22	Oct 0.88	Nov 0.98	Dec 1 20.38	21	(84)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna (87)m= 20.41  Temperature (88)m= 20.19  Utilisation fac (89)m= 0.99	nternal and 851.55 stands temperate during heat temperate 20.56 during heat 20.2 eter for gain 0.97	rature ( ating pons for li Mar 0.94 ture in l 20.72 ating pons for r 0.93	(84)m = (1037.98) (heating seriods in riving area 20.87) eriods in riving area 20.87 eriods in riving area 20.87	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follo 20.94 rest of do 20.21 relling, h2 0.64	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96 welling 20.23	993.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table  0.3	960  A 0.3  7 in T 20.  9a)  0.3	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95  9, Th2 (°C) 23 20.22	Oct 0.88 20.86 20.21	Nov 0.98 20.6	Dec 1 20.38	21	(84) (85) (86) (87) (88)
Total gains – i  (84)m = 696.19  7. Mean inter  Temperature  Utilisation fact  (86)m = 0.99  Mean internations  (87)m = 20.41  Temperature  (88)m = 20.19  Utilisation fact  (89)m = 0.99  Mean internations	nternal and 851.55 (strain temperature during heat temperature 20.56 during heat 20.2 ctor for gain 0.97 during heat 1.97 dur	rature ( ating points for li Mar 0.94  ture in l 20.72  ating points 20.72  ating points ating p	(84)m = (1037.98) (heating seriods in fiving area 20.87) eriods in fiving area 20.87 eriods in fiving area 20.87	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follo 20.94 rest of do 20.21 relling, h2 0.64 f dwelling	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96 velling 20.23 2,m (see 0.44	ywatts 993.86  from Table 9a) Jul 0.36 ps 3 to 7 20.96 from Table 20.23 ee Table 0.3 collow steep	960  A 0.3  in T 20.  sble 9  0.3  eps 3	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95  9, Th2 (°C) 23 20.22  12 0.53  to 7 in Table	Oct 0.88 20.86 20.21 0.85 e 9c)	Nov 0.98 20.6 20.21	Dec 1 20.38 20.2	21 ]	(84) (85) (86) (87) (88) (89)
Total gains – i (84)m= 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m= 0.99  Mean interna (87)m= 20.41  Temperature (88)m= 20.19  Utilisation fac (89)m= 0.99	nternal and 851.55 (strain temperature during heat temperature 20.56 during heat 20.2 ctor for gain 0.97 during heat 1.97 dur	rature ( ating pons for li Mar 0.94 ture in l 20.72 ating pons for r 0.93	(84)m = (1037.98) (heating seriods in fiving area 20.87) eriods in fiving area 20.87 eriods in fiving area 20.87	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follo 20.94 rest of do 20.21 relling, h2 0.64 f dwelling	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96 welling 20.23	993.86  from Table 9a)  Jul  0.36  ps 3 to 7  20.96  from Table  0.3	960  A 0.3  7 in T 20.  9a)  0.3	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95  9, Th2 (°C) 23 20.22  12 0.53  to 7 in Table 17 20.15	Oct 0.88  20.86  20.21  0.85 e 9c) 20.05	Nov 0.98 20.6 20.21 0.98	Dec 1 20.38 20.2 0.99		(84) (85) (86) (87) (88) (89)
Total gains – i (84)m = 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m = 0.99  Mean interna (87)m = 20.41  Temperature (88)m = 20.19  Utilisation fac (89)m = 0.99  Mean interna (90)m = 19.4	nternal and 851.55 stand temper during heater for gain per sector	rature of a ting points for limited and a solar of a ting points for rature in land and a solar of	(84) m = (1037.98) (heating seriods in riving area 20.87) eriods in riving area 20.87 eriods in riving area 20.21 est of dw 0.82 the rest of 20.05	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follo 20.94 rest of dv 20.21 relling, h2 0.64 f dwelling	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96 velling 20.23 2,m (se 0.44 g T2 (fo 20.16	993.86 from Tak ble 9a) Jul 0.36 ps 3 to 7 20.96 from Ta 20.23 ee Table 0.3 ollow ste 20.16	960  A 0.3  7 in T 20.  9a)  0.3  eps 3	92 927.77  Th1 (°C)  ug Sep 9 0.6  Table 9c) 96 20.95  0, Th2 (°C) 23 20.22  10 7 in Table 17 20.15	Oct 0.88  20.86  20.21  0.85 e 9c) 20.05	Nov 0.98 20.6 20.21	Dec 1 20.38 20.2 0.99	21	(84) (85) (86) (87) (88) (89)
Total gains – i  (84)m = 696.19  7. Mean inter  Temperature  Utilisation fac  (86)m = 0.99  Mean interna  (87)m = 20.41  Temperature  (88)m = 20.19  Utilisation fac  (89)m = 0.99  Mean interna  (90)m = 19.4	nternal and 851.55 (strain temperature during heat temperature 20.56 during heat 20.2 etor for gain 19.62 during heat 19	rature of ating points for in the state of t	(84)m = (1037.98) (heating seriods in fiving area 20.87) eriods in fiving area 20.87 e	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (followate) 20.94 rest of documents 20.21 relling, h2 0.64 f dwelling 20.13	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96 welling 20.23 2,m (se 0.44 g T2 (fo 20.16	993.86 from Table 9a) Jul 0.36 ps 3 to 7 20.96 from Ta 20.23 ee Table 0.3 collow ste 20.16	960  A  0.3  in T  20.  9a)  0.3  eps 3  20.	92 927.77  Th1 (°C)  ug Sep 99 0.6  Table 9c) 96 20.95  9, Th2 (°C) 23 20.22  10 7 in Table 17 20.15  fine of the control of t	Oct 0.88  20.86  20.21  0.85 e 9c) 20.05 LA = Liv	Nov 0.98 20.6 20.21 0.98	Dec 1 20.38 20.2 0.99 19.37		(84) (85) (86) (87) (88) (89) (90)
Total gains – i (84)m = 696.19  7. Mean inter Temperature Utilisation fac  Jan (86)m = 0.99  Mean interna (87)m = 20.41  Temperature (88)m = 20.19  Utilisation fac (89)m = 0.99  Mean interna (90)m = 19.4	nternal and 851.55 (stress of the state of t	rature of a ting points for in the control of the c	(84) m = (1037.98) (heating seriods in recor	(73)m + 1066.7 1 season) the living a, h1,m (s May 0.69 a T1 (follo 20.94 rest of do 20.21 relling, h2 0.64 f dwelling 20.13	(83)m 029.57 area f see Ta Jun 0.5 ow ste 20.96 velling 20.23 2,m (se 0.44 g T2 (fo 20.16	993.86  from Tak ble 9a)  Jul  0.36  ps 3 to 7  20.96  from Tak 20.23  ee Table  0.3  collow stee 20.16	960  A 0.3  7 in T 20.  9a) 0.3  eps 3 20.  + (1 20.	92 927.77  Th1 (°C)  ug Sep 9 0.6  Table 9c) 96 20.95  0, Th2 (°C) 23 20.22  10 7 in Table 17 20.15	Oct 0.88  20.86  20.21  0.85  e 9c) 20.05  LA = Liv	Nov 0.98 20.6 20.21 0.98 19.7 ving area ÷ (4	Dec 1 20.38 20.2 0.99		(84) (85) (86) (87) (88) (89)







Water heating fuel used 694.41 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 272.49 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 272.49 Electricity for lighting 396.63 (232)12a. CO2 emissions – Individual heating systems including micro-CHP **Emission factor Emissions Energy** kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x (261) 477.78 0.519 Space heating (secondary) (215) x (263)0.519 0 (219) x Water heating 0.519 360.4 (264)(261) + (262) + (263) + (264) =Space and water heating (265)838.18 (231) x Electricity for pumps, fans and electric keep-hot 0.519 141.42 (267)(232) x Electricity for lighting (268)0.519 205.85 Total CO2, kg/year sum of (265)...(271) = (272)1185.45  $(272) \div (4) =$ **Dwelling CO2 Emission Rate** (273)12.18 El rating (section 14) (274)89



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 33 - 1B2P -TF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.4 (2a) =(3a) 59.88 143.71 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)59.88 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =143.71 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.12 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.1 1.18



0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
alculate effec		_	rate for t	he appli	cable ca	se	<u> </u>			ļ.	!		
If mechanica												0.5	(2
If exhaust air he		0		, ,	,	. `	,, .	`	) = (23a)			0.5	(2
If balanced with		•	•	•		,		,				73.1	(2
a) If balance					·	<del>- ` `                                 </del>	<del>- ^ `</del>	<del>í `</del>	<del>– `</del>	<del></del>	<del>' ' '</del>	⊢÷ 100] 1	"
4a)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	]	(2
b) If balance						<del>-                                    </del>	<del>, ``</del>	ŕ	<del>r ´       `</del>	<del></del>	ı	1	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(2
c) If whole he				•	•				F (00h	. \			
if (22b)m lc)m= 0	1 < 0.5 ×	(23b), t	nen (240	(230)	o); otner	wise (24 0	$\frac{C}{C} = (22)$	o) m + 0.	.5 × (230	)   0	1 0	1	(:
									0	U	0	j	(4
d) If natural v if (22b)m									0.5]				
ld)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
Effective air	change	rate - er	nter (24a	or (24h	o) or (24	c) or (24	d) in box	x (25)				ı	
5)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27		(2
								<u> </u>					
. Heat losses									A >< 1.1				A 37.1
_EMENT	Gros area		Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²-l	-	A X k kJ/K
indows					4.6		/[1/( 1.1 )+		4.85				(
all <mark>s Type1</mark>	72.9	2	4.6		68.3		0.12		8.2	Ħг			) (:
alls Type2	26.5		0	=	26.57	X	0.14	$\pm 1$	3.76	Ħ		= =	()
oof	55	_	0	╡╹			0.14			븍 片		╡	(;
otal area of e					55	×	0.13		7.15	[			`
or windows and			offective wi	ndow I I-ve	154.4		n formula 1	/[/1/    <sub>-</sub> val	(۱۸۵ مرامر	se aiven in	naraarank	n 2 2	(
include the area						aleu using	j iorriula i	/[( 1/ <b>U-</b> vaic	1 <del>0</del> )+0.04] a	is giveri iii	paragrapi	1 3.2	
bric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				23.95	(
eat capacity	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	7135.6	2 (
ermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	<del></del> (
r design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		
n be used instea						_							
nermal bridge	,	,		Ο.	•	<						23.17	(
letails of therma Ital fabric hea		are not kn	own (36) =	= <i>0.05 x (</i> 3	11)			(33) +	(36) =			47.40	(
entilation hea		alculator	l monthly	,					$= 0.33 \times ($	25\m v (5)	\	47.12	(
			<u> </u>		lun	Jul	Διια				Dec	1	
Jan 3)m= 13.41	Feb 13.27	Mar 13.13	Apr 12.44	May 12.31	Jun 11.62	11.62	11.48	Sep 11.89	12.31	12.58	12.86		(:
· L			12.44	12.31	11.02	11.02	11.40	<u> </u>	<u> </u>	<u>.                                    </u>	12.00	I	(-
eat transfer o									= (37) + (3			1	
0)m= 60.53	60.39	60.25	59.57	59.43	58.74	58.74	58.6	59.01	59.43	59.7	59.98	F0.7-	
( ]	meter (F	HP) W	/m²K						Average = = (39)m ÷		12 /12=	59.53	(;
iat ingg nara								( )	(50)111 -	V 17			
eat loss para	1.01	1.01	0.99	0.99	0.98	0.98	0.98	0.99	0.99	1	1	]	



Number of days in month (Table 1a)

Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
n= 31	28	31	30	31	30	31	31	30	31	30	31		(4
Water h	eating ene	rgy requi	rement:								kWh/yea	ır:	
	ccupancy,			,	/	<b>.</b>		<b>/-</b>			98		(4
	3.9, N = 1 3.9, N = 1	+ 1./6 X	[1 - exp	(-0.0003	349 x (11	-A -13.9	)2)] + 0.0	)013 x (	IFA -13.	.9)			
	rage hot wa										.18		(4
	nual average 125 litres per				_	-	to achieve	a water us	se target o	f			
Ja	<u> </u>	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ge in litres pe	l						Sep	Oct	INOV	Dec		
n= 89.	3 86.05	82.81	79.56	76.31	73.06	73.06	76.31	79.56	82.81	86.05	89.3		
	L				l .	l				m(44) <sub>112</sub> =		974.2	(4
gy conter	t of hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
n= 132.	43 115.83	119.52	104.2	99.98	86.28	79.95	91.74	92.84	108.2	118.1	128.25		<b>—</b> 1.
tantaneou	ıs water heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		Total = Su	m(45) <sub>112</sub> =		1277.33	(4
n= 19.8	6 17.37	17.93	15.63	15	12.94	11.99	13.76	13.93	16.23	17.72	19.24		(4
	ge loss:												
rage vol	ume (litre <mark>s</mark>	) inc <mark>ludin</mark>	g any so	olar or W	WHRS	storage	within sa	ame ves	sel		150		(4
	y heating a						` '		(01) (	47)			
ter stora	no stored	not wate	er (tnis in	ciudes i	nstantar	ieous co	moi boii	ers) ente	er o in (	47)			
	acturer's d	eclared l	oss facto	or is kno	wn (kWł	n/day):				0.	99		(4
nperatur	e factor fro	m Table	2b							0.	54		(4
ergy lost	from water	rstorage	, kWh/ye	ear			(48) x (49)	) =		0.	53		(5
	acturer's d		,										
	torage loss y heating s			e∠(KVV	n/iitre/da	iy)					0		(5
	tor from Ta										0		(!
nperatur	e factor fro	m Table	2b								0		(!
rgy lost	from water	rstorage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		( !
` ,	or (54) in (	,								0.	53		(5
or otoro	ge loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m 				
er stora	7 4407	16.57	16.04	16.57	16.04	16.57	16.57	16.04	16.57	16.04	16.57		
n= 16.5						1144\1 . /5	0) also (F	7 m - (56)	m whore /	1 14 4 \ :a fra	A!'	1.1	(5
n= 16.5	ains dedicate		rage, (57)r	m = (56)m	x [(50) – (	H11)] ÷ (5	o), eise (5	7)111 = (30)	ili wilele (	H I I ) IS II 0	m Appendix	Н	(5
n= 16.5	ains dedicate		rage, (57)r 16.04	n = (56)m 16.57	x [(50) – (	16.57	16.57	16.04	16.57	16.04	m Appendix 16.57	н	(£

23.26

(59)m =

(61)m =

23.26

21.01

Primary circuit loss calculated for each month (59)m = (58)  $\div$  365 x (41)m

22.51

Combi loss calculated for each month (61)m = (60)  $\div$  365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

22.51

23.26

23.26

22.51

23.26

22.51

23.26

23.26

(59)

(61)

North

North

North

North

North

0.9x

0.9x

0.9x

0.9x

0.9x

0.77

0.77

0.77

0.77

0.77



### **DER WorkSheet: New dwelling design stage**

Total heat requir	ed for w	vater he	eating ca	alculated	for ea	ch month	(62)m :	= 0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)	m
(62)m= 172.27 1	151.81	159.36	142.75	139.82	124.83	119.78	131.58	131.39	148.03	156.65	168.09		(62)
Solar DHW input cal	culated us	sing Appe	endix G or	Appendix	H (nega	tive quantity	y) (enter '	D' if no sola	r contribut	ion to wate	er heating)	l	
(add additional li	ines if F	GHRS	and/or V	VWHRS	applie	s, see Ap	pendix	G)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water	er heate	er					•	•		•		•	
(64)m= 172.27 1	151.81	159.36	142.75	139.82	124.83	119.78	131.58	131.39	148.03	156.65	168.09		
	•					•	Ou	put from wa	ater heate	r (annual)₁	12	1746.35	(64)
Heat gains from	water h	eating,	kWh/mo	onth 0.2	5 ′ [0.8	5 × (45)m	ı + (61)ı	n] + 0.8 x	((46)m	+ (57)m	+ (59)m	]	
(65)m= 75.9	67.3	71.61	65.49	65.11	59.53	58.45	62.37	61.71	67.84	70.11	74.51		(65)
include (57)m	in calcu	lation c	of (65)m	only if c	ylinder	is in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gain	ns (see T	Table 5	and 5a)	):									
Metabolic gains	(Table 5	5), Watt	S										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91	98.91		(66)
Lighting gains (c	alculate	ed in Ap	pendix I	_, equati	on L9	or L9a), a	lso see	Table 5		•		'	
(67)m= 18.86	16.76	13.63	10.32	7.71	6.51	7.03	9.14	12.27	15.58	18.19	19.39		(67)
Appliances gains	s (calcul	lated in	Append	lix L, eq	uation I	_13 or L1	3a), als	o see Ta	ble 5				
(68)m= 172.64 1	174.44	169.92	160.31	148.18	136.78	129.16	127.37	131.88	141.49	153.62	165.03		(68)
Cooking gains (d	calculate	ed in Ap	pendix	L, equat	ion L15	or L15a	), also s	ee Table	5				
(69)m= 32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89	32.89		(69)
Pumps and fans	gains (	Table 5	a)										
(70)m = 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g. evar	poration	(negat	ive valu	es) (Tab	le 5)								
		-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13	-79.13		(71)
Water heating ga	ains (Ta					_I	!	1	<u> </u>	!	<u> </u>		
		96.25	90.95	87.52	82.68	78.56	83.83	85.71	91.19	97.37	100.15		(72)
Total internal g	ains =	!			(60	5)m + (67)m	n + (68)m	+ (69)m + (	<u>.                                    </u>	1)m + (72)	m		
		332.47	314.25	296.08	278.64	267.43	273.02	282.53	300.94	321.86	337.24		(73)
6. Solar gains:													
Solar gains are cal	culated us	sing solar	flux from	Table 6a	and asso	ciated equa	ations to o	onvert to th	e applicat	ole orientat	ion.		
Orientation: Ac	cess Fa	ctor	Area			ux		<b>g</b> _		FF		Gains	
Ta	ble 6d		m²		Ta	able 6a	•	Table 6b	T	able 6c		(W)	
North 0.9x	0.77	x	4.6	6	x	10.63	x _	0.45	x	0.67	=	10.22	(74)
North 0.9x	0.77	x	4.6	6	x	20.32	x	0.45	x	0.67	=	19.53	(74)
North 0.9x	0.77	x	4.6	6	х	34.53	х	0.45	x	0.67	=	33.19	(74)

X

0.45

0.45

0.45

0.45

0.45

X

0.67

0.67

0.67

0.67

0.67

X

4.6

4.6

4.6

4.6

4.6

X

55.46

74.72

79.99

74.68

59.25

(74)

(74)

(74)

(74)

(74)

53.31

71.81

76.88

71.77

56.94







9a. Energy requirements – Individual heating syst	tems including	micro-CH	IP)					
Space heating:		, 1111010 01	/					_
Fraction of space heat from secondary/supplement	entary 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	2) × [1 – (2	203)] =			1	(204)
Efficiency of main space heating system 1							143.82	(206)
Efficiency of secondary/supplementary heating s	system, %						0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)							İ	
428.61 359.4 330.26 220.33 121.45	0 0	0	0	187.59	311.19	434.14		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$ $298.01  249.89  229.63  153.19  84.44$	0 0	ΙοΙ	0	130.43	216.37	204.06	1	(211)
298.01   249.89   229.63   153.19   84.44	0 0				211) <sub>15,1012</sub>	301.86	1663.84	(211)
Space heating fuel (secondary), kWh/month		Total (	, KVVIII y OCI.	) =0diii(2	· ' /15,1012		1003.04	(211)
$= \{[(98) \text{m x } (201)] \} \times 100 \div (208)$								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
	-	Total (	kWh/year	r) =Sum(2	215) <sub>15,1012</sub>		0	(215)
Water heating								
Output from water heater (calculated above)  172.27 151.81 159.36 142.75 139.82 1	24.83 119.78	131.58	131.39	148.03	156.65	168.09		
Efficiency of water heater	24.03 119.70	131.50	131.39	140.03	130.03	100.09	305.24	(216)
	305.24 305.24	305.24	305.24	305.24	305.24	305.24	000.21	(217)
Fuel for water heating, kWh/month								
$(219)m = (64)m \times 100 \div (217)m$	Va a	1044	10.05	10.5	54.00	55.07	1	
(219)m= 56.44 49.73 52.21 46.77 45.81	40.9 39.24		43.05 = Sum(21	48.5	51.32	55.07	572.13	(219)
Annual totals		Total =	- Oum(21)		Nh/year	•	kWh/yea	┙` ´
Space heating fuel used, main system 1					iii y oa		1663.84	
Water heating fuel used							572.13	Ħ
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or pos	sitive input from	m outside				199.44		(230a)
Total electricity for the above, kWh/year	navo input noi		f (230a)	(230a) =		100.44	100.44	(231)
		Sum of	(2004)	.(200g) –			199.44	= ' '
Electricity for lighting							333.16	(232)
12a. CO2 emissions – Individual heating system	s including mi	icro-CHP						
	<b>Energy</b> kWh/year			<b>Emiss</b> kg CO2	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x			0.5	19	=	863.53	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x		ļ	0.5	==	=	296.94	(264)
Space and water heating	(261) + (262)	+ (263) + (26	64) =	0.5				
•		(200) 1 (20	- · <i>,</i> – I			_	1160.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	103.51	(267)

# envision

### **DER WorkSheet: New dwelling design stage**

(232) x Electricity for lighting (268)0.519 172.91 Total CO2, kg/year sum of (265)...(271) = (272) 1436.89 **Dwelling CO2 Emission Rate**  $(272) \div (4) =$ (273) 24 El rating (section 14) 82 (274)



				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 201			Stroma Softwa Address	are Ve	rsion:	- TF (Be		n: 1.0.4.23	
Address :	Branch Hill H	House, E	Branch H	Hill, LON	IDON, N	W3 7LS					
1. Overall dwelling dime	nsions:										
0 1"					a(m²)			ight(m)	1	Volume(m³)	_
Ground floor					92.4	(1a) x	2	2.6	(2a) =	500.24	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(	1d)+(1e	)+(1r	1) 1	92.4	(4)					
Dwelling volume						(3a)+(3b	)+(3c)+(3d	l)+(3e)+	.(3n) =	500.24	(5)
2. Ventilation rate:			_								
	main heating		econdar eating	У	other		total			m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0	+	0	+ [	0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns						0	x ′	10 =	0	(7a)
Number of passive vents						Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fi	res					F	0	X 4	40 =	0	(7c)
Infiltration due to chimne	to fluor and for	(6)	2) (6b) (7	70) ( (7b) ( (	70) -					anges per ho	7
Infiltration due to chimney						continue fi	0 rom (9) to (		÷ (5) =	0	(8)
Number of storeys in the			<i>''</i>				, ,	ĺ		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			oonding to	the great	er wall are	a (atter					
If suspended wooden f			ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else e	enter 0								0	(13)
Percentage of windows	s and doors dra	aught sti	ripped		0.05 10.0	(4.4)	1001			0	(14)
Window infiltration Infiltration rate					0.25 - [0.2 (8) + (10)	. ,	-	ı (15) —		0	(15)
Air permeability value,	a50 evnresse	d in cub	ic metre		. , . ,	. , , ,	, , ,	, ,	area	0	(16) (17)
If based on air permeabili						•	ictic oi c	ilvelope	aica	0.15	(18)
Air permeability value applie	•						is being us	sed		0.10	
Number of sides sheltere	d									1	(19)
Shelter factor					(20) = 1 -		19)] =			0.92	(20)
Infiltration rate incorporat	-				(21) = (18)	) x (20) =				0.14	(21)
Infiltration rate modified for	<del> </del>	<u> </u>			Ι	0	0.1	NI.			
	Mar   Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp			20	20	2.7	4	12	15	17		
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7		4.3	4.5	4.7		
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4										
(22a)m= 1.27 1.25	1.23 1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		



174.9<sub>age 2</sub> of 39)

Average =  $Sum(39)_{1...12}/12=$ 

## DER WorkSheet: New dwelling design stage

0.18	ration rat	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	1	
alculate effe		•	rate for t	he appli	cable ca	se		l			!	l 	
If mechanic												0.5	(2
If exhaust air		0		, ,	,	. ,	,, .	`	) = (23a)			0.5	(2
If balanced wi	th heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =				75.65	(2
a) If balance	ed mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
1a)m= 0.3	0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28	]	(2
b) If balance	ed mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b	m = (22)	2b)m + (	23b)		1	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole				•	•								
	m < 0.5	<del>``</del>	<u> </u>	<del></del>	ŕ		<del>_``</del>	ŕ –	· ` `	ŕ	1	1	
4c)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(2
d) If natura				•	•				0.51				
	$\frac{m = 1, th}{0}$	en (24a) 1 0	m = (22)	o)m otne		4a)m =	0.5 + [(2	20)m² x	0.5]	0	0	1	(:
				<u> </u>					0			J	(4
Effective ai	<del></del>		<u> </u>	<del>``</del>	<del></del>	ŕ	<del></del>	<del>`</del>	0.07	0.00	0.00	1	(:
5)m= 0.3	0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(,
. Heat loss	es and he	eat loss	oaram <b>et</b>	er:									
L <mark>EME</mark> NT	Gros		Openin		Net Ar		U-val		AXU		k-value		ΑXk
		(m²)	m	12	A ,r		W/m2		(W/I	K)	kJ/m²-l	K	kJ/K
indows Typ					10.34		/[1/( 1.1 )+		10.89				(
in <mark>dows</mark> Typ	e 2				9.9	x1.	/[1/( 1.1 )+	0.04] =	10.43	Ц			(:
indows Typ	e 3				5.25	x1.	/[1/( 1.1 )+	0.04] =	5.53				(:
indows Typ	e 4				5.5	x1,	/[1/( 1.1 )+	0.04] =	5.8				(:
alls Type1	146.	45	30.9	9	115.4	6 x	0.12	= [	13.85				(:
alls Type2	26.7	73	0		26.73	3 x	0.14	=	3.78			$\neg \vdash \vdash$	(2
oof	19	1	0		191	x	0.13	= i	24.83	₹ i		7 F	<u> </u>
otal area of	elements	 s. m²	L		364.1	8	<u> </u>						^ (;
arty floor		,			191	$\dashv$				Г			`` (;
or windows an	d roof wind	lows use e	effective wi	ndow H-va		l lated using	ı formula 1	/[(1/Ll-valu	ıe)+0 041 a	L as aiven in	naragranh		(
include the are						a.c.a a.cg	, , , , , , , , , , , , , , , , , , , ,	, [( 1, 0 1 a.o	,	.o g o	pa.ag.ap.	. 5.2	
bric heat Ic	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				75.12	(
eat capacity	Cm = S	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	19312.16	(
nermal mas	s parame	eter (TMF	P = Cm -	: TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(:
r design asses	ssments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
n be used inst													
nermal bridg	,	•			-	<						54.63	(
letails of thern Ital fabric h		are not kn	own (36) =	= 0.05 x (3	11)			(33) 1	(36) =				—,
		alaulata -	l manshi	a.						(25)m v: (5)		129.75	(;
entilation he	1	1	·		1, ,	1, ,1	۸			(25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	1
3)m= 49.3	48.73	48.16	45.29	44.72	41.86	41.86	41.29	43	44.72	45.87	47.01	j	(;
eat transfer	coefficie	nt, W/K	T	•	,	1	,	(39)m	= (37) + (	38)m		1	

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at loss para					1	1		· · ·	= (39)m ÷	r ·			
)m= 0.93	0.93	0.92	0.91	0.91	0.89	0.89	0.89	0.9	0.91	0.91	0.92		
mber of day	s in moi	nth (Tahl	e 1a)						Average =	Sum(40) <sub>1</sub> .	12 /12=	0.91	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
					<u> </u>	<u> </u>							
Water heat	ing ener	gy requi	rement:								kWh/ye	ar:	
sumed occu			[4 0)(0	( 0 0003	)40 v /T[	-A 12.0	)2)] . O.	0012 v /	TEA 12		99		(4
f TFA > 13.9 f TFA £ 13.9		+ 1.76 X	[i - exp	(-0.0003	949 X (11	-A -13.9	)2)] + 0.(	JU 13 X (	IFA -13.	.9)			
nual averag									4		5.26		(4
duce the annua more that 125	_				_	-	to acnieve	a water us	se target o	)†			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
water usage in								Госр	1 001	1101			
m= 115.79	111.58	107.37	103.16	98.94	94.73	94.73	98.94	103.16	107.37	111.58	115.79		
										M(44) <sub>112</sub> =	=	1263.13	(4
ergy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	7m / 3600	0 kWh/mor	nth ( <mark>see Ta</mark>	ables 1b, 1	c, 1d)		
)m= 171.71	150.18	154.97	135.11	129.64	111.87	103.66	118.95	120.37	140.28	153.13	166.29		
							, /		Total = Su	m(45) <sub>112</sub> =		1656.16	(4
st <mark>antane</mark> ous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	to (61)					
m= 25.76	22.53	23.25	20.27	19.45	16.78	15.55	17.84	18.06	21.04	22.97	24.94		(4
ater storage orage volum		includin	a anv so	olar or M	/WHRS	storage	within s	ame ves	امء		305		(4
community h									001		303		(-
nerwise if no	•			•			` '	ers) ente	er '0' in (	(47)			
ater storage	loss:		`					,	·	,			
If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):				1.	63		(4
mperature fa	actor fro	m Table	2b							0.	54		(4
ergy lost fro		_	-				(48) x (49	) =		0.	88		(5
If manufact of water stora			-										/5
community h	-			6 Z (KVV	11/11116/06	iy <i>)</i>					0		(5
lume factor	•										0		(5
mperature fa	actor fro	m Table	2b								0		(5
ergy lost fro	m water	storage	, kWh/ye	ear			(47) x (51	) x (52) x (	53) =		0		(5
nter (50) or (	54) in (5	55)								0.	88		(5
ater storage	loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m				
m= 27.29	24.65	27.29	26.41	27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(5
linder 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 Appendix	кH	
)m= 27.29	24.65	27.29	26.41	27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(!
mary oircuit	loss (on	nual) fra	m Toble	. 3	ı	ı					0		(5
mary circuit mary circuit	•	•			59)m = 1	(58) ± 36	35 × (41)	ım			~		,,
mary on our				,	•	` '	, ,						
modified by	factor fr	om Tabl	e H5 if t	here is s	solar wat	ter heatii	ng and a	a cylinde	r thermo	stat)			

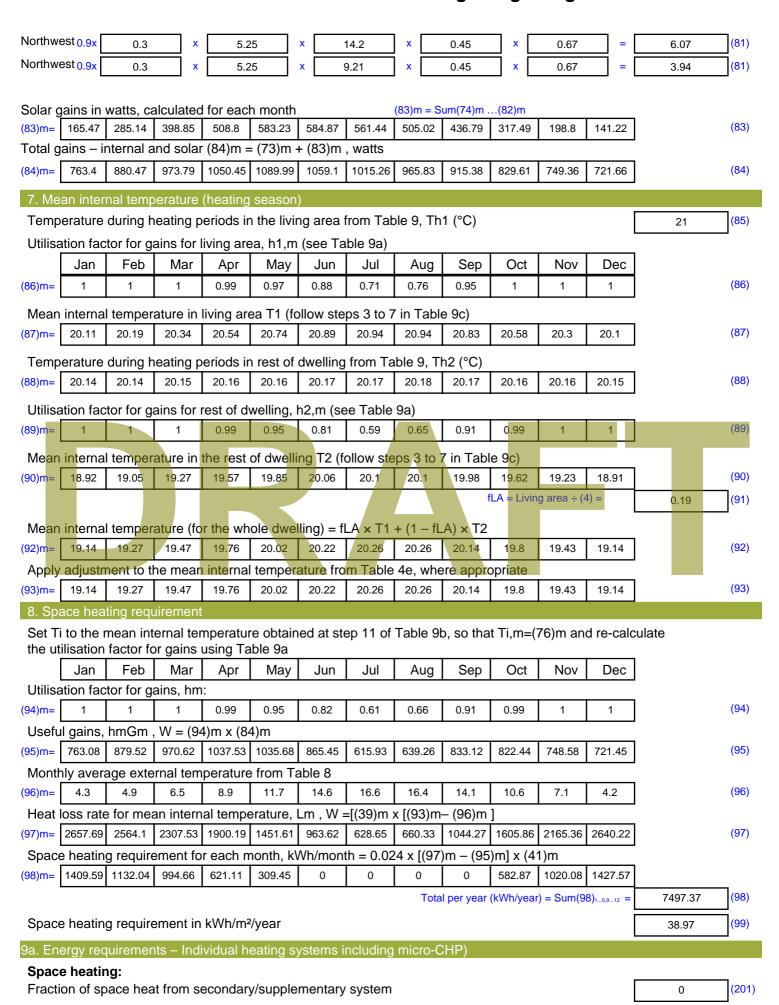


Combi loss calc	ulated fo	or each	month (	(61)m =	(60) ÷	365 🗴 (41	)m							
(61)m= 0	0	0	0	0	0	0	)		0	0	0	0	]	(61)
Total heat requi	red for v	water he	eating ca	alculated	l for ea	 ch month	(62)	—— m =	0.85 × (	 ′45)m +	(46)m +	(57)m +	ı - (59)m + (61)m	
<del></del>	195.83	205.52	184.02	180.19	160.79		169	_	169.29	190.83	202.05	216.84	]	(62)
Solar DHW input cal	lculated u	ısing App	endix G or	· Appendix	H (nega	tive quantit	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	)	
(add additional I	ines if F	GHRS	and/or V	VWHRS	applie	s, see Ap	pend	lix C	3)					
(63)m= 0	0	0	0	0	0	0	0	)	0	0	0	0	]	(63)
Output from wat	er heate	er								-		-	_	
(64)m= 222.26	195.83	205.52	184.02	180.19	160.79	154.21	169	9.5	169.29	190.83	202.05	216.84	]	_
								Outp	out from wa	ater heate	er (annual)	112	2251.33	(64)
Heat gains from	water h	neating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	1)m	] + 0.8 x	((46)m	+ (57)m	+ (59)m	<u>ı</u> ]	
(65)m= 97.53	86.46	91.97	84.06	83.54	76.33	74.91	79.	99	79.16	87.08	90.05	95.73	]	(65)
include (57)m	in calcu	ulation o	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal gair	ns (see	Table 5	and 5a	):										
Metabolic gains	(Table	5), Wat	ts										_	
Jan	Feb	Mar	Apr	May	Jun	Jul	А	ug	Sep	Oct	Nov	Dec	]	
(66)m= 149.6	149.6	149.6	149.6	149.6	149.6	149.6	149	9.6	149.6	149.6	149.6	149.6		(66)
Ligh <mark>ting g</mark> ains (d	calculate	ed in Ap	pendix	L, equ <mark>at</mark>	ion L9	or L9a), <mark>a</mark>	lso s	ee	Table 5					
(67)m= 35.19	31.26	<b>2</b> 5.42	19.24	14.38	12.14	13.12	17.	06	22.89	29.07	33.93	36.17		(67)
App <mark>liance</mark> s gain	s (ca <mark>lcu</mark>	ılated in	Append	dix L, eq	uation	L13 or L1	<mark>3</mark> a),	also	see Tal	ble 5				
(68)m= 363.76	367.54	<b>35</b> 8.03	337.78	312.21	288.19	272.14	268	.36	277.88	298.13	323.69	347.71		(68)
Cooking gains (	calculat	ed in A	pendix	L, equat	ion L1	5 or L15a	), als	o se	e Table	5		-		
(69)m= 37.96	37.96	37.96	37.96	37.96	37.96	37.96	37.	96	37.96	37.96	37.96	37.96		(69)
Pumps and fans	gains (	(Table 5	ia)											
(70)m= 0	0	0	0	0	0	0	0	)	0	0	0	0	]	(70)
Losses e.g. eva	poratior	n (negat	ive valu	es) (Tab	le 5)									
(71)m= -119.68 -	119.68	-119.68	-119.68	-119.68	-119.68	-119.68	-119	.68	-119.68	-119.68	-119.68	-119.68	]	(71)
Water heating g	ains (Ta	able 5)											_	
(72)m= 131.09	128.66	123.61	116.75	112.29	106.01	100.68	107	.51	109.94	117.05	125.07	128.67	]	(72)
Total internal g	ains =				(6	6)m + (67)n	n + (68	3)m +	- (69)m + (	(70)m + (	71)m + (72)	)m	_	
(73)m= 597.93	595.33	574.94	541.65	506.77	474.23	453.82	460	.82	478.59	512.12	550.57	580.43	]	(73)
6. Solar gains:														
Solar gains are cal		_					ations	to co	nvert to th	e applica		tion.		
Orientation: Ac	cess Fa ble 6d	actor	Area m²			ux able 6a		т	g_ able 6b	7	FF able 6c		Gains (W)	
							1						. ,	,
Northeast 0.9x	0.3	X	5.	5	x	11.28	X		0.45	×	0.67	=	5.05	(75)
Northeast 0.9x	0.3	X	5.5		x	22.97	X		0.45	X	0.67	=	10.28	(75)
Northeast 0.9x	0.3	X	5.5		x	41.38	X		0.45	X	0.67	=	18.53	(75)
Northeast <sub>0.9x</sub>	0.3	X	5.5	==	X _	67.96	X		0.45	x [	0.67	=	30.43	(75)
Northeast <sub>0.9x</sub>	0.3	X	5.	5	х	91.35	X		0.45	X	0.67	=	40.9	(75)



Northeast 0.9x	[75] (75) [75]
Northeast 0.9x	╡
Northeast 0.9x	(75)
Northeast 0.9x	
Northeast 0.9x	(75)
Northeast 0.9x	(75)
Southeast 0.9x       0.77       x       9.9       x       36.79       x       0.45       x       0.67       =       76.11         Southeast 0.9x       0.77       x       9.9       x       62.67       x       0.45       x       0.67       =       129.64         Southeast 0.9x       0.77       x       9.9       x       85.75       x       0.45       x       0.67       =       177.38         Southeast 0.9x       0.77       x       9.9       x       106.25       x       0.45       x       0.67       =       219.78         Southeast 0.9x       0.77       x       9.9       x       119.01       x       0.45       x       0.67       =       246.17         Southeast 0.9x       0.77       x       9.9       x       118.15       x       0.45       x       0.67       =       244.39	(75)
Southeast 0.9x       0.77       x       9.9       x       62.67       x       0.45       x       0.67       =       129.64         Southeast 0.9x       0.77       x       9.9       x       85.75       x       0.45       x       0.67       =       177.38         Southeast 0.9x       0.77       x       9.9       x       106.25       x       0.45       x       0.67       =       219.78         Southeast 0.9x       0.77       x       9.9       x       119.01       x       0.45       x       0.67       =       246.17         Southeast 0.9x       0.77       x       9.9       x       118.15       x       0.45       x       0.67       =       244.39	(75)
Southeast 0.9x       0.77       x       9.9       x       85.75       x       0.45       x       0.67       =       177.38         Southeast 0.9x       0.77       x       9.9       x       106.25       x       0.45       x       0.67       =       219.78         Southeast 0.9x       0.77       x       9.9       x       119.01       x       0.45       x       0.67       =       246.17         Southeast 0.9x       0.77       x       9.9       x       118.15       x       0.45       x       0.67       =       244.39	(77)
Southeast 0.9x       0.77       x       9.9       x       106.25       x       0.45       x       0.67       =       219.78         Southeast 0.9x       0.77       x       9.9       x       119.01       x       0.45       x       0.67       =       246.17         Southeast 0.9x       0.77       x       9.9       x       118.15       x       0.45       x       0.67       =       244.39	(77)
Southeast 0.9x 0.77 x 9.9 x 119.01 x 0.45 x 0.67 = 246.17 Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.45 x 0.67 = 244.39	(77)
Southeast 0.9x 0.77 x 9.9 x 118.15 x 0.45 x 0.67 = 244.39	(77)
	(77)
	(77)
Southeast 0.9x 0.77 x 9.9 x 113.91 x 0.45 x 0.67 = 235.62	(77)
Southeast 0.9x 0.77 x 9.9 x 104.39 x 0.45 x 0.67 = 215.93	(77)
Southeast 0.9x 0.77 x 9.9 x 92.85 x 0.45 x 0.67 = 192.06	(77)
Southeast 0.9x 0.77 x 9.9 x 69.27 x 0.45 x 0.67 = 143.28	(77)
Southeast 0.9x 0.77 x 9.9 x 44.07 x 0.45 x 0.67 = 91.16	(77)
Southeast 0.9x 0.77 x 9.9 x 31.49 x 0.45 x 0.67 = 65.13	(77)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 36.79 0.45 x 0.67 = 79.49	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 62.67 0.45 x 0.67 = 135.4	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 85.75 0.45 x 0.67 = 185.26	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 106.25 0.45 x 0.67 = 229.55	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 119.01 0.45 x 0.67 = 257.11	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 118.15 0.45 x 0.67 = 255.26	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 113.91 0.45 x 0.67 = 246.09	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 104.39 0.45 x 0.67 = 225.53	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 92.85 0.45 x 0.67 = 200.6	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 69.27 0.45 x 0.67 = 149.65	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 44.07 0.45 x 0.67 = 95.21	(79)
Southwest <sub>0.9x</sub> 0.77 x 10.34 x 31.49 0.45 x 0.67 = 68.03	(79)
Northwest 0.9x 0.3 x 5.25 x 11.28 x 0.45 x 0.67 = 4.82	(81)
Northwest 0.9x 0.3 x 5.25 x 22.97 x 0.45 x 0.67 = 9.82	(81)
Northwest 0.9x 0.3 x 5.25 x 41.38 x 0.45 x 0.67 = 17.68	(81)
Northwest 0.9x 0.3 x 5.25 x 67.96 x 0.45 x 0.67 = 29.04	(81)
Northwest 0.9x 0.3 x 5.25 x 91.35 x 0.45 x 0.67 = 39.04	(81)
Northwest 0.9x 0.3 x 5.25 x 97.38 x 0.45 x 0.67 = 41.62	(81)
Northwest 0.9x 0.3 x 5.25 x 91.1 x 0.45 x 0.67 = 38.93	(81)
Northwest 0.9x 0.3 x 5.25 x 72.63 x 0.45 x 0.67 = 31.04	(81)
Northwest 0.9x 0.3 x 5.25 x 50.42 x 0.45 x 0.67 = 21.55	(81)
Northwest 0.9x 0.3 x 5.25 x 28.07 x 0.45 x 0.67 = 12	(81)







								_
Fraction of space heat from main system(s)		(202) = 1 -	- (201) =				1	(202
Fraction of total heating from main system 1		(204) = (20	02) × [1 –	(203)] =			1	(20
Efficiency of main space heating system 1							361.62	(20
Efficiency of secondary/supplementary heating s	ystem, %			•		•	0	(20
	Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)  1409.59 1132.04 994.66 621.11 309.45	0 0	0	0	582.87	1020.08	1427.57	]	
	0 1 0		0	302.07	1020.00	1427.57		(21
211)m = {[(98)m x (204)] } x 100 ÷ (206) 389.8 313.05 275.06 171.76 85.57	0 0	0	0	161.18	282.09	394.77		(21
	<b> </b>	Total	l (kWh/yea	ar) =Sum(2		=	2073.27	(21
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	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	2=	0	(21
Vater heating								
Output from water heater (calculated above)  222.26   195.83   205.52   184.02   180.19   10	60.79 154.21	169.5	169.29	190.83	202.05	216.84	1	
Efficiency of water heater	00.79   154.21	109.5	109.29	190.63	202.05	210.04	300.39	(21
	00.39 300.39	300.39	300.39	300.39	300.39	300.39	300.33	(21
uel for water heating, kWh/month								
219)m = (64)m x 100 ÷ (217)m	0.50	V 50 (0 )	<b>50.00</b>	00.50	07.00	70.40	1	
219)m= 73.99 65.19 68.42 61.26 59.98 5	3.53 51.34	56.43	56.36 I = Sum(2	6 <mark>3.53</mark>	67.26	72.19	749.47	\_(21
Annual totals					Wh/yeaı	•	kWh/year	
Space heating fuel used, main system 1					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		2073.27	7
Vater heating fuel used							749.47	Ŧ
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or pos-	itive input fror	n outside	)			465.35		(23
otal electricity for the above, kWh/year	'			(230g) =			465.35	(23
Electricity for lighting			, ,	, 0,			621.47	\` ☐ <sub>(23)</sub>
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP					021.47	
12a. 002 emissions - maividual fleating systems	3 morading mi	CIO OI II						
	<b>Energy</b> kWh/year			kg CO	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x			0.5	19	=	1076.03	(26
Space heating (secondary)	(215) x			0.5	19	=	0	(26
Vater heating	(219) x			0.5	19	=	388.97	(26
Space and water heating	(261) + (262)	+ (263) + (2	264) =				1465	_ ](26
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	241.52	」` □(26
Electricity for lighting	(232) x			0.5		=	322.54	(26
	• •		SUM O	f (265)(2				╡
Fotal CO2, kg/year			Sulli 0	i (200)(i	_r i) =		2029.06	(27

# envision

### DER WorkSheet: New dwelling design stage

**Dwelling CO2 Emission Rate** 

 $(272) \div (4) =$ 

10.55 (273)

(274)

89

El rating (section 14)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 32 - 2B4P - TF (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor (1a) x 2.4 (2a) =283.2 (3a) 118 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)118 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =283.2 (5) total m³ per hour main secondary other heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)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 (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18



0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
alculate effec		-	rate for t	he appli	cable ca	se				<u> </u>			
If mechanica												0.5	(
If exhaust air he									) = (23a)			0.5	(
If balanced with												73.95	(
a) If balance						<u> </u>	<del></del>	<del>``</del>	<del>- ` `</del>	<del></del>	<del>` ` ´</del>	÷ 100]	
la)m= 0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28		(
b) If balance		1					<u> </u>	<u> </u>	<del></del>	<del></del>	ī	1	
b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
c) If whole he				•	•				F (00l-	. \			
if (22b)m	1 < 0.5 ×	(230), t	<u> </u>	(230)	o); otnerv	· ` ·	ŕ	0) m + 0.	· `	<del></del>		1	
c)m= 0			0			0	0		0	0	0		
d) If natural v if (22b)m									0.5]			_	
d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
Effective air	change	rate - er	nter (24a	or (24k	o) or (24	c) or (24	d) in box	(25)				_	
i)m= 0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28		(
. Heat losses	and he	at loss i	naramet	or.								_	-
EMENT	Gros		Openin		Net Ar	ea	U-valı	IE.	AXU		k-value	<u> </u>	ΑΧk
	area		m		A ,r		W/m2		(W/I	K)	kJ/m <sup>2</sup> ·l		kJ/K
n <mark>dows</mark> Type	1				6.2	x1.	/[1/( 1.1 )+	0.04] =	6.53				
n <mark>dows</mark> Type	2				0.36	x1.	/[1/( 1.1 )+	0.04] =	0.38	П			
alls Type1	103.	96	6.56		97.4	X	0.12	=	11.69	Πг			
alls Type2	4.93	3	0	= "	4.93	X	0.14	=	0.7	٦ i			
of	118	3	0		118	×	0.13	<u> </u>	15.34	<b>=</b>		7 F	
tal area of e	lements	 , m²			226.8	9							
r windows and			effective wi	ndow U-va			formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	n 3.2	
nclude the area	s on both	sides of in	nternal wal	ls and par	titions								
bric heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				34.64	
at capacity (	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	8224.8	2
ermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	
r design assess n be used instea				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
ermal bridge				ısina Ar	nendix k	<b>(</b>						34.03	
etails of therma	,	,		• .	•	`						34.03	'
tal fabric hea			()	(1	,			(33) +	(36) =			68.67	
ntilation hea	t 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		
)m= 27.37	27.07	26.77	25.28	24.98	23.49	23.49	23.19	24.09	24.98	25.58	26.17		(
eat transfer c	oefficier	nt, W/K			•			(39)m	= (37) + (37)	38)m	•	•	
	95.74	95.44	93.95	93.65	92.16	92.16	91.86	92.76	93.65	94.25	94.84		
)m=   96.03													



n= 0.81	0.04	0.04	m²K	0.70	0.70	0.70	0.70		= (39)m ÷		0.0		
	0.81	0.81	8.0	0.79	0.78	0.78	0.78	0.79	0.79	0.8 Sum(40) <sub>1.</sub>	0.8	0.8	
ber of day	s in mor	nth (Tabl	le 1a)					,	Average -	Sum(40)1.	12 / 12-	0.0	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
31	28	31	30	31	30	31	31	30	31	30	31		
Water hea	ting ener	rgy requi	rement:								kWh/ye	ar:	
ımed occı	inancy I	N									86		
TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.		00		
ΓFA £ 13.9	•	.40			المالين		(OF ~ NI)	. 20					
ual averag									se target o		2.01		
ore that 125	litres per p	person per	day (all w	ater use, h	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ater usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)		-	-			
112.21	108.13	104.05	99.97	95.89	91.81	91.81	95.89	99.97	104.05	108.13	112.21		
	last water			a satla la contra del la contra del la contra del la contra de la contra de la contra del l	400 · · \/-/ ·		T / 2000			m(44) <sub>112</sub> =		1224.14	
y content of													
166.41	145.54	150.19	130.94	125.64	108.41	100.46	115.28	116.66	135.95	148.41	161.16		
antaneous v	ater heatii	na at point	of use (no	hot water	storage).	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	<u> </u>	1605.05	
24.96	21.83	22.53	19.64	18.85	16.26	15.07	17.29	17.5	20.39	22.26	24.17		
er storage		22.00	10.04	10.00	10.20	10.07	17.20	17.5	20.00	22.20	27.17		
age volum	e (litres)	includin	anv so	olar or M	0.441.150								
			9	Jiai Oi VV	WHRS	storage	within sa	ame ves	sel		250		
mmunity h	eating a	ind no ta						ame ves	sel		250		
erwise if no	stored		nk in dw	elling, e	nter 110	litres in	(47)				250		
erwise if no er storage	stored loss:	hot wate	nk in dw er (this in	relling, e icludes i	nter 110 nstantar	litres in neous co	(47)			47)			
erwise if no er storage manufact	o stored loss: urer's de	hot wate	nk in dw er (this in	relling, e icludes i	nter 110 nstantar	litres in neous co	(47)			47)	49		
erwise if no er storage manufact perature f	o stored loss: urer's de actor fro	hot wate eclared le m Table	nk in dw er (this in oss facto 2b	relling, e acludes in or is know	nter 110 nstantar	litres in neous co n/day):	(47) ombi boil	ers) ente		1.	49 54		
erwise if no er storage manufact perature f gy lost fro	o stored loss: urer's de actor fro	hot wate eclared le m Table storage	nk in dw er (this in oss facto 2b , kWh/ye	relling, e acludes i or is know ear	nter 110 nstantar wn (kWh	litres in neous co n/day):	(47)	ers) ente		1.	49		
erwise if no er storage manufact perature f gy lost fro manufact	o stored loss: urer's de actor fro om water urer's de	hot wate eclared lom Table storage eclared c	nk in dw er (this in oss facto 2b , kWh/ye	relling, e acludes in or is known ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		1. 0. 0	49 54		
erwise if no er storage manufact perature f rgy lost fro manufact water stora mmunity h	o stored loss: urer's de actor fro om water urer's de age loss neating s	hot water clared long the manager storage eclared confidered confidered confidered confidered section from the manager from t	nk in dwer (this in 2b, kWh/ye cylinder l	relling, e acludes in or is known ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		1. 0. 0	49 54 .8		
erwise if no er storage manufact perature f gy lost fro manufact water stora mmunity h me factor	o stored loss: urer's de actor fro water urer's de age loss leating s from Tal	hot water clared long the storage colored of factor free sections to ble 2a	nk in dw er (this ir oss facto 2b , kWh/ye cylinder l om Tabl on 4.3	relling, e acludes in or is known ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boil	ers) ente		47)  1.  0.  0	49 54 .8 0		
erwise if no er storage manufact perature f gy lost fro manufact water stor mmunity h me factor perature f	o stored loss: urer's de actor fro m water urer's de age loss neating s from Talactor fro	hot water eclared long table storage eclared of factor free sections ble 2a m Table	nk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e acludes in or is known ear oss facto e 2 (kWI	nter 110 nstantar wn (kWh	heous con/day): known:	(47) ombi boil (48) x (49)	ers) ente	er '0' in (	47)  1.  0.  0	49 54 .8 0		
erwise if no er storage manufact perature f gy lost fro manufact water stora mmunity h me factor perature f	o stored loss: curer's de actor fro m water age loss aeating s from Talactor fro	eclared long transfer storage eclared of factor free section ble 2a m Table estorage	nk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e acludes in or is known ear oss facto e 2 (kWI	nter 110 nstantar wn (kWh	heous con/day): known:	(47) ombi boil	ers) ente	er '0' in (	47)  1. 0. 0	49 54 .8 0		
erwise if noter storage manufact perature from munity had been merature from perature from perature from (50) or for the storage from the stor	o stored loss: curer's de actor fro meating seating seator from water actor from water (54) in (5	eclared long transfer water and the colored to factor from the colored to f	nk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3 2b , kWh/ye	relling, e acludes in or is known ear oss factor e 2 (kWI	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boil (48) x (49) (47) x (51)	ers) ente	er 'O' in (	47)  1. 0. 0	49 54 .8 0		
erwise if noter storage manufact perature from manufact water storage from perature from factor perature from (50) or the storage	o stored loss: urer's de actor fro meating s from Talactor from water (54) in (54) loss calactor scalactor from the control of	eclared long transfer water the clared of factor from the clared of the clared from the clared	nk in dwer (this in 2b, kWh/ye cylinder lon 4.3, kWh/ye for each	relling, e acludes in or is known ear oss factor e 2 (kWl	nter 110 nstantar wn (kWh or is not h/litre/da	litres in neous co n/day): known:	(47) ombi boil (48) x (49) (47) x (51) ((56)m = (	ers) ente	er 'O' in (	1. 0. 0	49 54 .8 0 0 0 0 0		
erwise if noter storage manufact perature from manufact water storage menunity in the factor perature from from factor perature from factor perature from factor for (50) or factorage = 24.94	o stored loss: urer's de actor fro mater actor from Talactor from water (54) in (54) loss calactors actor from water (52).	eclared long transfer water the clared of factor from the clared of factor from the clared fro	nk in dwer (this in oss factor 2b), kWh/ye on 4.3 2b, kWh/ye on 4.3 2b, kWh/ye or each	relling, encludes in or is known ear oss factor e 2 (kWl	nter 110 nstantar wn (kWh or is not h/litre/da	heous con/day): known: ay)	(47) ombi boil (48) x (49) (47) x (51) ((56)m = ( 24.94)	ers) ente	53) = m 24.94	47)  1. 0. 0. 0. 24.14	49 54 .8 0 0 0 0 .8	x H	
erwise if noter storage manufact perature for manufact water storage menunity home factor perature for (50) or ear storage = 24.94 mater contains	o stored loss: urer's de actor fro water actor fro mater actor from Water (54) in (54) in (54) is dedicated	m Table storage eclared of factor fr ee section ble 2a m Table storage 55) culated f 24.94 d solar sto	nk in dwer (this in oss factor 2b), kWh/ye on 4.3  2b, kWh/ye or each 24.14  rage, (57)	relling, e acludes in or is known ear oss factor e 2 (kWl	nter 110 nstantar wn (kWh or is not h/litre/da 24.14 x [(50) - (	litres in neous co n/day): known: ay)	(47) cmbi boil (48) x (49) (47) x (51) ((56)m = ( 24.94 0), else (5)	ers) enters) = (52) × (52) × (41)(24.14) (7)m = (56)	53) = m 24.94 m where (	47)  1. 0. 0. 0. 24.14 H11) is fro	49 54 .8 0 0 0 0 .8 24.94 m Appendi	хH	
erwise if noter storage manufact perature from manufact water storage memority in the factor perature from from factor perature from from factor perature from factor (50) or factor storage = 24.94 mater contains = 24.94	o stored loss: urer's de actor from water actor from Talactor from water (54) in (54) in (554) is dedicated 22.53	hot water eclared lend a storage eclared of factor free section ble 2a m Table a storage (55) culated for 24.94 d solar storage (24.94)	nk in dwer (this in oss factor 2b), kWh/ye om Tablon 4.3 2b, kWh/ye or each 24.14 rage, (57)	relling, e acludes in or is known ear oss factor e 2 (kWl	nter 110 nstantar wn (kWh or is not h/litre/da	heous con/day): known: ay)	(47) ombi boil (48) x (49) (47) x (51) ((56)m = ( 24.94)	ers) ente	53) = m 24.94	47)  1. 0. 0  24.14  H11) is fro	49 54 .8 0 0 0 0 .8 24.94 m Appendi 24.94	хH	
nder contain	o stored loss: curer's de actor from water actor from Tal actor from water (54) in (554) in (5	hot water eclared less storage eclared of factor free section ble 2a m Table estorage (55) culated for 24.94 disolar storage (24.94) anual) from the factor free section factor free section (55) culated for 24.94 disolar storage factor facto	nk in dwer (this in oss factor 2b), kWh/ye cylinder I om Table on 4.3  2b, kWh/ye cylinder I om 4.3  2b, kWh/ye cylinder I om 4.3  2b, kWh/ye cylinder I om 4.3  2b, kWh/ye cylinder I om 500000000000000000000000000000000000	relling, e acludes in or is known ear oss factor e 2 (kWl	nter 110 nstantar wn (kWh or is not h/litre/da  24.14 x [(50) - (	24.94 H11)] ÷ (5	(47) x (48) x (49) (47) x (51) ((56)m = ( 24.94 0), else (5)	ers) enters) = (52) × (52) × (41) (24.14) (24.14) (24.14)	53) = m 24.94 m where (	47)  1. 0. 0  24.14  H11) is fro	49 54 .8 0 0 0 0 .8 24.94 m Appendi	хH	

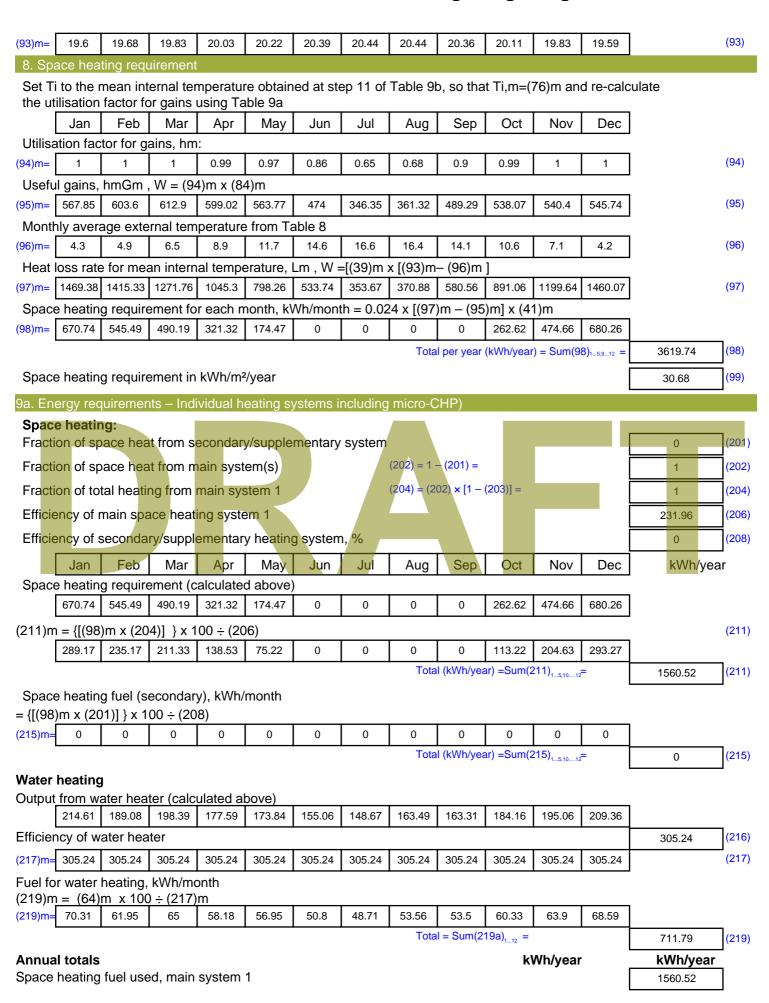


Combi loss o	alaulata d	for oach	month	(61)m –	(60) · 2(	SE (41)	١m						
(61)m= 0	0	0	0	0	00) + 3	0 7 (41)	0	T 0	0	0	0	1	(61)
			<u> </u>	<u> </u>			<u> </u>				ļ	J · (59)m + (61)m	` /
(62)m= 214.6	<del></del>	198.39	177.59	173.84	155.06	148.67	163.49		184.16	195.06	209.36	]	(62)
Solar DHW inpu		using App	endix G o	Appendix	H (negati	ve quantity	/) (enter	'0' if no sola	r contribu	tion to wate	L er heating)	<b>J</b>	
(add addition											3,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter									-	-	
(64)m= 214.6	1 189.08	198.39	177.59	173.84	155.06	148.67	163.49	163.31	184.16	195.06	209.36		_
							Οι	itput from w	ater heate	er (annual)	112	2172.62	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	<u>[</u> ]	
(65)m= 93.89	83.22	88.5	80.86	80.34	73.37	71.97	76.9	76.11	83.77	86.66	92.15		(65)
include (5	7)m in cald	culation (	of (65)m	only if c	ylinder i	s in the o	dwellin	g or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a	):									
Metabolic ga	ins (Table	5), Wat	ts	1		1		-1	,			1	
Jan	Feb Feb	Mar	Apr	May	Jun	Jul	Aug	<del>-</del>	Oct	Nov	Dec		
(66)m= 142.7	6 142.76	142.76	142.76	142.76	142.76	142.76	142.76	142.76	142.76	142.76	142.76		(66)
Ligh <mark>ting g</mark> air		ted in Ap	pendix	L, equat	ion L9 o	r L9a), <mark>a</mark>	lso see	Table 5				,	
(67)m= $32.48$	3 28.85	23.46	17. <mark>76</mark>	13.28	11.21	12.11	15.74	21.13	26.83	31.31	33.38		(67)
App <mark>liance</mark> s g	gains (ca <mark>lc</mark>	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), als	so see Ta	ble 5			_	
(68)m= 282.5	9 285.52	27 <mark>8.13</mark>	262.4	242.54	223.88	211.41	208.48	215.86	231.6	251.45	270.12		(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	ion L15	or L15a	, also	see Table	5			_	
(69)m= 37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28	37.28		(69)
Pumps and f	fans gains	(Table 5	ōa)									-	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)			_				-	
(71)m= -114.2	1 -114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21	-114.21		(71)
Water heating	ng gains (T	able 5)									,	-	
(72)m= 126.2	123.85	118.95	112.3	107.98	101.9	96.73	103.35	105.71	112.59	120.37	123.86		(72)
Total intern	_ <del>_</del>	:	•	•	(66)	)m + (67)m	n + (68)m	n + (69)m +	(70)m + (7	71)m + (72)	)m	-	
(73)m= 507.1		486.37	458.29	429.63	402.81	386.08	393.4	408.53	436.85	468.96	493.18		(73)
6. Solar gai				<b>-</b>									
Solar gains ar		•					itions to		ie applica		tion.	Ostas	
Orientation:	Table 6d		Area m²		Flu Tal	ix ble 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
North 0.9				) <sub>C</sub>			. –				<u> </u>	. ,	(74)
North 0.93		X	0.3			0.63	]	0.45	×	0.67	=	0.8	-
North 0.93		×	0.3			20.32		0.45	×	0.67	=	1.53	[74] (74)
North 0.93		×	0.3			34.53		0.45	×	0.67	_ =	2.6	_
		×	0.3	==	<b>-</b>	55.46	]	0.45	×	0.67	╡ -	4.17	[(74) ] <sub>(74)</sub>
North 0.93	0.77	X	0.3	86	× 7	74.72	X	0.45	Х	0.67	=	5.62	(74)



North													
	0.9x 0.77	х	0.3	6 ×	-	79.99	x	0.45	X	0.67	=	6.02	(74)
North	0.9x 0.77	×	0.3	6 ×		74.68	x	0.45	x	0.67		5.62	(74)
North	0.9x 0.77	x	0.3	6 ×		59.25	x	0.45	x	0.67		4.46	(74)
North	0.9x 0.77	x	0.3	6 ×		11.52	x	0.45	x	0.67		3.12	(74)
North	0.9x 0.77	x	0.3	6 ×		24.19	x	0.45	X	0.67	_	1.82	(74)
North	0.9x 0.77	x	0.3	6 ×		13.12	x	0.45	X	0.67	=	0.99	(74)
North	0.9x 0.77	x	0.3	6 ×		8.86	x	0.45	X	0.67	=	0.67	(74)
South	0.9x 0.77	x	6.2	2 x	4	46.75	X	0.45	x	0.67	=	60.56	(78)
South	0.9x 0.77	х	6.2	2 X		76.57	x	0.45	x	0.67		99.19	(78)
South	0.9x 0.77	х	6.2	2 X	(	97.53	x	0.45	X	0.67		126.35	(78)
South	0.9x 0.77	х	6.2	2 X	1	10.23	x	0.45	X	0.67	=	142.8	(78)
South	0.9x 0.77	x	6.2	2 X	1	14.87	x	0.45	X	0.67	=	148.81	(78)
South	0.9x 0.77	x	6.2	2 x	1	10.55	x	0.45	x	0.67	=	143.21	(78)
South	0.9x 0.77	x	6.2	2 X	1	08.01	X	0.45	X	0.67	=	139.92	(78)
South	0.9x 0.77	x	6.2	2 X	1	04.89	X	0.45	X	0.67	=	135.88	(78)
South	0.9x 0.77	x	6.2	2 x	1	01.89	x	0.45	x	0.67	=	131.99	(78)
South	0.9x 0.77	x	6.2	2 X		32.59	x	0.45	X	0.67	=	106.98	(78)
South	0.9x 0.77	x	6.2	2 ×		55.42	Х	0.45	X	0.67	=	71.79	(78)
South	0.9x 0.77	x	6.2	2 ×		40.4	] x	0.45	x	0.67	=	52.33	(78)
Solar g (83)m=	ains in watts, c				440.00			I = Sum(74)m.	, ,			1	4
(03)111=							1 1 1 1	24   125 11	100 0	72 70	E2		(83)
Total d		128.95	146.97 (84)m =		149.22 (83)m	145.54 watts	140	.34   135.11	108.8	72.78	53		(83)
ľ	ains – internal a	and solar	(84)m =	: (73)m +	(83)m	, watts						1	
(84)m=	ains – internal a	and solar 615.32	(84)m =	: (73)m + 584.05			533		108.8 545.65		53		(83)
(84)m= [ 7. Me	ains — internal a 568.46 604.76 an internal temp	615.32 Derature	(84)m = 605.26 (heating	584.05 season)	(83)m 552.04	, watts 531.62	533	.74 543.64					(84)
(84)m= 7. Me: Temp	ains – internal a 568.46 604.76 an internal temperature during h	615.32 Derature (neating po	(84)m = 605.26 (heating eriods in	584.05 season)	(83)m 552.04 g area	, watts 531.62 from Tab	533	.74 543.64				21	
(84)m= 7. Me: Temp	ains – internal a 568.46 604.76  an internal temperature during hation factor for g	615.32  Derature ( neating policy ains for li	(84)m = 605.26 (heating eriods in iving are	season) the living	(83)m 552.04 g area (see Ta	from Tabable 9a)	533 ole 9	.74 543.64 .Th1 (°C)	545.65	5 541.74	546.18	21	(84)
7. Mea	ains – internal a 568.46 604.76  an internal temperature during hation factor for g  Jan Feb	615.32  Derature (neating polarins for limited Mar	(84)m = 605.26 (heating eriods in iving are Apr	season) the living a, h1,m ( May	(83)m 552.04 g area see Ta Jun	from Tabable 9a)	533 ole 9	.74 543.64 Th1 (°C)	545.65 Oct	5 541.74 Nov	546.18 Dec	21	(84)
7. Med Temp Utilisa (86)m=	ains – internal a 568.46 604.76  an internal temperature during hation factor for g  Jan Feb 1 1	615.32  Derature (neating policy for line)  Mar	(84)m = 605.26 (heating eriods in iving are Apr 0.99	season) the living a, h1,m ( May 0.98	(83)m 552.04 g area (see Ta Jun 0.9	, watts  531.62  from Tab able 9a)  Jul  0.73	533 ole 9,	.74	545.65	5 541.74	546.18	21	(84)
(84)m= 7. Mean Temp Utilisa (86)m= Mean	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb  1 1  internal temper	eand solar 615.32 Derature (neating positions for limited in limit	(84)m = 605.26 (heating eriods in iving are Apr 0.99 iving are	season) a the living ea, h1,m ( May 0.98  ea T1 (fol	(83)m 552.04 g area see Ta Jun 0.9	from Tabable 9a) Jul 0.73	533  ole 9,  Al  0.7	.74 543.64  Th1 (°C)  ug Sep '5 0.93  Table 9c)	545.65 Oct 0.99	Nov 1	546.18  Dec 1	21	(84)
7. Mean (87)m=	ains – internal a 568.46 604.76  an internal temperature during hation factor for g Jan Feb 1 1  internal temper 20.3 20.36	eand solar 615.32 Derature (neating positions for limited in limit	(84)m = 605.26 (heating eriods in iving are Apr 0.99 iving are 20.61	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77	(83)m 552.04 g area see Ta Jun 0.9 low ste 20.9	from Tabable 9a) Jul 0.73 pps 3 to 7 20.95	533 Die 9, Ai 0.7 in T 20.	Th1 (°C)  ug Sep '5 0.93  Table 9c)  95 20.87	545.65 Oct	Nov 1	546.18 Dec	21	(84)
7. Med Temp Utilisa (86)m= Mean (87)m= Temp	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb  1 1  internal temperature during hation factor for g  Jan Feb  20.3 20.36  erature during hations factor for g	eating portature in land 20.47	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77	g area see Ta Jun 0.9 low stee 20.9 welling	from Table 9a)  Jul  0.73  pps 3 to 7  20.95	533  Die 9,  Ai  0.7  in T  20.	Th1 (°C)  Sep 5 0.93  Table 9c) 95 20.87  9, Th2 (°C)	Oct 0.99	Nov 1 20.46	Dec 1 20.29	21	(84) (85) (86) (87)
7. Mean (87)m=	ains – internal a 568.46 604.76  an internal temperature during hation factor for g Jan Feb 1 1  internal temper 20.3 20.36	eand solar 615.32 Derature (neating positions for limited in limit	(84)m = 605.26 (heating eriods in iving are Apr 0.99 iving are 20.61	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77	(83)m 552.04 g area see Ta Jun 0.9 low ste 20.9	from Tabable 9a) Jul 0.73 pps 3 to 7 20.95	533 Die 9, Ai 0.7 in T 20.	Th1 (°C)  Sep 5 0.93  Table 9c) 95 20.87  9, Th2 (°C)	545.65 Oct 0.99	Nov 1 20.46	546.18  Dec 1	21	(84)
(84)m=  7. Mean Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb  1 1  internal temper 20.3 20.36  erature during hation factor for g	eard solar 615.32  Derature (neating positions for limited positions)  Mar 1  ature in l 20.47  neating positions 20.25  ains for r	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in 20.26 est of dv	season) the living ea, h1,m ( May 0.98 ea T1 (foll 20.77 rest of d 20.26 welling, h.	g area see Ta Jun 0.9 low ste 20.9 welling 20.27 2,m (se	from Table 9a)  Jul  0.73  pps 3 to 7  20.95  g from Table 20.27  pee Table	533 ble 9 A 0.7 in T 20. able 9 20. 9a)	Th1 (°C)  ug Sep '5 0.93  Table 9c)  95 20.87  0, Th2 (°C)  27 20.27	Oct 0.99 20.68	Nov 1 20.46	Dec 1 20.29 20.25	21	(84) (85) (86) (87) (88)
7. Med Temp Utilisa (86)m= Mean (87)m= Temp (88)m=	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb 1 1  internal temper 20.3 20.36  erature during hation factor during hation factor for g  20.24 20.24	perature (neating perature in leating per	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in 20.26	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77 rest of d 20.26	g area (see Ta Jun 0.9) low stee 20.9 welling 20.27	ywatts  531.62  from Takable 9a)  Jul  0.73  pps 3 to 7  20.95  from Takable 9a)	533  A  0.7  in T  20.	Th1 (°C)  ug Sep '5 0.93  Table 9c)  95 20.87  9, Th2 (°C)  27 20.27	Oct 0.99	Nov 1 20.46	Dec 1 20.29	21	(84) (85) (86) (87)
(84)m=  7. Mean Temp Utilisa (86)m=  Mean (87)m=  Temp (88)m=  Utilisa (89)m=	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb 1 1  internal temper 20.3 20.36  erature during hation factor for g  1 20.24 20.24  ation factor for g 1 1  internal temperature during hation factor for g 1 1	perature (neating positions for limited positions)  Mar 1	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in 20.26 est of dv 0.99	season) the living ea, h1,m ( May 0.98 ea T1 (foll 20.77 rest of d 20.26 welling, h. 0.97	(83)m 552.04 g area (see Ta Jun 0.9 low ste 20.9 welling 20.27 2,m (se 0.85	from Table 9a)  Jul  0.73  pps 3 to 7  20.95  from Table 9a  0.63	533 ble 9 A 0.7 in T 20. 9a) 0.6	Th1 (°C)  ug Sep '5 0.93  Table 9c)  95 20.87  0, Th2 (°C)  27 20.27	Oct 0.99 20.68	Nov 1 20.46	Dec 1 20.29 20.25	21	(84) (85) (86) (87) (88)
(84)m=  7. Mean Temp Utilisa (86)m=  Mean (87)m=  Temp (88)m=  Utilisa (89)m=	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb  1 1  internal temperature during hation factor for g  20.3 20.36  erature during hation factor for g  1 1 1	perature (neating positions for limited positions)  Mar 1	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in 20.26 est of dv	season) the living ea, h1,m ( May 0.98 ea T1 (foll 20.77 rest of d 20.26 welling, h. 0.97	(83)m 552.04 g area (see Ta Jun 0.9 low ste 20.9 welling 20.27 2,m (se 0.85	from Table 9a)  Jul  0.73  pps 3 to 7  20.95  from Table 9a  0.63	533 ble 9 A 0.7 in T 20. 9a) 0.6	Th1 (°C)  ug Sep 75 0.93  Table 9c) 95 20.87  0, Th2 (°C) 27 20.27  to 7 in Table 21 20.13	Oct 0.99 20.68 20.26 0.99 e 9c) 19.86	Nov 1 20.46 20.25	Dec 1 20.29 20.25 1	21	(84) (85) (86) (87) (88) (89)
(84)m=  7. Me Temp Utilisa (86)m=  Mean (87)m=  Temp (88)m=  Utilisa (89)m=  Mean	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb 1 1  internal temper 20.3 20.36  erature during hation factor for g  1 20.24 20.24  ation factor for g 1 1  internal temperature during hation factor for g 1 1	perature (neating perature in I 20.47 neating perature in I 20.25 ains for reature in tertains for rea	(84)m = 605.26 (heating eriods in 1.0.99 iving are 20.61 eriods in 20.26 est of dw 0.99 the rest of	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77 rest of d 20.26 welling, h: 0.97	(83)m 552.04 g area (see Ta Jun 0.9 low stee 20.9 welling 20.27 2,m (see 0.85 g T2 (f	from Takable 9a)  Jul  0.73  pps 3 to 7  20.95  from Takable 9a)  0.63  collow steel	533  A  0.7  in T  20.  9a)  0.6	Th1 (°C)  ug Sep 75 0.93  Table 9c) 95 20.87  0, Th2 (°C) 27 20.27  to 7 in Table 21 20.13	Oct 0.99 20.68 20.26 0.99 e 9c) 19.86	Nov 1 20.46 20.25	Dec 1 20.29 20.25 1	21	(84) (85) (86) (87) (88) (89)
(84)m=  7. Me Temp Utilisa (86)m=  Mean (87)m=  Temp (88)m=  Utilisa (89)m=  Mean (90)m=	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb 1 1  internal temper 20.3 20.36  erature during hation factor for g  1 20.24 20.24  ation factor for g 1 1  internal temperature during hation factor for g 1 1	perature (neating perature in I 20.47 neating perature in I 20.25 ains for reature in tature in	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in 20.26 est of dv 0.99 the rest of 19.76	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77 rest of d 20.26 welling, h 0.97 of dwellin 19.98	(83)m 552.04 g area see Ta Jun 0.9 low ste 20.9 welling 20.27 2,m (se 0.85 g T2 (f	from Table 9a)  Jul  0.73  pps 3 to 7  20.95  from Table 0.63  ollow stee 20.21	533 ble 9 A 0.7 in T 20. 9a) 0.6 eps 3	Th1 (°C)  ug Sep '5 0.93  Table 9c)  95 20.87  9, Th2 (°C)  27 20.27  to 7 in Table 21 20.13	Oct 0.99 20.68 20.26 0.99 e 9c) 19.86	Nov 1 20.46 20.25	Dec 1 20.29 20.25 1		(84) (85) (86) (87) (88) (89)
(84)m=  7. Me Temp Utilisa (86)m=  Mean (87)m=  Temp (88)m=  Utilisa (89)m=  Mean (90)m=	ains – internal a  568.46 604.76  an internal temperature during hation factor for g  Jan Feb  1 1  internal temper  20.3 20.36  erature during hation factor for g  1 1  internal temper  1 1  internal temper  1 1  internal temper  1 1  internal temper  1 1	perature (neating perature in I 20.47 neating perature in I 20.25 ains for reature in tature in	(84)m = 605.26 (heating eriods in iving are 20.61 eriods in 20.26 est of dv 0.99 the rest of 19.76	season) the living ea, h1,m ( May 0.98 ea T1 (fol 20.77 rest of d 20.26 welling, h 0.97 of dwellin 19.98	(83)m 552.04 g area see Ta Jun 0.9 low ste 20.9 welling 20.27 2,m (se 0.85 g T2 (f	from Table 9a)  Jul  0.73  pps 3 to 7  20.95  from Table 0.63  ollow stee 20.21	533 ble 9 A 0.7 in T 20. 9a) 0.6 eps 3	Th1 (°C)  ug Sep 5 0.93  fable 9c) 95 20.87  9, Th2 (°C) 27 20.27  to 7 in Table 21 20.13  full factors of the	Oct 0.99 20.68 20.26 0.99 e 9c) 19.86	Nov 1 20.46 20.25	Dec 1 20.29 20.25 1		(84) (85) (86) (87) (88) (89)







Water heating fuel used 711.79 Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside (230a) 293.68 sum of (230a)...(230g) = Total electricity for the above, kWh/year (231) 293.68 Electricity for lighting 573.57 (232)12a. CO2 emissions – Individual heating systems including micro-CHP **Emission factor Emissions Energy** kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x (261) 0.519 809.91 Space heating (secondary) (215) x (263)0.519 (219) x Water heating (264)0.519 369.42 (261) + (262) + (263) + (264) =Space and water heating (265)1179.33 (231) x Electricity for pumps, fans and electric keep-hot 0.519 152.42 (267)(232) x Electricity for lighting (268)0.519 297.68 sum of (265)...(271) = Total CO2, kg/year (272)1629.43 **Dwelling CO2 Emission Rate**  $(272) \div (4) =$ (273)13.81 El rating (section 14) (274)87



User Details: **Assessor Name:** Stroma Number: **Software Version: Software Name:** Stroma FSAP 2012 Version: 1.0.4.23 Property Address: Gate House (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) **Basement** 36.22 (1a) x 3.2 (2a) =(3a) 115.9 Ground floor (1b) x (3b) 47.4 3.2 (2b) =151.68 First floor 36.22 (1c) x 3.2 (2c) 115.9 (3c)Second floor (1d) x 37.02 2.76 (2d) 102.18 (3d)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 156.86 (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =Dwelling volume 485.66 (5)2. Ventilation rate: main secondary other total m³ per hour heating heating x 40 =Number of chimneys 0 n 0 (6a) 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)0 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =0 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8)0 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) 0 (9)Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)(8) + (10) + (11) + (12) + (13) + (15) =Infiltration rate (16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1 Shelter factor  $(20) = 1 - [0.075 \times (19)] =$ 0.92 (20)Infiltration rate incorporating shelter factor  $(21) = (18) \times (20) =$ (21)0.14 Infiltration rate modified for monthly wind speed

Mar

Apr

Jun

May

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb



Monthly avera	ige wind s	speed fr	om Tabl	le 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 (2	22a)m = (	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	
Adjusted infiltr	ation rate	e (allowi	ina for st	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	]	
Calculate effe		•	rate for t	he appli	cable ca	se	Į.						(oc. )
If exhaust air h			endix N. (2	23b) = (23a	ı) × Fmv (e	eguation (I	N5)) . othe	rwise (23b	) = (23a)			0.5	(23a) (23b)
If balanced with		0		, ,	, ,	. `	,, .	,	(===)			74.8	(23c)
a) If balance	ed mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [	1 – (23c)		(200)
(24a)m= 0.3	0.3	0.3	0.28	0.28	0.26	0.26	0.25	0.26	0.28	0.28	0.29	]	(24a)
b) If balance	ed mecha	inical ve	ntilation	without	heat red	covery (I	ЛV) (24b	o)m = (22	2b)m + (2	23b)		-	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole h									<b>5</b> (00)	`			
(24c)m = 0	n < 0.5 ×	(23b), t	nen (240	(230)	o); otner	wise (24	c) = (221)	o) m + 0.	$.5 \times (230)$	0	0	1	(24c)
d) If natural		-			-						U		(210)
,	n = 1, the								0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air		rate - er	`	_	o) or (24	c) or (24	d) in box	x (25)				,	
(25)m= 0.3	0.3	0.3	0.28	0.28	0.26	0.26	0.25	0.26	0.28	0.28	0.29		(25)
3. Heat losse	es and he	at loss p	paramet	er:									
ELEMENT	Gros area	_	Openin	as	A								A 37.1
Doors Type 1		(m²)	m		Net Ar A ,r		U-val W/m2		A X U (W/l	≺)	k-value kJ/m²-		A X k kJ/K
		(m²)				m²			_	<) 			
Doors Type 2		(m²)			A ,r	m² x	W/m2	2K	(W/ł	<) 			kJ/K
Doors Type 3		(m²)			A ,r	m <sup>2</sup>	1.2 1.2 1.2	2K =   =   =	(W/k 4.896	<) 			kJ/K (26)
Doors Type 3 Windows Type		(m²)			A ,r 4.08	m <sup>2</sup>	W/m2 1.2 1.2 1.2 /[1/( 1.1 )+	= = = = = = = = = = = = = = = = = = =	(W/k 4.896 2.916	<) 			kJ/K (26) (26)
Doors Type 3 Windows Type Windows Type	e 2	(m²)			A ,r 4.08 2.43	m <sup>2</sup>	1.2 1.2 1.2	= = = = = = = = = = = = = = = = = = =	(W/F 4.896 2.916 2.916	<) 			kJ/K (26) (26) (26)
Doors Type 3 Windows Type Windows Type Windows Type	e 2 e 3	(m²)			A ,r 4.08 2.43 2.43 0.408	m <sup>2</sup>	W/m2  1.2  1.2  1.2  (1/(1.1)+ (1/(1.1)+ (1/(1.1)+	=     =     =     0.04  =     0.04  =	(W/k 4.896 2.916 2.916 0.43	<)			kJ/K (26) (26) (26) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4	(m²)			A ,r 4.08 2.43 2.43 0.408 1.84	m <sup>2</sup>	W/m2  1.2  1.2  1.2  (1/(1.1)+ (1/(1.1)+ (1/(1.1)+	EK =   =   =   =   =   =   =   =   =   =	(W/H 4.896 2.916 2.916 0.43 1.94	<)			kJ/K (26) (26) (26) (27) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5	(m²)			A ,r 4.08 2.43 2.43 0.408 1.84 0.408	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK =   =   =   =   =   =   =   =   =   =	(W/k 4.896 2.916 2.916 0.43 1.94 0.43	<)			kJ/K (26) (26) (26) (27) (27) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5 e 6	(m²)			A ,r 4.08 2.43 2.43 0.408 1.84 0.408	m <sup>2</sup>	W/m2  1.2  1.2  (1/( 1.1 )+ (1/( 1.1 )+ (1/( 1.1 )+ (1/( 1.1 )+ (1/( 1.1 )+ (1/( 1.1 )+	EK =   =   =   =   =   =   =   =   =   =	(W/k 4.896 2.916 2.916 0.43 1.94 0.43	<)			kJ/K (26) (26) (26) (27) (27) (27) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5 e 6	(m²)			A ,r  4.08  2.43  0.408  1.84  0.907  0.907	x       x <t< td=""><td>W/m2  1.2  1.2  1.2  (1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+</td><td>EK = = = = = = = = = = = = = = = = = = =</td><td>(W/H 4.896 2.916 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41</td><td>&lt;)</td><td></td><td></td><td>kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27)</td></t<>	W/m2  1.2  1.2  1.2  (1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+ /(1/(1.1)+	EK = = = = = = = = = = = = = = = = = = =	(W/H 4.896 2.916 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41	<)			kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27)
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5 e 6 e 7 e 8	(m²)			A ,r  4.08  2.43  0.408  1.84  0.907  0.907  1.34  2.72	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK = = = = = = = = = = = = = = = = = = =	(W/h 4.896 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41 2.87	<)			kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9	(m²)			A ,r  4.08  2.43  0.408  1.84  0.907  0.907  1.34  2.72  1.82	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+ /[1/(1.1)+	EK = = = = = = = = = = = = = = = = = = =	(W/h 4.896 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41 2.87 1.92	<)			kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 9 e 10	(m²)			A ,r  4.08  2.43  0.408  1.84  0.907  0.907  1.34  2.72	m <sup>2</sup>	W/m2  1.2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	EK =   =   =   =   =   =   =   =   =   =	(W/h 4.896 2.916 0.43 1.94 0.43 1.94 0.96 0.96 1.41 2.87	<)			kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27



Windows Type 12	2.91 X	1/[1/( 1.1 )+	0.04] =	3.07				(27)
Windows Type 13	0.58 X	1/[1/( 1.1 )+	0.04] =	0.61				(27)
Floor Type 1	36.22 ×	0.12	=	4.3464				(28)
Floor Type 2	47.41 ×	0.12	=	5.6892				(28)
Walls Type1 66.24 4.08	62.16 ×	0.12	=	7.46				(29)
Walls Type2 76.51 11.17	65.34 ×	0.11	= [	7.48				(29)
Walls Type3 66.24 8.6	57.64 ×	0.12	= [	6.92				(29)
Walls Type4 75.9 4.94	70.96 ×	0.12	= [	8.52				(29)
Roof 45 0	45 X	0.13	= [	5.85				(30)
Total area of elements, m <sup>2</sup>	413.52						_	(31)
Party wall	14.08 ×	0	= [	0				(32)
Party wall	14.08 ×	0	=	0				(32)
Party wall	14.08 ×	0	=	0				(32)
Party wall	9.91 ×	0	=	0				(32)
Party floor	36.22							(32a)
Party floor	37.02							(32a)
Party ceiling	36.22							(32b)
Party ceiling	47.4							(32b)
Party ceiling	36.22							(32b)
* for windows and roof windows, use effective window U-va ** include the areas on both sides of internal walls and par		g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	_
Fabric heat loss, W/K = S (A x U)		(26)(30)	+ (32) =				77.9	(33)
Heat capacity Cm = S(A x k)			((28)	.(30) + (32	2) + (32a).	(32e) =	37002.6	(34)
The rmal mass parameter (TMP = $Cm \div TFA$ ) in	n kJ/m²K		Indica	tive Value:	Medium		250	(35)
For design assessments where the details of the construct can be used instead of a detailed calculation.	ion are not known p	recisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridges: S (L x Y) calculated using Ap	pendix K						62.03	(36)
if details of thermal bridging are not known (36) = $0.05 \times (3)$	•						000	<b>」</b> ` ′
Total fabric heat loss			(33) +	(36) =			139.93	(37)
Ventilation heat loss calculated monthly		1		= 0.33 × (	25)m x (5)	ı	ı	
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)m= 48.55 47.99 47.43 44.65 44.1	41.32 41.32	40.76	42.43	44.1	45.21	46.32		(38)
Heat transfer coefficient, W/K	104.05 1.04.05	1,00,00		= (37) + (3	-	400.05		
(39)m= 188.48 187.92 187.36 184.58 184.03	181.25 181.25	180.69	182.36	184.03 Average =	185.14	186.25	184.45	(39)
Heat loss parameter (HLP), W/m²K				= (39)m ÷		12 / 12=	104.43	<b>_</b> (33)
(40)m= 1.2 1.2 1.19 1.18 1.17	1.16 1.16	1.15	1.16	1.17	1.18	1.19		
N. all and death of the state o				Average =	Sum(40) <sub>1</sub> .	12 /12=	1.18	(40)
Number of days in month (Table 1a)	lug lud	Δ	Can	0-4	Navi	Daa		
Jan   Feb   Mar   Apr   May   (41)m=   31   28   31   30   31	Jun         Jul           30         31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(41)
(11)	1 00 1 01	1 "						(2.7)

4. Water heating energy requirement:

kWh/year:

2.94

Assumed occupancy, N if TFA > 13.9,  $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ 

 $Str_{\mbox{\scriptsize MP}} \mbox{${\rm MP}$ 123.19}, \mbox{${\rm We}$ rsioh} : 1.0.4.23 \mbox{ (SAP } 9.92) - \mbox{${\rm http://www.stroma.com}$}$ 

Annual average hot water usage in litres per day Vd average =  $(25 \times N) + 36$ 

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(42)



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) 169.86 148.56 153.31 133.66 128.25 110.67 102.55 117.68 119.08 138.78 151.49 164.5 (45)m =Total =  $Sum(45)_{1...12}$  = 1638.38 (45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)25.48 22.28 20.05 19.24 16.6 15.38 20.82 22.72 24.68 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 305 (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): (48)1.63 Temperature factor from Table 2b 0.54 (49)Energy lost from water storage, kWh/year  $(48) \times (49) =$ (50)0.88 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) (51)0 If community heating see section 4.3 Volume factor from Table 2a 0 (52)Temperature factor from Table 2b 0 (53)Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)Enter (50) or (54) in (55) (55)0.88 Water storage loss calculated for each month  $((56)m = (55) \times (41)m$ (56)m =27.29 24.65 27.29 26.41 27.29 26.41 27.29 27.29 26.41 27.29 26.41 (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 **2**7.29 24.65 27.29 26.41 27.29 26.41 27.29 27.29 26.41 27.29 26.41 27.29 (57)(57)m =(58)Primary circuit loss (annual) from Table 3 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 thermostat) (59)(59)m =23.26 21.01 23.26 23.26 22.51 23.26 22.51 23.26 22.51 23.26 Combi loss calculated for each month (61)m = (60)  $\div$  365 x (41)m 0 0 0 0 0 (61)(61)m =0 0 Total heat required for water heating calculated for each month  $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ 182.57 220.41 194.22 203.85 (62)178.79 159.58 153.1 168.22 168 189.33 200.4 215.05 (62)m =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)(63)m =0 0 0 0 0 0 0 Output from water heater 220.41 194.22 203.85 (64)m =182.57 178.79 159.58 153.1 168.22 168 189.33 200.4 215.05 (64)Output from water heater (annual) 1...12 2233.55 Heat gains from water heating, kWh/month  $0.25 (0.85 \times (45)) + (61) + 0.8 \times ((46)) + (57) + (59) +$ 74.54 79.57 (65)(65)m =96.92 91.41 83.57 83.08 75.93 78.73 86.58 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



(00)	<u> </u>	<del> 1</del>	447.00   447.4	I	47.00	447.00	4.47	00 1 447 00	1,47.0	0 1 4 4 7 0 0		1	(00)
(66)m= 147.2		7.22	147.22 147.2		47.22	147.22	147		ļ	2 147.22	147.22		(66)
· -	ns (calculated		<del></del>		1			-	_			1	(67)
(67)m= 32.38		3.39	17.71   13.2	!_	11.17	12.07	15.	!	26.75	31.22	33.28		(67)
	gains (calculat			<del>-i-</del>			<u> </u>			.   ==		1	(00)
(68)m= 327.8		2.72	304.46 281.4		259.77	245.3	241		268.7	3 291.77	313.42		(68)
ے ا	ns (calculated	<del></del> i	<del></del>				_			T	l	1	(00)
(69)m= 37.72		7.72	37.72 37.7	2	37.72	37.72	37.	72 37.72	37.72	37.72	37.72		(69)
	fans gains (Ta		<del></del>	_			_	<u> </u>	<del>-</del>	<u> </u>	<u> </u>	1	(70)
(70)m= 0		0	0 0		0	0	0	0	0	0	0		(70)
	evaporation (r			$\neg$	<del></del>			- 1	1	ĺ	1	1	(74)
(71)m= -117.7		!	-117.78 -117.	78   -′	117.78	-117.78	-117	.78 -117.78	-117.7	8 -117.78	-117.78		(71)
	ng gains (Tabl	<del></del> _			-				1		1	1	(==)
(72)m= 130.2		2.87	116.08 111.6	67 1	05.46	100.18	106	<u> </u>	ļ	<u> </u>	127.87		(72)
Total intern	<del></del>		1		<u> </u>		<u>`</u>	3)m + (69)m +	<del>`</del>	<del>`                                    </del>		1	<b>.</b>
(73)m= 557.		6.14	505.41 473.4	49 4	143.57	424.72	431	.7 448.05	479.0	1 514.46	541.74		(73)
6. Solar ga		a a a la r	flow from Toble	es en	d 00000i	atad agua	tiona	ta convert to t	ha annlis	abla arianta	tion		
	e calculated using Access Fact	-	Area	oa and	Flu		lions		пе аррік	FF	uori.	Gains	
Onemation.	Table 6d	Oi	m <sup>2</sup>			ole 6a		g_ Table 6b		Table 6c		(W)	
North 0.9	× 0.77	Пх	0.41	) 1 x/	1	0.63	l x	0.45	×	0.67	=	0.91	(74)
North 0.9		」 ^ □ x	1.84	X	_	0.63	X	0.45	×	0.67		4.09	(74)
North 0.9			1.34			0.63	X	0.45	×	0.67	= =	2.98	(74)
North 0.9			2.72	X ا	<b> </b>	0.63	X	0.45	×	0.67	= =	6.04	(74)
North 0.9		]	1.45	<b>1</b> x	$\vdash$	0.63	X	0.45	$=$ $\frac{1}{x}$	0.67	= =	3.22	(74)
North 0.9	0	⊒   x	0.58	]   x		0.63	X	0.45	×	0.67	= =	1.29	(74)
North 0.9		] x	0.41	J		0.32	X	0.45	x	0.67	= =	1.73	(74)
North 0.9		X	1.84	d x		0.32	X	0.45	x	0.67	╡ -	7.81	(74)
North 0.9		X	1.34	d x		0.32	X	0.45	x	0.67	╡ -	5.69	(74)
North 0.9		X	2.72	d x		0.32	X	0.45	x	0.67	╡ -	11.55	(74)
North 0.9		X	1.45	d x		0.32	X	0.45	x	0.67	<del>-</del>	6.16	(74)
North 0.9		x	0.58	d x		0.32	X	0.45	X	0.67	_ =	2.46	(74)
North 0.9		X	0.41	d x		4.53	X	0.45	x	0.67	<del>-</del>	2.94	(74)
North 0.9		X	1.84	d x		4.53	X	0.45	x	0.67	╡ -	13.28	(74)
North 0.9		X	1.34	d x		4.53	X	0.45	=  x	0.67	╡ -	9.67	(74)
North 0.9		X	2.72	] x		4.53	X	0.45	X	0.67	= =	19.62	(74)
North 0.9		X	1.45	] x		4.53	x	0.45	X	0.67	= =	10.46	(74)
North 0.9		X	0.58	] x		4.53	X	0.45	×	0.67	= =	4.18	(74)
North 0.9		]	0.41	] ^		5.46	x	0.45	= x	0.67	= -	4.73	(74)
North 0.9		_	1.84	] ^		5.46	x	0.45	= x	0.67	= -	21.32	(74)
North 0.9		^   x	1.34	^   x		5.46	x	0.45	T x	0.67		15.53	(74)
0.9	0.77	」^	1.04	_ ^		0.40	^	0.40	^	U.07		10.00	(′, ¬,



	_		-										_
North	0.9x	0.77	X	2.72	X	55.46	X	0.45	X	0.67	=	31.52	(74)
North	0.9x	0.77	X	1.45	X	55.46	X	0.45	X	0.67	=	16.8	(74)
North	0.9x	0.77	X	0.58	X	55.46	X	0.45	X	0.67	=	6.72	(74)
North	0.9x	0.77	X	0.41	X	74.72	X	0.45	X	0.67	=	6.37	(74)
North	0.9x	0.77	X	1.84	X	74.72	X	0.45	X	0.67	=	28.72	(74)
North	0.9x	0.77	X	1.34	x	74.72	X	0.45	X	0.67	=	20.92	(74)
North	0.9x	0.77	X	2.72	X	74.72	X	0.45	X	0.67	] =	42.46	(74)
North	0.9x	0.77	X	1.45	X	74.72	X	0.45	X	0.67	=	22.64	(74)
North	0.9x	0.77	X	0.58	X	74.72	X	0.45	X	0.67	=	9.05	(74)
North	0.9x	0.77	X	0.41	X	79.99	X	0.45	X	0.67	] =	6.82	(74)
North	0.9x	0.77	X	1.84	X	79.99	X	0.45	X	0.67	=	30.75	(74)
North	0.9x	0.77	X	1.34	X	79.99	X	0.45	X	0.67	=	22.39	(74)
North	0.9x	0.77	X	2.72	x	79.99	X	0.45	X	0.67	=	45.46	(74)
North	0.9x	0.77	X	1.45	X	79.99	X	0.45	X	0.67	=	24.23	(74)
North	0.9x	0.77	X	0.58	X	79.99	X	0.45	X	0.67	=	9.69	(74)
North	0.9x	0.77	X	0.41	x	74.68	X	0.45	x	0.67	=	6.37	(74)
North	0.9x	0.77	X	1.84	X	74.68	X	0.45	X	0.67	=	28.71	(74)
North	0.9x	0.77	X	1.34	×	74.68	Х	0.45	X	0.67	-	20.91	(74)
North	0.9x	0.77	x	2.72	х	74.68	x	0.45	x	0.67	=	42.44	(74)
North	0.9x	0.77	X	1.45	х	74.68	x	0.45	x	0.67	=	22.62	(74)
North	0.9x	0.77	X	0.58	X	74.68	X	0.45	x	0.67	=	9.05	(74)
North	0.9x	0.77	X	0.41	x	59.25	Х	0.45	x	0.67	=	5.05	(74)
North	0.9x	0.77	X	1.84	х	59.25	X	0.45	x	0.67	=	22.78	(74)
North	0.9x	0.77	X	1.34	Х	59.25	X	0.45	X	0.67	=	16.59	(74)
North	0.9x	0.77	X	2.72	X	59.25	X	0.45	X	0.67	=	33.67	(74)
North	0.9x	0.77	X	1.45	X	59.25	X	0.45	X	0.67	=	17.95	(74)
North	0.9x	0.77	X	0.58	x	59.25	X	0.45	X	0.67	=	7.18	(74)
North	0.9x	0.77	X	0.41	X	41.52	X	0.45	X	0.67	=	3.54	(74)
North	0.9x	0.77	X	1.84	x	41.52	X	0.45	X	0.67	=	15.96	(74)
North	0.9x	0.77	X	1.34	X	41.52	X	0.45	X	0.67	] =	11.62	(74)
North	0.9x	0.77	X	2.72	x	41.52	X	0.45	X	0.67	=	23.59	(74)
North	0.9x	0.77	X	1.45	X	41.52	X	0.45	X	0.67	=	12.58	(74)
North	0.9x	0.77	X	0.58	Х	41.52	X	0.45	X	0.67	=	5.03	(74)
North	0.9x	0.77	X	0.41	x	24.19	X	0.45	X	0.67	=	2.06	(74)
North	0.9x	0.77	X	1.84	x	24.19	X	0.45	X	0.67	=	9.3	(74)
North	0.9x	0.77	X	1.34	x	24.19	X	0.45	X	0.67	=	6.77	(74)
North	0.9x	0.77	X	2.72	x	24.19	X	0.45	X	0.67	=	13.75	(74)
North	0.9x	0.77	X	1.45	x	24.19	x	0.45	X	0.67	=	7.33	(74)
North	0.9x	0.77	X	0.58	x	24.19	x	0.45	x	0.67	] =	2.93	(74)
North	0.9x	0.77	X	0.41	x	13.12	X	0.45	X	0.67	=	1.12	(74)
North	0.9x	0.77	X	1.84	X	13.12	X	0.45	X	0.67	=	5.04	(74)

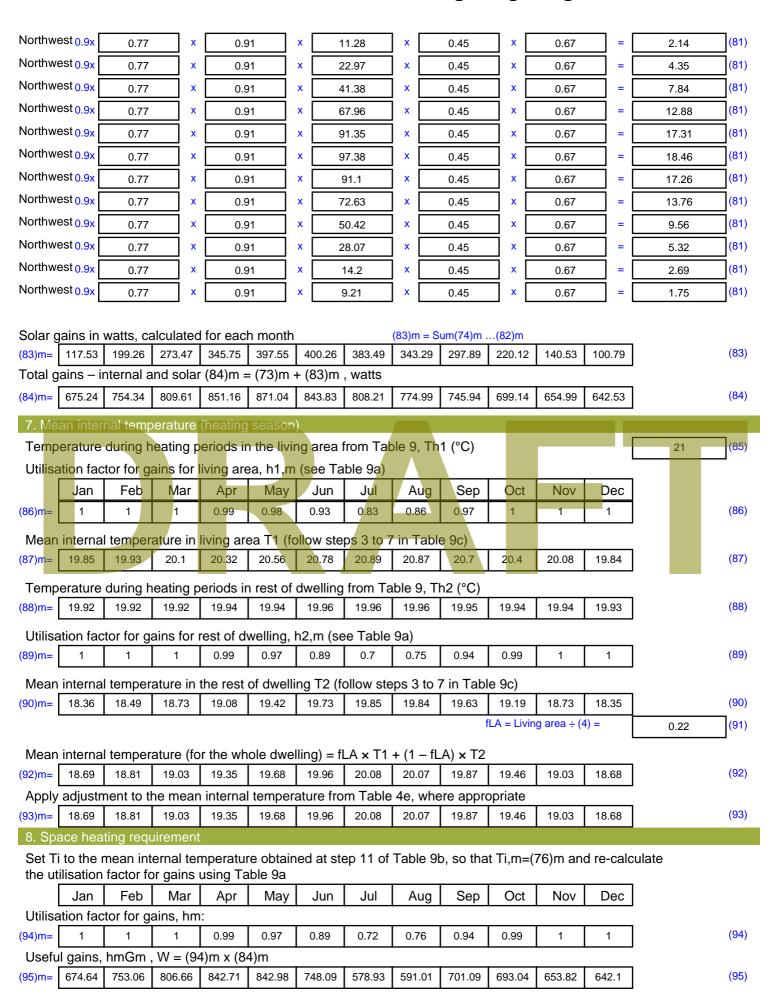


North														
North	North	0.9x	0.77	X	1.34	X	13.12	x	0.45	X	0.67	=	3.67	(74)
North	North	0.9x	0.77	X	2.72	x	13.12	x	0.45	x	0.67	=	7.45	(74)
North	North	0.9x	0.77	X	1.45	x	13.12	x	0.45	x	0.67	=	3.97	(74)
North 0.0x	North	0.9x	0.77	X	0.58	x	13.12	x	0.45	x	0.67	] =	1.59	(74)
North	North	0.9x	0.77	X	0.41	x	8.86	x	0.45	x	0.67	=	0.76	(74)
North	North	0.9x	0.77	X	1.84	x	8.86	x	0.45	x	0.67	=	3.41	(74)
North	North	0.9x	0.77	X	1.34	x	8.86	x	0.45	X	0.67	=	2.48	(74)
Northeast 0.9x	North	0.9x	0.77	X	2.72	X	8.86	x	0.45	X	0.67	=	5.04	(74)
Northeast 0,5% 0,77	North	0.9x	0.77	X	1.45	X	8.86	x	0.45	X	0.67	=	2.69	(74)
Northeast 0.9x	North	0.9x	0.77	X	0.58	x	8.86	x	0.45	x	0.67	=	1.07	(74)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	11.28	x	0.45	X	0.67	=	2.14	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	22.97	x	0.45	X	0.67	=	4.35	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	x	41.38	x	0.45	X	0.67	=	7.84	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	67.96	x	0.45	X	0.67	=	12.88	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	X	91.35	x	0.45	X	0.67	=	17.31	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	x	97.38	x	0.45	x	0.67	=	18.46	(75)
Northeast 0.9x 0.77	Northeast	0.9x	0.77	X	0.91	X	91.1	x	0.45	X	0.67	=	17.26	(75)
Northeast 0.9x	Northeast	0.9x	0.77	x	0.91	X	72.63	X	0.45	X	0.67	=	13.76	(75)
Northeast 0.9x	Northeast	0.9x	0.77	x	0.91	x	50.42	] x	0.45	X	0.67	=	9.56	(75)
Northeast 0.9x	Northeast	0.9x	0.77	X	0.91	х	28.07	x	0.45	X	0.67	=	5.32	(75)
South         0.9x         0.77         x         0.41         x         46,75         x         0.45         x         0.67         =         3.99         (78)           South         0.9x         0.77         x         1.84         x         46,75         x         0.45         x         0.67         =         17.97         (78)           South         0.9x         0.77         x         1.82         x         46,75         x         0.45         x         0.67         =         17.78         (78)           South         0.9x         0.77         x         2.72         x         46,75         x         0.45         x         0.67         =         26,57         (78)           South         0.9x         0.77         x         2.91         x         46,75         x         0.45         x         0.67         =         28,43         (78)           South         0.9x         0.77         x         1.84         x         76,57         x         0.45         x         0.67         =         29,44         (78)           South         0.9x         0.77         x         1.82         x         76,57 </td <td>Northeast</td> <td>0.9x</td> <td>0.77</td> <td>] x</td> <td>0.91</td> <td>X</td> <td>14.2</td> <td>x</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>=</td> <td>2.69</td> <td>(75)</td>	Northeast	0.9x	0.77	] x	0.91	X	14.2	x	0.45	x	0.67	=	2.69	(75)
South 0.9x 0.77 x 1.84 x 46.75 x 0.45 x 0.67 = 17.97 (78)  South 0.9x 0.77 x 1.82 x 46.75 x 0.45 x 0.67 = 17.97 (78)  South 0.9x 0.77 x 2.72 x 46.75 x 0.45 x 0.67 = 26.57 (78)  South 0.9x 0.77 x 2.91 x 46.75 x 0.45 x 0.67 = 28.43 (78)  South 0.9x 0.77 x 0.41 x 76.57 x 0.45 x 0.67 = 29.44 (78)  South 0.9x 0.77 x 1.84 x 76.57 x 0.45 x 0.67 = 29.44 (78)  South 0.9x 0.77 x 1.82 x 76.57 x 0.45 x 0.67 = 29.12 (78)  South 0.9x 0.77 x 2.91 x 76.57 x 0.45 x 0.67 = 29.12 (78)  South 0.9x 0.77 x 2.91 x 76.57 x 0.45 x 0.67 = 43.51 (78)  South 0.9x 0.77 x 2.91 x 76.57 x 0.45 x 0.67 = 43.51 (78)  South 0.9x 0.77 x 0.41 x 97.53 x 0.45 x 0.67 = 44.55 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.5 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 37.09 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 55.43 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 55.43 (78)  South 0.9x 0.77 x 1.84 x 97.53 x 0.45 x 0.67 = 59.3 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 9.4 (78)  South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 42.38 (78)	Northeast	0.9x	0.77	x	0.91	x	9.21	Х	0.45	X	0.67	=	1.75	(75)
South         0.9x         0.77         x         1.82         x         46.75         x         0.45         x         0.67         =         17.78         (78)           South         0.9x         0.77         x         2.72         x         46.75         x         0.45         x         0.67         =         26.57         (78)           South         0.9x         0.77         x         2.91         x         46.75         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57<	South	0.9x	0.77	] x	0.41	x	46.75	X	0.45	x	0.67	=	3.99	(78)
South         0.9x         0.77         x         2.72         x         46.75         x         0.45         x         0.67         =         26.57         (78)           South         0.9x         0.77         x         2.91         x         46.75         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         0.41         x         97.53<	South	0.9x	0.77	x	1.84	x	46.75	X	0.45	x	0.67	=	17.97	(78)
South         0.9x         0.77         x         2.91         x         46.75         x         0.45         x         0.67         =         28.43         (78)           South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         6.53         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         1.84         x         97.53 </td <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>1.82</td> <td>x</td> <td>46.75</td> <td>x</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>=</td> <td>17.78</td> <td>(78)</td>	South	0.9x	0.77	X	1.82	x	46.75	x	0.45	x	0.67	=	17.78	(78)
South         0.9x         0.77         x         0.41         x         76.57         x         0.45         x         0.67         =         6.53         (78)           South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.82         x         97.53 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>2.72</td> <td>x</td> <td>46.75</td> <td>X</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>] =</td> <td>26.57</td> <td>(78)</td>	South	0.9x	0.77	X	2.72	x	46.75	X	0.45	x	0.67	] =	26.57	(78)
South         0.9x         0.77         x         1.84         x         76.57         x         0.45         x         0.67         =         29.44         (78)           South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         46.55         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53 </td <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>2.91</td> <td>X</td> <td>46.75</td> <td>X</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>] =</td> <td>28.43</td> <td>(78)</td>	South	0.9x	0.77	X	2.91	X	46.75	X	0.45	x	0.67	] =	28.43	(78)
South         0.9x         0.77         x         1.82         x         76.57         x         0.45         x         0.67         =         29.12         (78)           South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>0.41</td> <td>x</td> <td>76.57</td> <td>x</td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>6.53</td> <td>(78)</td>	South	0.9x	0.77	X	0.41	x	76.57	x	0.45	X	0.67	=	6.53	(78)
South         0.9x         0.77         x         2.72         x         76.57         x         0.45         x         0.67         =         43.51         (78)           South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         46.55         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>1.84</td> <td>x</td> <td>76.57</td> <td>X</td> <td>0.45</td> <td>x</td> <td>0.67</td> <td>] =</td> <td>29.44</td> <td>(78)</td>	South	0.9x	0.77	X	1.84	x	76.57	X	0.45	x	0.67	] =	29.44	(78)
South         0.9x         0.77         x         2.91         x         76.57         x         0.45         x         0.67         =         46.55         (78)           South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         0.41         x         110.23 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>1.82</td> <td>X</td> <td>76.57</td> <td>X</td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>29.12</td> <td>(78)</td>	South	0.9x	0.77	X	1.82	X	76.57	X	0.45	X	0.67	=	29.12	(78)
South         0.9x         0.77         x         0.41         x         97.53         x         0.45         x         0.67         =         8.31         (78)           South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         0.41         x         110.23 <td>South</td> <td>0.9x</td> <td>0.77</td> <td>X</td> <td>2.72</td> <td>X</td> <td>76.57</td> <td>X</td> <td>0.45</td> <td>X</td> <td>0.67</td> <td>=</td> <td>43.51</td> <td>(78)</td>	South	0.9x	0.77	X	2.72	X	76.57	X	0.45	X	0.67	=	43.51	(78)
South         0.9x         0.77         x         1.84         x         97.53         x         0.45         x         0.67         =         37.5         (78)           South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         2.91         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         0.41         x         110.23         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         1.84         x         110.23         x         0.45         x         0.67         =         42.38         (78)           South         0.9x         0.77         x         1.82         x         110.23	South	0.9x	0.77	X	2.91	X	76.57	X	0.45	X	0.67	=	46.55	(78)
South         0.9x         0.77         x         1.82         x         97.53         x         0.45         x         0.67         =         37.09         (78)           South         0.9x         0.77         x         2.72         x         97.53         x         0.45         x         0.67         =         55.43         (78)           South         0.9x         0.77         x         0.41         x         110.23         x         0.45         x         0.67         =         59.3         (78)           South         0.9x         0.77         x         0.41         x         110.23         x         0.45         x         0.67         =         9.4         (78)           South         0.9x         0.77         x         1.84         x         110.23         x         0.45         x         0.67         =         42.38         (78)           South         0.9x         0.77         x         1.82         x         110.23         x         0.45         x         0.67         =         41.92         (78)	South	0.9x	0.77	X	0.41	X	97.53	X	0.45	X	0.67	=	8.31	(78)
South       0.9x       0.77       x       2.72       x       97.53       x       0.45       x       0.67       =       55.43       (78)         South       0.9x       0.77       x       2.91       x       97.53       x       0.45       x       0.67       =       59.3       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.45       x       0.67       =       9.4       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.45       x       0.67       =       42.38       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.45       x       0.67       =       41.92       (78)		0.9x	0.77	X	1.84	X	97.53	X	0.45	X	0.67	=	37.5	(78)
South       0.9x       0.77       x       2.91       x       97.53       x       0.45       x       0.67       =       59.3       (78)         South       0.9x       0.77       x       0.41       x       110.23       x       0.45       x       0.67       =       9.4       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.45       x       0.67       =       42.38       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.45       x       0.67       =       41.92       (78)	South	0.9x	0.77	X	1.82	X	97.53	X	0.45	X	0.67	=	37.09	(78)
South       0.9x       0.77       x       0.41       x       110.23       x       0.45       x       0.67       =       9.4       (78)         South       0.9x       0.77       x       1.84       x       110.23       x       0.45       x       0.67       =       42.38       (78)         South       0.9x       0.77       x       1.82       x       110.23       x       0.45       x       0.67       =       41.92       (78)		0.9x	0.77	X	2.72	x	97.53	x	0.45	x	0.67	_ =	55.43	(78)
South 0.9x 0.77 x 1.84 x 110.23 x 0.45 x 0.67 = 42.38 (78) South 0.9x 0.77 x 1.82 x 110.23 x 0.45 x 0.67 = 41.92 (78)				X	2.91	X	97.53	x	0.45	x	0.67	_ =	59.3	(78)
South 0.9x 0.77 x 1.82 x 110.23 x 0.45 x 0.67 = 41.92 (78)		0.9x	0.77	X	0.41	x	110.23	x	0.45	x	0.67	_ =	9.4	(78)
On the Control of the		0.9x	0.77	X	1.84	x	110.23	x	0.45	x	0.67	] =	42.38	(78)
South $0.9x$ $0.77$ $\times$ $2.72$ $\times$ $110.23$ $\times$ $0.45$ $\times$ $0.67$ = $62.65$ $(78)$		0.9x	0.77	X	1.82	x	110.23	x	0.45	x	0.67	] =	41.92	(78)
	South	0.9x	0.77	X	2.72	X	110.23	X	0.45	X	0.67	=	62.65	(78)



South	0.9x	0.77	X	2.91	x	110.23	x	0.45	x	0.67	=	67.02	(78)
South	0.9x	0.77	X	0.41	x	114.87	x	0.45	x	0.67	=	9.79	(78)
South	0.9x	0.77	X	1.84	x	114.87	x	0.45	x	0.67	=	44.16	(78)
South	0.9x	0.77	X	1.82	x	114.87	x	0.45	x	0.67	=	43.68	(78)
South	0.9x	0.77	X	2.72	x	114.87	x	0.45	x	0.67	=	65.28	(78)
South	0.9x	0.77	X	2.91	x	114.87	X	0.45	x	0.67	=	69.84	(78)
South	0.9x	0.77	X	0.41	x	110.55	x	0.45	x	0.67	=	9.42	(78)
South	0.9x	0.77	X	1.84	x	110.55	x	0.45	x	0.67	] =	42.5	(78)
South	0.9x	0.77	X	1.82	x	110.55	x	0.45	x	0.67	=	42.04	(78)
South	0.9x	0.77	X	2.72	x	110.55	x	0.45	x	0.67	=	62.83	(78)
South	0.9x	0.77	X	2.91	x	110.55	X	0.45	x	0.67	=	67.21	(78)
South	0.9x	0.77	X	0.41	x	108.01	x	0.45	x	0.67	=	9.21	(78)
South	0.9x	0.77	X	1.84	x	108.01	x	0.45	x	0.67	=	41.53	(78)
South	0.9x	0.77	X	1.82	x	108.01	x	0.45	x	0.67	=	41.07	(78)
South	0.9x	0.77	X	2.72	x	108.01	x	0.45	x	0.67	=	61.38	(78)
South	0.9x	0.77	X	2.91	x	108.01	x	0.45	x	0.67	=	65.67	(78)
South	0.9x	0.77	X	0.41	X	104.89	X	0.45	X	0.67	=	8.94	(78)
South	0.9x	0.77	X	1.84	X	104.89	Х	0.45	X	0.67	-	40.33	(78)
South	0.9x	0.77	X	1.82	х	104.89	x	0.45	x	0.67	=	39.89	(78)
South	0.9x	0.77	X	2.72	х	104.89	x	0.45	x	0.67	=	59.61	(78)
South	0.9x	0.77	X	2.91	X	104.89	X	0.45	x	0.67	=	63.78	(78)
South	0.9x	0.77	X	0.41	х	101.89	Х	0.45	x	0.67	=	8.69	(78)
South	0.9x	0.77	X	1.84	х	101.89	X	0.45	x	0.67	=	39.17	(78)
South	0.9x	0.77	X	1.82	х	101.89	X	0.45	X	0.67	=	38.74	(78)
South	0.9x	0.77	X	2.72	x	101.89	X	0.45	X	0.67	=	57.9	(78)
South	0.9x	0.77	X	2.91	x	101.89	X	0.45	X	0.67	=	61.95	(78)
South	0.9x	0.77	X	0.41	x	82.59	X	0.45	X	0.67	=	7.04	(78)
South	0.9x	0.77	X	1.84	x	82.59	X	0.45	X	0.67	=	31.75	(78)
South	0.9x	0.77	X	1.82	x	82.59	X	0.45	X	0.67	=	31.4	(78)
South	0.9x	0.77	X	2.72	x	82.59	X	0.45	X	0.67	=	46.93	(78)
South	0.9x	0.77	X	2.91	x	82.59	X	0.45	X	0.67	=	50.21	(78)
South	0.9x	0.77	X	0.41	X	55.42	X	0.45	X	0.67	=	4.72	(78)
South	0.9x	0.77	X	1.84	Х	55.42	X	0.45	X	0.67	=	21.31	(78)
South	0.9x	0.77	X	1.82	X	55.42	X	0.45	X	0.67	=	21.07	(78)
South	0.9x	0.77	X	2.72	X	55.42	X	0.45	X	0.67	=	31.49	(78)
South	0.9x	0.77	X	2.91	x	55.42	X	0.45	X	0.67	=	33.69	(78)
South	0.9x	0.77	X	0.41	x	40.4	X	0.45	X	0.67	=	3.44	(78)
South	0.9x	0.77	x	1.84	x	40.4	x	0.45	x	0.67	=	15.53	(78)
South	0.9x	0.77	X	1.82	x	40.4	x	0.45	X	0.67	=	15.36	(78)
South	0.9x	0.77	X	2.72	x	40.4	x	0.45	X	0.67	=	22.96	(78)
South	0.9x	0.77	X	2.91	X	40.4	X	0.45	X	0.67	=	24.56	(78)







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)
Heat loss rate for mean internal temperature, Lm , W					7.1	7.2		(00)
(97)m= 2712.09 2614.25 2348.22 1929.54 1467.8 972.15	1 '	662.77	1052.2	1630.41	2208.54	2697.8		(97)
Space heating requirement for each month, kWh/mon	th = 0.02	24 x [(97	ı——— )m – (95	)m] x (4 <sup>-</sup>	1)m			
(98)m= 1515.86 1250.71 1146.92 782.51 464.87 0	0	0	0	697.41	1119.4	1529.44		
	-	Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	8507.12	(98)
Space heating requirement in kWh/m²/year							54.23	(99)
9a. Energy requirements – Individual heating systems i	including	g micro-C	CHP)					
Space heating:						ı		_
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) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1							383.71	(206)
Efficiency of secondary/supplementary heating system	n, %						0	(208)
Jan Feb Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)								
1515.86 1250.71 1146.92 782.51 464.87 0	0	0	0	697.41	1119.4	1529.44		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$								(211)
395.05 325.95 298.9 203.93 121.15 0	0	O Tota	0	181.75	291.73	398.59		٦٠٠٠
		Tota	ıl (kWh/yea	ar) =5um(2	11) <sub>15,1012</sub>		2217.05	(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		
		Tota	ıl (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water heating								_
Output from water heater (calculated above)								
220.41 194.22 203.85 182.57 178.79 159.58	153.1	168.22	168	189.33	200.4	215.05		<b>-</b>
Efficiency of water heater	T	T					300.39	(216)
(217)m= 300.39 300.39 300.39 300.39 300.39 300.39	300.39	300.39	300.39	300.39	300.39	300.39		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m								
(219)m= 73.38 64.66 67.86 60.78 59.52 53.13	50.97	56	55.93	63.03	66.71	71.59		
		Tota	I = Sum(2	19a) <sub>112</sub> =			743.55	(219)
Annual totals				k\	Wh/year		kWh/year	
Space heating fuel used, main system 1							2217.05	╛
Water heating fuel used							743.55	
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or positive i	nput fror	m outside	Э			555.48		(230a)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =	'		555.48	(231)
Electricity for lighting							571.83	(232)



12a. CO2 emissions - Individual heating systems including micro-CHP

	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519 =	1150.65 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.519 =	385.9 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1536.55 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	288.29 (267)
Electricity for lighting	(232) x	0.519 =	296.78 (268)
Total CO2, kg/year	sum	of (265)(271) =	2121.62 (272)
Dwelling CO2 Emission Rate	(272	?) ÷ (4) =	13.53 (273)
EI rating (section 14)			86 (274)





User Details: **Assessor Name:** Stroma Number: **Software Version: Software Name:** Stroma FSAP 2012 Version: 1.0.4.23 Property Address: Triplex (Be Green) Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) **Basement** 70.32 (1a) x 3.2 (2a) =225.02 (3a) Ground floor (1b) x (2b) (3b) 82.3 3.2 263.36 First floor 115 (1c) x (2c) 310.5 (3c)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 267.62 (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =Dwelling volume (5) 798.88 2. Ventilation rate: other total main secondary m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues (6b) 0 0 0 0 0 Number of intermittent fans x 10 =(7a)0 0 x 10 =Number of passive vents 0 0 (7b) Number of flueless gas fires x 40 =0 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = 0 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)O Additional infiltration (10)[(9)-1]x0.1 =0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ (15)0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)3 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.15 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.13 Infiltration rate modified for monthly wind speed Jan Feb Mar Jul Sep Oct Nov Apr May Jun Aug Dec Monthly average wind speed from Table 7

4.4

4.3

3.8

3.8

3.7

4.9

(22)m =

5.1

5

4.3

4.5

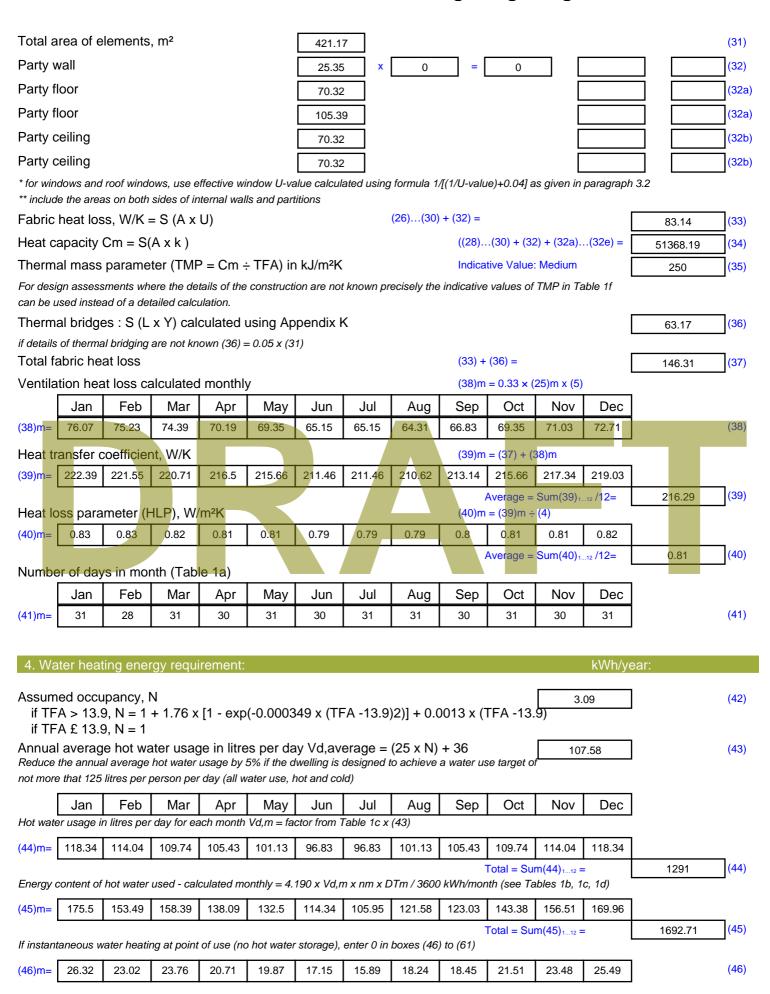
4.7

4



Wind Factor (	(22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infilt	ration rat	e (allowi	ng for sl	nelter an	d wind s	peed) =	: (21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effe		_	rate for t	he appli	cable ca	se	!	!		!			
If mechanic			andiv N (2	3h) - (23a	a) v Emy (e	auation (	N5N othe	nvice (23k	n) = (33a)			0.	
If balanced wi									)) = (23a)			0.	
a) If balanc		•	-	_					2h)m + (	23h) <b>x</b> [1	 1 <i>– (2</i> 3c)	74 ÷ 1001	.8 (23c)
(24a)m= 0.29	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28	. 100]	(24a)
b) If balanc	ed mech	anical ve	entilation	without	heat rec	overy (I	MV) (24t	m = (2)	2b)m + (	23b)		l	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole	house ex	tract ver	ntilation o	or positiv	e input v	/entilatio	on from o	outside		-	-		
	m < 0.5 >	<u> </u>	· ` `	<u> </u>	<del></del>	· ` `	<del></del>	ŕ	· ` `	<del></del>	ı	l	(0.1.)
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	l ventilation m = 1, the			•	•				0.51				
$ (24d)_{m=} 0 $	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective ai	r change	rate - er	nter (24a	) or (24k	o) or (24	c) or (2 <mark>4</mark>	ld) in box	k (25)					
(25)m= 0.29	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.25	0.26	0.27	0.28		(25)
3. Heat loss	es and he	eat loss	paramet	er:									
3. Heat loss	Gros	ss	Openin	gs	Net Ar		U-val		AXU		k-value		A X k
ELEMENT		ss		gs	A ,n	n²	W/m2	2K	(W/	<)	k-value kJ/m²-ł		kJ/K
ELEMENT  Doors Type 1	Gros area	ss	Openin	gs	A ,n	m² x	W/m2	2K =	(W/ 4.032	<)			kJ/K (26)
ELEMENT  Doors Type 1  Doors Type 2	Gros area	ss	Openin	gs	A ,n 3.36 2.8	m <sup>2</sup> x x	W/m2 1.2	= =	4.032 3.36	<) 			kJ/K (26) (26)
Doors Type 1 Doors Type 2 Windows Type	Gros area	ss	Openin	gs	A ,n 3.36 2.8 2.72	x x x1	W/m2 1.2 1.2 /[1/( 1.1 )+	= = = = = = = = = = = = = = = = = = =	4.032 3.36 2.87	<) 			kJ/K (26) (26) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ	Gros area	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18	x x x x x x x x x x x x x x x x x x x	W/m2 1.2 1.2 /[1/( 1.1 )+ /[1/( 1.1 )+	= = 0.04] = 0.04] =	4.032 3.36 2.87 6.51	K)			kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ	Gros area de 1 de 2 de 3	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44	x x x1 x1 x1	W/m2 1.2 1.2 /[1/( 1.1 )+ /[1/( 1.1 )+	= = 0.04] = 0.04] = 0.04] =	4.032 3.36 2.87 6.51 5.73	K)			kJ/K (26) (26) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81	x x x1 x1 x1 x1	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	4.032 3.36 2.87 6.51 5.73	<) 			kJ/K (26) (26) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55	x x x1 x1 x1 x1 x1	W/m2  1.2  1.2  /[1/( 1.1 )+  /[1/( 1.1 )+  /[1/( 1.1 )+  /[1/( 1.1 )+  /[1/( 1.1 )+	= 0.04] = 0.04] = 0.04] = 0.04] =	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79	<) 			kJ/K (26) (26) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37	x x x1 x1 x1 x1 x1 x1	W/m2  1.2  1.1  1.2  1.1  1.1  1.1  1.1  1	= 0.04] = 0.04	4.032 3.36 2.87 6.51 5.73 1.91 4.79				kJ/K (26) (26) (27) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Floor Type 1	Gros area e 1 e 2 e 3 e 4 e 5	ss	Openin	gs	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32	x x x1 x1 x1 x1 x1 x1 x1 x1 x1	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (27)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Floor Type 1 Floor Type 2	Gros area e 1 e 2 e 3 e 4 e 5 e 6	ss (m²)	Openin m	gs <sub>1</sub> <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12	= 0.04] = 0.04	4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Floor Type 1 Floor Type 2 Walls Type1	Gros area se 1 se 2 se 3 se 4 se 5 se 6	ss (m²)	Openin	gs <sub>1</sub> <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Floor Type 1 Floor Type 2 Walls Type1 Walls Type2	Gros area  e 1  e 2  e 3  e 4  e 5  e 6  69.2	25 21	Openin m	gs <sub>1</sub> <sup>2</sup>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14	= 0.04] = 0.04	(VV/ 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
Doors Type 1 Doors Type 2 Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Floor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3	Gros area  e 1  e 2  e 3  e 4  e 5  e 6  69.2  73.0	25 21 6	6.16 0 8.9	gs <sub>1</sub> <sup>2</sup>	A ,n  3.36  2.8  2.72  6.18  5.44  1.81  4.55  4.37  70.32  11.98  63.09  38.21  64.7	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ 0.12  0.12  0.14  0.12	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = = = = = = = = = = = = = = = = = =	4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29)
Doors Type 1 Doors Type 2 Windows Type 1 Walls Type 2 Walls Type 3 Walls Type 4	Gros area  2.	25 21 6 32	6.16 0 8.9	gs <sub>12</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.15	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41 7.76				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29)
Doors Type 1 Doors Type 2 Windows Typ Wind	Gros area  2.	25 21 6 32	6.16 0 8.9 0	gs <sub>12</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32 74.82	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.15  0.15	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41 7.76 4.25 8.98				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29) (29)
Doors Type 1 Doors Type 2 Windows Type 1 Walls Type 2 Walls Type 3 Walls Type 4	Gros area  2.	25 (m²) 21 6 32 39	6.16 0 8.9	gs <sub>12</sub>	A ,n 3.36 2.8 2.72 6.18 5.44 1.81 4.55 4.37 70.32 11.98 63.09 38.21 64.7 28.32	x x x x x x x x x x x x x x x x x x x	W/m2  1.2  1.2  /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+ /[1/( 1.1 )+  0.12  0.12  0.14  0.15	= 0.04] = 0.04	(W// 4.032 3.36 2.87 6.51 5.73 1.91 4.79 4.6 8.43839 1.4376 7.57 5.41 7.76				kJ/K (26) (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29)







Water storage loss:	
Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel	305 (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 Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day):	1.63 (48)
Temperature factor from Table 2b	0.54 (49)
Energy lost from water storage, kWh/year (48) x (49) = b) If manufacturer's declared cylinder loss factor is not known:	0.88 (50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	0 (51)
If community heating see section 4.3	
Volume factor from Table 2a	0 (52)
Temperature factor from Table 2b	0 (53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ Enter (50) or (54) in (55)	• • • • • • • • • • • • • • • • • • • •
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	0.88 (55)
	2.29 26.41 27.29 (56)
If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m w	
	2.29 26.41 27.29 (57)
Primary circuit loss (annual) from Table 3  Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0 (58)
(modified by factor from Table H5 if there is solar water heating and a cylinder the	ermostat)
	.26 22.51 23.26 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
	0 0 0 (61)
Total heat required for water heating calculated for each month $(62)$ m = $0.85 \times (45)$	m + (46)m + (57)m + (59)m + (61)m
	3.93 205.43 220.51 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar cor	tribution 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= 226.05 199.15 208.94 187.01 183.05 163.25 156.5 172.13 171.95 19	3.93 205.43 220.51
Output from water I	neater (annual) <sub>112</sub> 2287.88 (64)
Heat gains from water heating, kWh/month $0.25 \cdot [0.85 \times (45)m + (61)m] + 0.8 \times [(45)m + (61)m] + 0.8$	<del></del>
	.11 91.17 96.95 (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	
	Oct Nov Dec
	4.49   154.49   154.49   (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	(07)
	7.02 43.2 46.06 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table	
(68)m= 431.48 435.96 424.68 400.66 370.34 341.84 322.8 318.32 329.61 35	3.63 383.95 412.44 (68)

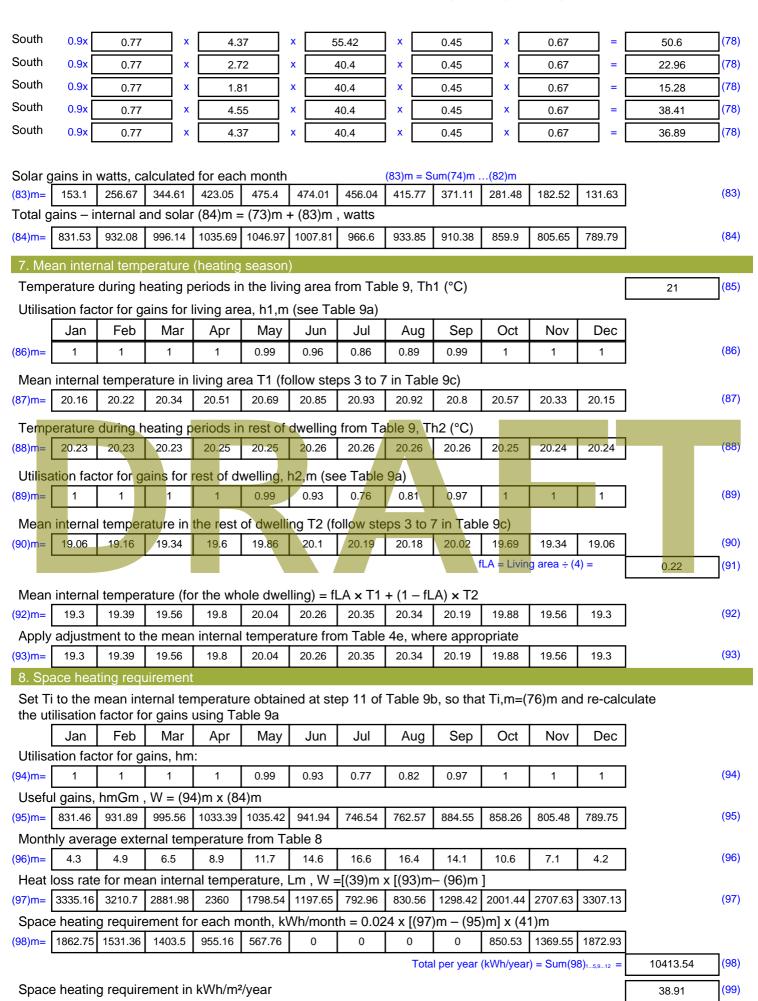


Cooking	gains	(calcula	ted in	Ar	pendix I	eans.	tior	n L15 or L15a	a) a	lso	see Table :	5				
Ť	38.45	38.45	38.45	Ť	<del>`                                    </del>	38.45	_	88.45 38.45	<del>i</del>	8.4		38.45	38.45	38.45	]	(69)
Pumps a		ns gains	(Tabl	—1 е 5	L a)			<u> </u>	_!		<u> </u>		<u>!</u>		J	
(70)m=	0	0	0		0	0		0 0		0	0	0	0	0	]	(70)
Losses e	e.g. ev	/aporatio	n (neg	gat	ive values	) (Tab	ole	 5)	'				<u> </u>		J	
(71)m= -	123.59	-123.59	-123.5	9	-123.59 -1	23.59	-1	23.59 -123.59	-12	23.5	59 -123.59	-123.5	9 -123.59	-123.59	]	(71)
Water h	eating	gains (T	able 5	5)	•			'					•		4	
(72)m=	132.78	130.3	125.1	4	118.12 1	13.57	10	07.15 101.7	10	08.6	69 111.17	118.4	3 126.63	130.31	]	(72)
Total in	ternal	gains =			•			(66)m + (67)	m + (	68)	m + (69)m + (7	'0)m +	(71)m + (72)	m	•	
(73)m=	678.43	675.41	651.5	3	612.63 5	71.57	5	533.8 510.56	5 51	18.0	08 539.28	578.4	2 623.13	658.16		(73)
6. Sola	r gains	S:														
_			•	olar	flux from Ta	ble 6a	and	associated equ	uation	s to	convert to the	applio		ion.		
Orientat		Access F Γable 6d	actor		Area m²			Flux Table 6a			g_ Table 6b		FF Table 6c		Gains	
<b>N</b> 1 41	_	i able ou						Table 0a	_	_	Table ob	_	Table 60		(W)	_
North	0.9x	0.54		X	6.18		X	10.63	_ ×	F	0.45	X	0.67	=	9.63	(74)
North	0.9x	0.77		X	5.44	_	X	10.63	×	Ļ	0.45	X	0.67	=	12.09	(74)
North	0.9x	0.54		X	6.18		X	20.32	X	늗	0.45	X	0.67		18.4	(74)
North	0.9x	0.77		X	5.44	$\exists$	X	20.32	_  ×	ᄼ	0.45	X	0.67		23.1	(74)
North	0.9x	0.54		X	6.18		X	34.53	_	H	0.45	X	0.67	=	31.27	(74)
North	0.9x	0.77		X	5.44		X	34.53	<b></b> ↓/×	 	0.45	X	0.67	=	39.25	(74)
North	0.9x	0.54		X	6.18		X	55.46	_  ×	늗	0.45	X	0.67	_  =	50.23	(74)
North	0.9x	0.77		X	5.44	$\exists$	X	55,46	X	누	0.45	X	0.67	=	63.04	(74)
North	0.9x	0.54		X	6.18	=	Х	74.72	×	늗	0.45	X	0.67	_ =	67.66	(74)
North	0.9x	0.77		X	5.44	_	X	74.72	×	늗	0.45	X	0.67	=	84.92	(74)
North	0.9x	0.54		X	6.18	_	X	79.99	×	늗	0.45	X	0.67	=	72.43	(74)
North	0.9x	0.77		X	5.44	_	X	79.99	⊒ ×	늗	0.45	X	0.67	_ =	90.91	(74)
North	0.9x	0.54		X	6.18	_	X	74.68	_ ×	누	0.45	X	0.67	=	67.62	(74)
North	0.9x	0.77		X	5.44		X	74.68	→   ×	누	0.45	X	0.67	=	84.88	(74)
North North	0.9x	0.54		X	6.18		X	59.25	_  ×	늗	0.45	X	0.67	_ =	53.65	(74)
North	0.9x	0.77		X	5.44		X	59.25	×	누	0.45	X	0.67	=	67.34	(74)
North	0.9x	0.54		X	6.18		X	41.52	→	늗	0.45	X	0.67	_ =	37.6	(74)
North	0.9x	0.77		X	5.44		X	41.52	_   ×	F	0.45	X	0.67	_ =	47.19	(74)
North	0.9x	0.54		X	6.18		X	24.19	×	누	0.45	X	0.67	=	21.9	(74)
North	0.9x	0.77		X	5.44		X	24.19	→   ×	누	0.45	X	0.67	_ =	27.49	(74)
	0.9x	0.54		X	6.18		X	13.12	_  ×	F	0.45	X	0.67	_ =	11.88	(74)
North	0.9x	0.77		X	5.44	_	X	13.12	→	늗	0.45	X	0.67	_ =	14.91	(74)
North	0.9x	0.54		X	6.18	_	X	8.86	_ X	누	0.45	X	0.67	_ =	8.03	(74)
North	0.9x	0.77		X	5.44	_	X	8.86	_ X	늗	0.45	X	0.67	_ =	10.08	(74)
South	0.9x	0.77		X	2.72	$\blacksquare$	X	46.75	_   ×	늗	0.45	X	0.67	=	26.57	(78)
South	0.9x	0.77		X	1.81		X	46.75	x	L	0.45	X	0.67	=	17.68	(78)



South	0.9x	0.77	x	4.55	x	46.75	x	0.45	x	0.67	=	44.45	(78)
South	0.9x	0.77	x	4.37	x	46.75	x	0.45	x	0.67	=	42.69	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.45	x	0.67	=	43.51	(78)
South	0.9x	0.77	X	1.81	x	76.57	x	0.45	x	0.67	=	28.96	(78)
South	0.9x	0.77	x	4.55	x	76.57	x	0.45	x	0.67	=	72.79	(78)
South	0.9x	0.77	x	4.37	x	76.57	x	0.45	x	0.67	=	69.91	(78)
South	0.9x	0.77	X	2.72	x	97.53	x	0.45	x	0.67	=	55.43	(78)
South	0.9x	0.77	X	1.81	x	97.53	x	0.45	x	0.67	=	36.89	(78)
South	0.9x	0.77	X	4.55	x	97.53	X	0.45	x	0.67	=	92.72	(78)
South	0.9x	0.77	X	4.37	x	97.53	x	0.45	x	0.67	=	89.05	(78)
South	0.9x	0.77	X	2.72	x	110.23	x	0.45	x	0.67	=	62.65	(78)
South	0.9x	0.77	X	1.81	x	110.23	x	0.45	x	0.67	=	41.69	(78)
South	0.9x	0.77	X	4.55	x	110.23	x	0.45	x	0.67	=	104.8	(78)
South	0.9x	0.77	X	4.37	x	110.23	x	0.45	x	0.67	=	100.65	(78)
South	0.9x	0.77	X	2.72	x	114.87	x	0.45	x	0.67	=	65.28	(78)
South	0.9x	0.77	X	1.81	x	114.87	x	0.45	x	0.67	=	43.44	(78)
South	0.9x	0.77	X	4.55	X	114.87	X	0.45	x	0.67	=	109.21	(78)
South	0.9x	0.77	×	4.37	X	114.87	Х	0.45	X	0.67	=	104.88	(78)
South	0.9x	0.77	x	2.72	х	110.55	x	0.45	x	0.67	=	62.83	(78)
South	0.9x	0.77	×	1.81	x	110.55	×	0.45	x	0.67	=	41.81	(78)
South	0.9x	0.77	X	4.55	X	110.55	X	0.45	x	0.67	=	105.1	(78)
South	0.9x	0.77	x	4.37	x	110.55	Х	0.45	x	0.67	=	100.94	(78)
South	0.9x	0.77	×	2.72	x	108.01	X	0.45	x	0.67	=	61.38	(78)
South	0.9x	0.77	X	1.81	x	108.01	X	0.45	x	0.67	=	40.85	(78)
South	0.9x	0.77	X	4.55	x	108.01	X	0.45	X	0.67	=	102.68	(78)
South	0.9x	0.77	X	4.37	X	108.01	X	0.45	X	0.67	=	98.62	(78)
South	0.9x	0.77	X	2.72	x	104.89	X	0.45	X	0.67	=	59.61	(78)
South	0.9x	0.77	X	1.81	X	104.89	X	0.45	X	0.67	=	39.67	(78)
South	0.9x	0.77	X	4.55	x	104.89	X	0.45	X	0.67	=	99.72	(78)
South	0.9x	0.77	X	4.37	x	104.89	X	0.45	X	0.67	=	95.78	(78)
South	0.9x	0.77	X	2.72	X	101.89	X	0.45	X	0.67	=	57.9	(78)
South	0.9x	0.77	X	1.81	x	101.89	X	0.45	X	0.67	=	38.53	(78)
South	0.9x	0.77	X	4.55	X	101.89	X	0.45	X	0.67	=	96.86	(78)
South	0.9x	0.77	X	4.37	x	101.89	X	0.45	X	0.67	=	93.03	(78)
South	0.9x	0.77	X	2.72	x	82.59	X	0.45	X	0.67	=	46.93	(78)
South	0.9x	0.77	x	1.81	x	82.59	x	0.45	x	0.67	=	31.23	(78)
South	0.9x	0.77	x	4.55	x	82.59	x	0.45	x	0.67	=	78.51	(78)
South	0.9x	0.77	x	4.37	x	82.59	x	0.45	x	0.67	=	75.41	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.45	x	0.67	=	31.49	(78)
South	0.9x	0.77	x	1.81	x	55.42	x	0.45	x	0.67	=	20.96	(78)
South	0.9x	0.77	X	4.55	X	55.42	X	0.45	X	0.67	=	52.68	(78)







9a. Energy requirements – Individual heating syst	ems includina	micro-CH	IP)				
Space heating:			,				_
Fraction of space heat from secondary/supplement						0	(201)
Fraction of space heat from main system(s)		(202) = 1 - (202)	,			1	(202)
Fraction of total heating from main system 1	(	(204) = (202)	() × [1 – (203)] =			1	(204)
Efficiency of main space heating system 1						299.66	(206)
Efficiency of secondary/supplementary heating s	ystem, %					0	(208)
	Jun Jul	Aug	Sep Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calculated above)			0 050 50	1,000 55	1,070,00	1	
1862.75     1531.36     1403.5     955.16     567.76	0 0	0	0 850.53	1369.55	1872.93		
$ (211)m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ (2162 511.03 468.36 318.75 189.47 ) $	0 0	0	0 283.83	457.03	625.02		(211)
621.62   511.03   468.36   318.75   189.47	0   0		kWh/year) =Sum			3475.1	(211)
Space heating fuel (secondary), kWh/month		rotar (i	ittringour) –ouri	·(-··/ <sub>15,101</sub>	2	3473.1	(211)
$= \{[(98) \text{m x } (201)] \} \times 100 \div (208)$							
(215)m= 0 0 0 0 0	0 0	0	0 0	0	0		
		Total (k	kWh/year) =Sum	1(215) <sub>15,101</sub>	=	0	(215)
Water heating							
Output from water heater (calculated above)  226.05 199.15 208.94 187.01 183.05 10	63.25 156.5	172.13 1	171.95 193.93	205.43	220.51		
Efficiency of water heater	05.25   150.5	172.13	171.95	203.43	220.51	291.08	(216)
	91.08 291.08	291.08 2	291.08 291.08	291.08	291.08	201.00	(217)
Fuel for water heating, kWh/month							
$(219)$ m = $(64)$ m x $100 \div (217)$ m					l		
(219)m= 77.66 68.42 71.78 64.25 62.89 5	66.09 53.76		59.07 66.62 Sum(219a) <sub>1.12</sub>	70.57	75.76	700	7(040)
Annual totals		rotar =		- kWh/yeaı	<u>,</u>	<sup>786</sup> kWh/yea	(219)
Space heating fuel used, main system 1				KVVII/yeai	'	3475.1	<u>.</u>
Water heating fuel used						786	Ħ
Electricity for pumps, fans and electric keep-hot							
mechanical ventilation - balanced, extract or pos	itive input from	n outside			913.72		(230a)
Total electricity for the above, kWh/year	, , , , ,		f (230a)(230g)	=		913.72	(231)
Electricity for lighting						791.38	(232)
12a. CO2 emissions – Individual heating systems	s including mig	cro-CHP				701.00	
12a. 002 omissions marriada nodang systems	<u> </u>	310 0111					
	<b>Energy</b> kWh/year			<b>sion fac</b> D2/kWh	tor	Emission: kg CO2/ye	
Space heating (main system 1)	(211) x		0.	519	=	1803.58	(261)
Space heating (secondary)	(215) x		0.	519	=	0	(263)
Water heating	(219) x		0.	519	=	407.93	(264)
Space and water heating	(261) + (262) +	+ (263) + (26	64) =			2211.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0	519	=	474.22	(267)
7 - 1 - 1 - 7 - 2				<u> </u>		11 7.22	()

El rating (section 14)

# envision

87

(274)

#### **DER WorkSheet: New dwelling design stage**

Electricity for lighting (232) x 0.519 = 410.73 (268) Total CO2, kg/year sum of (265)...(271) = 3096.46 (272) **Dwelling CO2 Emission Rate** (272)  $\div$  (4) = 11.57 (273)



## **APPENDIX IX – TER WORKSHEETS (REFURB)**



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 1 - Existing - 3B6P - GF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor (1a) x 2.9 (2a) =516.2 (3a) 178 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)178 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =516.2 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)3 30 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.06 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.81 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.75 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



· —	1	<u> </u>	ng for sh			<del>`                                    </del>	<del>`</del>	<u> </u>			T	1	
0.95 alculate effe	0.93 Ctive air	0.92 Change i	0.82 rate for t	0.8 <b>he appli</b>	0.71 cable ca	0.71 se	0.69	0.75	0.8	0.84	0.88		
If mechanica	al ventila	tion:										0	(2
If exhaust air he	eat pump (	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b	) = (23a)			0	(2
If balanced with	heat reco	overy: effici	iency in %	allowing f	or in-use fa	actor (from	n Table 4h	) =				0	(2
a) If balance		anical ve		with hea		ery (MVI	HR) (24a	m = (22)	2b)m + (	23b) × [	1 – (23c)	) ÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
b) If balance						<u> </u>	<del></del>	<u> </u>	<del> </del>	<del></del>	T -	1	,
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
c) If whole h if (22b)n				•	•				5 × (23b	o)			
c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
d) If natural				•	•					•		•	
if (22b)n		<u> </u>			<u> </u>		<del></del>				1	1	
d)m= 0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89		(
Effective air			<u> </u>	, ,	ŕ	<u> </u>	<del></del>		0.00	0.05	0.00	1	,
5)m= 0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89		(
. Heat losse	s and he	eat loss	oaramete	er:									
-EMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-		A X k kJ/K
n <mark>dows</mark> Type	1				10.69	8 x1	/[1/( 3.1 )+	0.04] =	29.51				(
n <mark>dows</mark> Type	2				3.14	×1,	/[1/( 3.1 )+	0.04] =	8.66	Ħ			(
indows Type	3				3.61	x1,	/[1/( 3.1 )+	0.04] =	9.96	Ħ			(
oor					178.5	1 X	0.25	=	44.627	5 [			
alls	134.	39	17.4	5	116.9	4 x	0.6	<b>=</b> i	70.16	Ħ i		7 F	
oof	51.4	.2	0		51.42	2 x	0.68	<b>=</b> i	34.97	Ħ i		7 F	
tal area of e	lements	, m²			364.3	2							(
rty wall					54.81	x	0		0	$\neg$			
rty ceiling					127.0	4						7 F	
or windows and	roof wind	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	n 3.2	
nclude the area				s and part	titions		(00) (00)	(00)					
bric heat los		,	U)				(26)(30)	` '	(20) . (2)	a) . (20-)	(20-)	197.88	
eat capacity	`	,	) Cm :	T[	l (   /m2 /				.(30) + (32 tive Value	, , ,	(32e) =	34562.19	=
ermal mass r design assess	•	`		,			ecisely the				ahle 1f	250	(
n be used inste				oononaon	ion are not	naiowii pi	colocity tire	maroative	values of	71011 117 1	abio 11		
ermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix k	<						54.65	(
etails of therma		are not kn	own (36) =	= 0.05 x (3	1)			(00)	(0.0)				<u> </u>
tal fabric he		alaudati l	l mara a that					` '	(36) =	OC) (-	<b>\</b>	252.53	(
entilation hea					1	11	Λ		= 0.33 × (		1	1	
Jan 162.54	Feb	Mar	Apr 142.76	May 140.17	Jun 128.12	Jul 128.12	Aug	Sep 132.76	Oct 140.17	Nov	Dec 150.88	1	(
3)m= 162.54	159.54	156.59	142.70	140.17	120.12	120.12	125.89		<u> </u>	145.41	130.00	J	(
eat transfer o			395.28	392.7	380.65	380.65	378.42	(39)m 385.29	392.7	38)m 397.93	403.4	1	
)m= 415.06	412.06	409.12											



Heat loss para	meter (H	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 2.33	2.31	2.3	2.22	2.21	2.14	2.14	2.13	2.16	2.21	2.24	2.27		
		<u>!</u>		<u> </u>	<u>I</u>	<u> </u>	<u> </u>		L Average =	: Sum(40) <sub>1.</sub>	12 /12=	2.22	(40)
Number of day	s in mo	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 heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
A		N.I											(15)
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (¯	TFA -13		97		(42)
Annual averag											4.81		(43)
Reduce the annua not more that 125	-		• .		-	-	to achieve	a water us	se target o	of Total			
							l .			1			
Jan Hot water usage ii	Feb	Mar	Apr	May	Jun	Jul Table 10 Y	Aug	Sep	Oct	Nov	Dec		
					1	1	· <i>′</i>	T					
(44)m= 115.29	111.1	106.91	102.72	98.52	94.33	94.33	98.52	102.72	106.91	111.1	115.29		<b>—</b>
Energy content of	hot water	used - cal	culated mo	onth $lv = 4$ .	190 x Vd.r	n x nm x E	7m / 3600			ım(44) <sub>112</sub> = ables 1b. 1		1257.76	(44)
(45)m= 170.98	149.54	154.31	134.53	129.09	111.39	103.22	118.45	119.86	139.69	152.48	165.58		
(43)11= 170.98	145.54	134.31	154.55	129.09	111.39	103.22	110.43			m(45) <sub>112</sub> =		1649.12	(45)
If ins <mark>tantane</mark> ous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		Total = Su	III(43)112 =		1049.12	(40)
(46)m= 25.65	22.43	23.15	20.18	19.36	16.71	15.48	17.77	17.98	20.95	22.87	24.84		(46)
Water storage	loss:												
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		210		(47)
If community h	eating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage				!	(1.\ \ / /	. /-1					- 1		(10)
a) If manufact				or is kno	wn (kvvr	1/day):					0		(48)
Temperature fa											0		(49)
Energy lost fro b) If manufact		_	-		or ic not		(48) x (49)	) =		2	10		(50)
Hot water stora			-							0	02		(51)
If community h	-			`		,				<u> </u>	<u></u>		• •
Volume factor	from Ta	ble 2a								0.	83		(52)
Temperature fa	actor fro	m Table	2b							0	.6		(53)
Energy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	59		(54)
Enter (50) or (	(54) in (5	55)								1.	59		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m				
(56)m= 49.22	44.46	49.22	47.63	49.22	47.63	49.22	49.22	47.63	49.22	47.63	49.22		(56)
If cylinder contains	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= 49.22	44.46	49.22	47.63	49.22	47.63	49.22	49.22	47.63	49.22	47.63	49.22		(57)
Primary circuit	•	•									0		(58)
Primary circuit				,	•	. ,	, ,						
(modified by				i	ı —		<del></del>	<u> </u>		<del>-                                    </del>	- I		/=-·
(59)m= 54.55	49.27	54.55	52.79	54.55	36.09	37.3	37.3	36.09	54.55	52.79	54.55		(59)



Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$													
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		= (00) + 3	05 x (41)	0	0	0	T 0	0	1	(61)			
Total heat required for water				<u> </u>					(50)m + (61)m	(0.)			
(62)m= 274.75 243.27 258.0	<del></del>		189.74	204.97	203.59	243.46	252.91	269.36	(59)111 + (61)111	(62)			
Solar DHW input calculated using A	_		1						l	(02)			
(add additional lines if FGHR						i continbu	lion to wate	er neating)					
(63)m= 0 0 0	0 0		0	0	0	0	0	0	1	(63)			
Output from water heater			I						I	` '			
(64)m= 274.75 243.27 258.0	8 234.96 232.8	6 195.12	189.74	204.97	203.59	243.46	252.91	269.36	]				
			1		l		 er (annual)₁	l	2803.06	(64)			
Heat gains from water heating	a kWh/month 0	25 ′ [0 85	i x (45)m						1	<b>J</b>			
(65)m= 139.87 124.71 134.3			103.54	108.6	106.84	129.46	131.04	138.08	]	(65)			
include (57)m in calculation				<u> </u>					l seating	` '			
5. Internal gains (see Table	. , ,	Cymraci		aweiling	OI HOUW	ator io i	10111 00111	indinity i	loating				
Metabolic gains (Table 5), W	,												
Jan Feb Ma	1 1	y Jun	Jul	Aug	Sep	Oct	Nov	Dec	]				
(66)m= 148.66 148.66 148.6	<del></del>		148.66	148.66	148.66	148.66	148.66	148.66		(66)			
Lighting gains (calculated in	Appendix L. equ	ation L9 c	r L9a). a	lso see	Table 5								
(67)m= 62.89 55.86 45.43	<u> </u>	_	23.45	30.48	40.91	51.95	60.63	64.64	]	(67)			
Appliances gains (calculated	in Appendix L. 6	equation L	13 or L1	3a), also	see Tal	ble 5							
(68)m= 349.62 353.25 344.1		<del>-</del>	261.56	257.93	267.07	286.54	311.11	334.2	]	(68)			
Cooking gains (calculated in	Appendix L. equ	ation L15	or L15a	), also s	ee Table	5		<u> </u>	1				
(69)m= 37.87 37.87 37.87			37.87	37.87	37.87	37.87	37.87	37.87	]	(69)			
Pumps and fans gains (Table	e 5a)							<u> </u>					
(70)m= 10 10 10	10 10	10	10	10	10	10	10	10	1	(70)			
Losses e.g. evaporation (neg	ative values) (T	able 5)		ļ.		<u> </u>	1	<u> </u>	ı				
(71)m= -118.93 -118.93 -118.9	<del>'                                    </del>	<del></del>	-118.93	-118.93	-118.93	-118.93	-118.93	-118.93	]	(71)			
Water heating gains (Table 5		-		<u>I</u>	ļ	<u>[</u>	1	!	ı				
(72)m= 188 185.58 180.5	<del></del>	7 144.47	139.16	145.96	148.38	174.01	182	185.59	]	(72)			
Total internal gains =		(66	)m + (67)m	ı + (68)m ·	+ (69)m + (	(70)m + (7	71)m + (72)	)m	ı				
(73)m= 678.11 672.28 647.6	8 610.35 572.6	5 520.76	501.77	511.98	533.97	590.1	631.34	662.02	]	(73)			
6. Solar gains:													
Solar gains are calculated using so	olar flux from Table 6	a and assoc	ciated equa	tions to co	onvert to th	e applica	ble orientat	tion.					
Orientation: Access Factor	Area	Flu			g_		FF		Gains				
Table 6d	m²	Та	ble 6a	Т	able 6b	Т	able 6c		(W)				
Northeast <sub>0.9x</sub> 0.77	x 3.14	x	11.28	x	0.76	X	0.65	=	12.13	(75)			
Northeast 0.9x 0.54	x 3.61	x	11.28	x	0.76	x	0.65	=	9.78	(75)			
Northeast 0.9x 0.77	x 3.14	x	22.97	x	0.76	x	0.65	=	24.69	(75)			
Northeast 0.9x 0.54	x 3.61	x	22.97	х	0.76	x [	0.65	=	19.91	(75)			
Northeast 0.9x 0.77	X 3.14	X .	41.38	x	0.76	x	0.65	=	44.48	(75)			

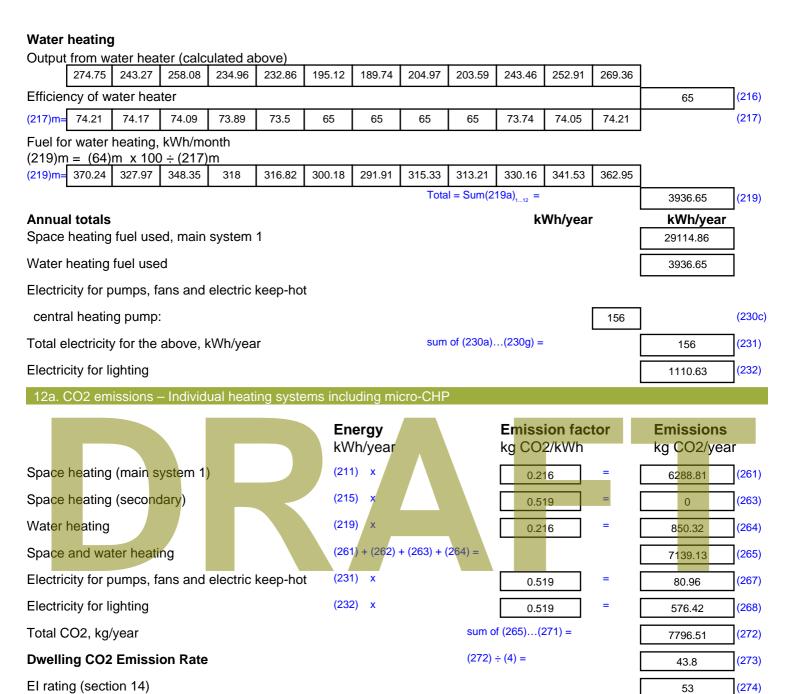


_				_								
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	41.38	X	0.76	X	0.65	=	35.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.14	X	67.96	X	0.76	x	0.65	=	73.05	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	67.96	X	0.76	x	0.65	=	58.9	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.14	X	91.35	X	0.76	x	0.65	=	98.19	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	91.35	x	0.76	x	0.65	=	79.17	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.14	X	97.38	x	0.76	x	0.65	=	104.68	(75)
Northeast 0.9x	0.54	X	3.61	X	97.38	x	0.76	x	0.65	=	84.4	(75)
Northeast 0.9x	0.77	X	3.14	X	91.1	x	0.76	x	0.65	=	97.93	(75)
Northeast 0.9x	0.54	X	3.61	X	91.1	x	0.76	x	0.65	=	78.96	(75)
Northeast 0.9x	0.77	X	3.14	X	72.63	x	0.76	x [	0.65	=	78.07	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	72.63	_ x [	0.76	x	0.65	=	62.95	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.14	X	50.42	x	0.76	x	0.65	=	54.2	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	50.42	x	0.76	x	0.65	=	43.7	(75)
Northeast <sub>0.9x</sub>	0.77	x	3.14	X	28.07	x	0.76	x	0.65	=	30.17	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	28.07	x	0.76	x [	0.65	=	24.33	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.14	X	14.2	x	0.76	x [	0.65	=	15.26	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.61	X	14.2	_ x [	0.76	x	0.65	=	12.3	(75)
Northeast 0.9x	0.77	X	3.14	X	9.21	Х	0.76	Х	0.65	=	9.9	(75)
Northeast 0.9x	0.54	x	3.61	x	9.21	] x [	0.76	х	0.65	=	7.99	(75)
Southwest <sub>0.9x</sub>	0.77	×	10.7	х	36.79		0.76	х	0.65	=	134.75	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.7	X	62.67		0.76	х	0.65	=	2 <mark>29.53</mark>	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.7	X	85.75		0.76	х	0.65	=	314.06	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.7	X	106.25		0.76	x	0.65	=	389.13	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.7	х	119.01	] [	0.76	х	0.65	=	435.86	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.7	X	118.15	] [	0.76	x	0.65	=	432.71	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.7	X	113.91	] [	0.76	x	0.65	=	417.18	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.7	X	104.39	] [	0.76	x	0.65	=	382.32	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.7	x	92.85		0.76	x	0.65	=	340.06	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.7	X	69.27		0.76	x	0.65	=	253.68	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.7	X	44.07	] [	0.76	x	0.65	=	161.4	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.7	X	31.49	] [	0.76	x	0.65	=	115.32	(79)
				_								
Solar gains in			i	nth		(83)m	= Sum(74)m .	(82)m			1	
(83)m= 156.66		394.4	521.08 613.2		521.8 594.07	523.	33 437.96	308.18	188.97	133.21		(83)
Total gains – ir			<u>`                                    </u>	<del></del>	<del></del>	1					I	, · ·
(84)m= 834.77	946.41 1	042.08	1131.43 1185.	.88 1	142.55 1095.83	1035	.31 971.93	898.28	820.3	795.23		(84)
7. Mean inter	nal tempe	rature (	heating seas	on)								
Temperature	during hea	ating pe	eriods in the l	living	area from Tal	ole 9,	Th1 (°C)				21	(85)
I Itilication fac	tor for gai	ns for li	ving area, h1	,m (s	ee Table 9a)				_		Ī	
Cuisation lac			Apr   Ma	ay	Jun Jul	Αι	ıg Sep İ	Oct	Nov	Dec		
Jan	Feb	Mar	<del>_</del>	<del>-</del>			_					
	Feb 1	Mar 1	0.99 0.98	<del>-</del>	0.95 0.89	0.9	1 0.97	0.99	1	1		(86)
Jan	1	1	0.99 0.98	3	<u> </u>	<u> </u>		0.99	1	1		(86)
(86)m= Jan	1 temperat	1	0.99 0.98	(folic	<u> </u>	<u> </u>	able 9c)	0.99	18.92	1 18.38		(86)



			neating p			·	i	1	<del>`</del>				1	
(88)m=	19.83	19.84	19.85	19.89	19.9	19.93	19.93	19.94	19.92	19.9	19.88	19.87	I	(88)
Utilisa	ation fac	ctor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.99	0.97	0.92	0.81	0.85	0.96	0.99	1	1		(89)
Mean	interna	ıl tempei	rature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 7	7 in Tabl	le 9c)				
(90)m=	17.4	17.57	17.92	18.47	18.98	19.49	19.76	19.73	19.33	18.68	18	17.44		(90)
						Į.				fLA = Livin	g area ÷ (4	4) =	0.28	(91)
Mean	interna	ıl tempei	rature (fo	r the wh	ole dwe	lling) = fl	I A 🗴 T1	+ (1 – fl	A) x T2			1		
(92)m=	17.67	17.84	18.18	18.72	19.24	19.75	20.02	19.99	19.59	18.93	18.26	17.71		(92)
	adjustr	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.27	18.44	18.78	19.32	19.84	20.35	20.62	20.59	20.19	19.53	18.86	18.31		(93)
8. Sp	ace hea	iting req	uirement											
				•		ed at ste	ep 11 of	Table 9	o, so tha	nt Ti,m=(	76)m an	d re-calc	:ulate	
the ut		1	or gains							ī			1	
1.1411	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	I	
	ation fac	ctor for g	ains, hm	0.99	0.97	0.02	0.87	_0.89	0.96	0.99	1	1		(94)
(94)m=						0.93	0.87	0.89	0.96	0.99	<u> </u>			(94)
(95)m=	832.57	942.57	W = (94)	1116.12		1067.71	952.01	923.62	935.13	888.42	817.08	793.51		(95)
			ernal tem				302.01	020.02	300.10	000.42	017.00	7 30.01		()
(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)
	loss rat	e for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	1				
	_		5025.99				1530.93			3507.3	4680	5690.37		(97)
Space	e heatin	g requir	ement fo	r each m	nonth, k\	Wh/mon	th = 0.02	24 x [(97)	)m – (95	j)m] x (4 <sup>-</sup>	1)m			
(98)m=	3693.08	3115.9	2969.39	2162.9	1521.88	0	0	0	0	1948.44	2781.3	3643.26		
						-	_	Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	21836.15	(98)
Space	e heatin	g requir	ement in	kWh/m²	/year								122.67	(99)
9a. En	erav red	guireme	nts – Indi	ividual h	eating s	vstems i	ncludina	micro-C	CHP)					
	e heati	•				, 0101110 1			··· /					
-		•	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of s	oace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) <b>=</b>				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								75	(206)
	-		ıry/suppl			a svsten	า. %					ļ	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	
Snace		<u> </u>	ement (c			L	Jui	Aug	Зер	Oct	NOV	Dec	KVVII/y	Eai
Opao	3693.08	<del></del>	2969.39	2162.9	1521.88	0	0	0	0	1948.44	2781.3	3643.26		
(211)m	_ \[(08	l lm v (20	)4)] } x 1	00 ÷ (20	)6)	l	l .			1	Į	<u> </u>		(211)
(211)11	4924.1	<del> </del>	3959.19			0	0	0	0	2597.92	3708.4	4857.68		(211)
									l (kWh/yea	ar) =Sum(2			29114.86	(211)
Snace	e heatin	n fuel (s	econdar	v) k\//h/	month				-			l		` ′
•		•	00 ÷ (20	• •										
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
		•	•					Tota	l (kWh/yea	ar) =Sum(2	215),5,1012	F	0	(215)







User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 2 - Existing - 4B8P - GF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 227.6 (1a) x (2a) =(3a) 2.9 660.04 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)227.6 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =660.04 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)5 50 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.08 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.83 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.7 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjusted in	nfiltration r	ate (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
0.	89 0.88	0.86	0.77	0.75	0.67	0.67	0.65	0.7	0.75	0.79	0.82		
Calculate	<i>effective a</i> anical vent	_	rate for t	he appli	cable ca	se				•			(22-)
	air heat pum		endix N (2	3h) <i>– (</i> 23a	a) × Fmv (e	equation (	N5)) othe	rwise (23h	n) = (23a)		l I	0	(23a)
	d with heat re		•	, ,	,	. ,		•	) = (23a)			0	(23b) (23c)
	anced med	•	•	Ū		•		,	2h\m + (	23h) <b>v</b> [	 1 <i>– (2</i> 3c)	0 1001	(230)
	0 0	0	0	0	0	0	0	0	0	0	0	+ 100j	(24a)
	anced med			without	heat red	covery (I	<u> </u>	<u> </u>	L	23b)			, ,
· -	0 0	0	0	0	0	0	0	0	0	0	0		(24b)
,	ole house ( 2b)m < 0.5			•	•				.5 × (23k	) )	<u> </u>		
	0 0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If nat	ural ventila	tion or wh	ole hous	e positiv	/e input	ventilati	on from	loft				l	
if (2	2b)m = 1,	then (24d)	m = (22k)	o)m othe	· `	24d)m =		22b)m² x	0.5]			ı	
(24d)m = 0	.9 0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(24d)
	e air chang		<u> </u>	<u> </u>	<del>´`</del>	c) or (24	<del>ŕ –</del>	x (25)				ı	
(25)m = 0	.9 0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(25)
3. Heat lo	osses and	heat loss	oaramete	er:									
ELEMEN	• •	oss a (m²)	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-k		A X k kJ/K
Windows <sup>-</sup>	Type 1				3.77	x1	/[1/( 3.1 )+	- 0.04] =	10.4				(27)
Windows <sup>7</sup>	Type 2				3.77	x1	/[1/( 3.1 )+	- 0.04] =	10.4				(27)
Windows <sup>1</sup>	Туре 3				3.77	x1	/[1/( 3.1 )+	- 0.04] =	10.4				(27)
Windows 7	Type 4	'			4.94	x1	/[1/( 3.1 )+	- 0.04] =	13.62				(27)
Floor					227.5	5 x	0.25	=	56.875	<u> </u>			(28)
Walls Type	e1 9	4.68	16.2	5	78.43	3 x	0.6	=	47.06				(29)
Walls Type	e2 5	3.48	0		53.48	3 x	0.48	=	25.88				(29)
Roof	10	14.54	0		104.5	4 x	0.68	=	71.09				(30)
Total area	of elemen	ts, m²			480.2	2						_	(31)
Party wall					83.58	3 x	0	=	0			$\neg  \sqcap$	(32)
Party ceilin	ng				122.9	6						7 6	(32b)
	s and roof wi e areas on bo					lated using	g formula 1	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	3.2	
Fabric hea	at loss, W/I	X = S (A x)	U)				(26)(30	) + (32) =				245.7	2 (33)
Heat capa	city Cm =	S(A x k)						((28).	(30) + (3	2) + (32a).	(32e) =	42649.	(34)
Thermal m	nass paran	neter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
For design a can be used				constructi	ion are no	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal b	ridges : S	(L x Y) cal	culated ı	using Ap	pendix I	K						72.03	(36)
if details of the	_	-	own (36) =	= 0.05 x (3	1)			(33) +	- (36) =		· I	317.7	5 (37)



Manglaga a basa								(0.0)	0.00	(5)			
Ventilation hea					l	l. d	Δ			(25)m x (5)			
(38)m= 196.13	Feb 192.74	Mar 189.42	Apr 173.83	May 170.91	Jun 157.33	Jul 157.33	Aug 154.81	Sep 162.56	Oct 170.91	Nov 176.81	Dec 182.98		(38)
` '			173.03	170.91	137.33	137.33	154.01		<u> </u>		102.90		(00)
Heat transfer of			104.57	400.00	475.07	475.07	470.50		= (37) + (				
(39)m= 513.87	510.49	507.17	491.57	488.66	475.07	475.07	472.56	480.31	488.66	494.56	500.73	404.56	(39)
Heat loss para	meter (F	HLP), W/	m²K						= (39)m ÷	Sum(39) <sub>1.</sub> · (4)	12 / 12=	491.56	(39)
(40)m= 2.26	2.24	2.23	2.16	2.15	2.09	2.09	2.08	2.11	2.15	2.17	2.2		_
Number of day	s in mor	nth (Tab	le 1a)				-		Average =	Sum(40) <sub>1</sub> .	12 /12=	2.16	(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)
4. Water heat	ing ener	gy requi	rement:								kWh/ye	ear:	
Assumed occu	nancy I	V								3	04		(42)
if TFA > 13.9	0, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9	)2)] + 0.0	0013 x (	TFA -13		.04		(12)
if TFA £ 13.9	•	. 4	! !!		\ / =   =		(OE NI)	. 00					
Annual averag Reduce the annua									se target o		6.35		(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= 116.98	112.73	108.47	104.22	99.97	95.71	95.71	99.97	104.22	108.47	112.73	116.98		
Energy content of	hot water	ușed - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	)Tm / 3600			m(44) <sub>112</sub> =	L	1276.18	(44)
(45)m= 173.48	151.73	156.57	136.5	130.98	113.02	104.73	120.18	121.62	141.73	154.71	168.01		
				_			<u> </u>		Total = Su	m(45) <sub>112</sub> =	=	1673.27	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)			•		
(46)m= 26.02	22.76	23.49	20.48	19.65	16.95	15.71	18.03	18.24	21.26	23.21	25.2		(46)
Water storage		والمرابع والمرابع		.	/\/! IDC	-4			1				( )
Storage volum	, ,		•			•		ame ves	sei		210		(47)
If community h Otherwise if no	•			•			` '	ers) ente	er '0' in (	47)			
Water storage	loss:												
a) If manufact				or is kno	wn (kWh	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro		-	-				(48) x (49)	) =		2	10		(50)
b) If manufact Hot water stora			•								20		(E4)
If community h	-			6 Z (KVV)	ii/iiti <del>c</del> /ua	iy <i>)</i>				0.	.02		(51)
Volume factor	_									0.	83		(52)
Temperature fa	actor fro	m Table	2b							0	.6		(53)
Energy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (	53) =	1.	59		(54)
Enter (50) or (		_	-								59		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
(56)m= 49.22	44.46	49.22	47.63	49.22	47.63	49.22	49.22	47.63	49.22	47.63	49.22		(56)



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50)$ – $(H11)$ ] $\div$ $(50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 (57)	7)
Primary circuit loss (annual) from Table 3 0 (58	3)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 54.55 49.27 54.55 52.79 54.55 36.09 37.3 37.3 36.09 54.55 52.79 54.55 (59)	∌)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m =	1)
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= 277.26 245.46 260.34 236.93 234.75 196.75 191.25 206.7 205.34 245.51 255.14 271.78 (62)	2)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (63	3)
Output from water heater	
(64)m= 277.26 245.46 260.34 236.93 234.75 196.75 191.25 206.7 205.34 245.51 255.14 271.78	
Output from water heater (annual) <sub>112</sub> 2827.21 (64	1)
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= 140.7 125.43 135.08 125.73 126.57 104.56 104.04 109.17 107.42 130.15 131.78 138.88 (65)	5)
in <mark>clude</mark> (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	
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
	3)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	5)
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)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)  Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)  Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 (67)	7)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	7)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08	7) 3)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	7) 3)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19	7) 3) 9)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m   151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m   27.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57   Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5   (68)m   396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08   Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5   (69)m   38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 (69)   Pumps and fans gains (Table 5a)	7) 3) 9)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 (69)m= 30.00 10 10 10 10 10 10 10 10 10 10 10 10 1	77)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	77)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(3) (3) (3) (4) (4) (5) (6) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 77.42 68.77 55.92 42.34 31.65 26.72 28.87 37.53 50.37 63.96 74.65 79.57 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 (69)m= 38.19	(3) (3) (3) (4) (4) (5) (6) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	77)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m	77)

Flux

Table 6a

Area

m²

Orientation: Access Factor

Table 6d

Gains

(W)

FF

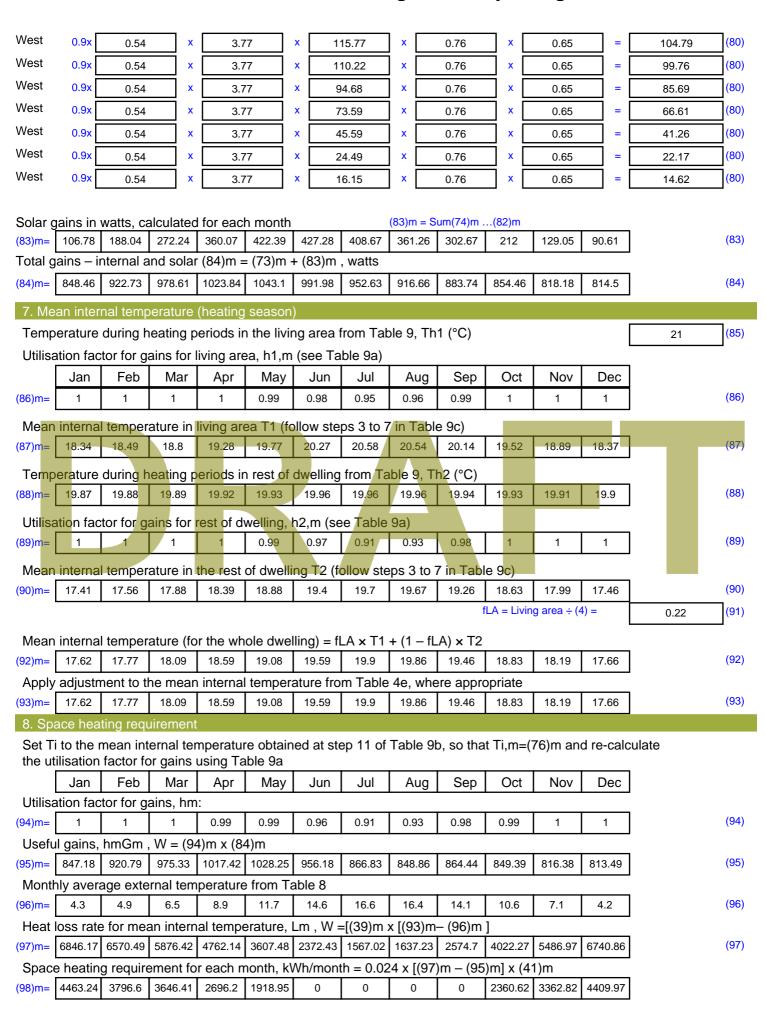
Table 6c

Table 6b



Northeast <sub>0.9x</sub>	0.54	X	4.94	x	11.28	X	0.76	X	0.65	=	13.38	(75)
Northeast <sub>0.9x</sub>	0.54	x	4.94	x	22.97	X	0.76	x	0.65	=	27.24	(75)
Northeast <sub>0.9x</sub>	0.54	x	4.94	x	41.38	X	0.76	x	0.65	=	49.08	(75)
Northeast <sub>0.9x</sub>	0.54	X	4.94	x	67.96	x	0.76	x	0.65	=	80.6	(75)
Northeast <sub>0.9x</sub>	0.54	x	4.94	x	91.35	x	0.76	x	0.65	=	108.34	(75)
Northeast <sub>0.9x</sub>	0.54	x	4.94	x	97.38	x	0.76	x	0.65	=	115.5	(75)
Northeast 0.9x	0.54	x	4.94	x	91.1	X	0.76	x	0.65	=	108.05	(75)
Northeast <sub>0.9x</sub>	0.54	x	4.94	x	72.63	X	0.76	x	0.65	=	86.14	(75)
Northeast <sub>0.9x</sub>	0.54	X	4.94	X	50.42	X	0.76	x	0.65	=	59.8	(75)
Northeast 0.9x	0.54	X	4.94	x	28.07	X	0.76	x	0.65	=	33.29	(75)
Northeast <sub>0.9x</sub>	0.54	x	4.94	x	14.2	X	0.76	x	0.65	=	16.84	(75)
Northeast <sub>0.9x</sub>	0.54	X	4.94	x	9.21	X	0.76	x	0.65	=	10.93	(75)
South 0.9x	0.54	x	3.77	x	46.75	X	0.76	x	0.65	=	42.32	(78)
South 0.9x	0.54	X	3.77	x	76.57	X	0.76	x	0.65	=	69.3	(78)
South 0.9x	0.54	X	3.77	x	97.53	X	0.76	x	0.65	=	88.28	(78)
South 0.9x	0.54	x	3.77	x	110.23	X	0.76	x	0.65	=	99.78	(78)
South 0.9x	0.54	X	3.77	x	114.87	X	0.76	x	0.65	=	103.97	(78)
South 0.9x	0.54	X	3.77	X	110.55	X	0.76	X	0.65	=	100.06	(78)
South 0.9x	0.54	x	3.77	х	108.01	X	0.76	x	0.65	=	97.76	(78)
South 0.9x	0.54	x	3.77	х	104.89	x	0.76	x	0.65	=	94.94	(78)
South 0.9x	0.54	x	3.77	X	101.89	X	0.76	x	0.65	=	92.22	(78)
South 0.9x	0.54	x	3.77	x	82.59	Х	0.76	x	0.65	=	74.75	(78)
South 0.9x	0.54	x	3.77	x	55.42	X	0.76	x	0.65	=	50.16	(78)
South 0.9x	0.54	x	3.77	х	40.4	X	0.76	x	0.65	=	36.56	(78)
Southwest <sub>0.9x</sub>	0.54	x	3.77	x	36.79		0.76	x	0.65	=	33.3	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	X	62.67		0.76	x	0.65	=	56.73	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	85.75		0.76	x	0.65	=	77.62	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	X	106.25		0.76	x	0.65	=	96.17	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	119.01		0.76	X	0.65	=	107.72	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	X	118.15		0.76	X	0.65	=	106.94	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	113.91		0.76	X	0.65	=	103.1	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	104.39		0.76	X	0.65	=	94.49	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	92.85		0.76	X	0.65	=	84.04	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	69.27		0.76	x	0.65	=	62.7	(79)
Southwest <sub>0.9x</sub>	0.54	X	3.77	x	44.07		0.76	x	0.65	=	39.89	(79)
Southwest <sub>0.9x</sub>	0.54	x	3.77	x	31.49		0.76	x	0.65	=	28.5	(79)
West 0.9x	0.54	x	3.77	x	19.64	X	0.76	x	0.65	=	17.78	(80)
West 0.9x	0.54	x	3.77	x	38.42	X	0.76	x	0.65	=	34.78	(80)
West 0.9x	0.54	x	3.77	x	63.27	x	0.76	x	0.65	=	57.27	(80)
West 0.9x	0.54	x	3.77	x	92.28	X	0.76	x	0.65	=	83.52	(80)
West 0.9x	0.54	x	3.77	X	113.09	×	0.76	X	0.65	=	102.36	(80)







			Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	26654.81	(98)
Space heating requirement in kWh/m²/year								117.11	(99)
9a. Energy requirements – Individual heating s	systems i	ncluding	micro-C	CHP)					
Space heating:							ı		<b></b>
Fraction of space heat from secondary/supple	ementary	•		(004)				0	(201)
Fraction of space heat from main system(s)			(202) = 1	, ,	(0.00)			1	(202)
Fraction of total heating from main system 1			(204) = (2	02) <b>×</b> [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1								75	(206)
Efficiency of secondary/supplementary heating	0	(208)							
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calculated above 4463.24 3796.6 3646.41 2696.2 1918.95	<del>i                                      </del>	0	0	0	2360.62	3362.82	4409.97		
	71 0	0			2300.02	3302.02	4409.97		(044)
$ (211)m = \{[(98)m \times (204)] \} \times 100 \div (206) $ $ 5950.99 \ 5062.14 \ 4861.88 \ 3594.93 \ 2558.6 $	0	0	0	0	3147.5	4483.77	5879.96		(211)
	<u> </u>		Tota	l (kWh/yea	ar) =Sum(2		<u></u>	35539.75	(211)
Space heating fuel (secondary), kWh/month									
$= \{[(98)m \times (201)]\} \times 100 \div (208)$								1	
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		_
			Tota	ıl (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	<u></u>	0	(215)
Water heating Output from water heater (calculated above)									
277.26 245.46 260.34 236.93 234.75	196.75	191.25	206.7	205.34	245.51	255.14	271.78		
Efficiency of water heater								65	(216)
(217)m= 74.33 74.31 74.24 74.08 73.76	65	65	65	65	73.93	74.2	74.34		(217)
Fuel for water heating, kWh/month									
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 373  330.34  350.68  319.83  318.25 $	302.69	294.23	318	315.91	332.09	343.88	365.61		
				l = Sum(2		ļ.	l	3964.51	(219)
Annual totals					k'	Wh/yeaı	· .	kWh/yea	<u></u>
Space heating fuel used, main system 1								35539.75	
Water heating fuel used								3964.51	
Electricity for pumps, fans and electric keep-ho	ot								
central heating pump:							120		(230c)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			120	(231)
Electricity for lighting								1367.31	(232)
12a. CO2 emissions – Individual heating syst	ems incl	uding mi	cro-CHF	)					
<u> </u>		J			<b></b> !	: <b>f</b>	4	Fusianiau	
		<b>lergy</b> /h/year			kg CO	<b>ion fac</b> 2/kWh	ior	Emission kg CO2/ye	
Space heating (main system 1)		1) x			0.2		=	7676.59	(261)
Space heating (secondary)	(21	5) x			0.5		=	0	(263)
apara maamig (aaaamaan)	`	•			U.5	13		U	(200)



Water heating	(219) x	0.216 =	856.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =		8532.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	62.28	(267)
Electricity for lighting	(232) x	0.519 =	709.63	(268)
Total CO2, kg/year	sum	of (265)(271) =	9304.83	(272)
Dwelling CO2 Emission Rate	(272	) ÷ (4) =	40.88	(273)
EI rating (section 14)			54	(274)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 7 - Existing - 3B6P - MF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 250.9 (1a) x (2a) =(3a) 4.4 1103.96 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)250.9 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =1103.96 (5) total main secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.04 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.79 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.73 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) = (	21a) x (22a)m
0.93 0.91 0.89 0.8 0.78 0.69 0.69	0.67 0.73 0.78 0.82 0.85
Calculate effective air change rate for the applicable case  If mechanical ventilation:	(222)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (Ns	0   (23a) 5)) otherwise (23b) = (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from	T 11 (1)
a) If balanced mechanical ventilation with heat recovery (MVH	(=55)
(24a)m= 0 0 0 0 0 0 0 0	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
b) If balanced mechanical ventilation without heat recovery (M	, ,
(24b)m= 0 0 0 0 0 0 0 0	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
c) If whole house extract ventilation or positive input ventilation	
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c)$	
(24c)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilation	n from loft
if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0$	
(24d)m= 0.93 0.91 0.9 0.82 0.81 0.74 0.74	0.73   0.76   0.81   0.83   0.87   (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d	) in box (25)
(25)m= 0.93 0.91 0.9 0.82 0.81 0.74 0.74	0.73 0.76 0.81 0.83 0.87 (25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross Openings Net Area A,m²	U-value A X U k-value A X k W/m2K (W/K) kJ/m²-K kJ/K
	$\frac{1}{(3.1) + 0.04} = \frac{41.12}{(27)}$
	$1/(3.1) + 0.041 = 81.55 \tag{27}$
	$\frac{1/(3.1) + 0.04}{1/(3.1) + 0.04} = 81.55 $ $\frac{29.89}{1/(3.1) + 0.04} = 29.89 $ (27)
Windows Type 3 10.836 x1/[	1/(3.1) + 0.04] = 29.89  (27)
Windows Type 3  10.836  10.836  x1/[1]  Windows Type 4	1/(3.1) + 0.04] = 29.89  (27)
Windows Type 3       10.836       x1/[         Windows Type 4       4.81       x1/[         Windows Type 5       7.72       x1/[	$\frac{1}{(3.1) + 0.04} = 29.89$ $\frac{1}{(3.1) + 0.04} = 13.27$ (27)
Windows Type 3       10.836       x1/[         Windows Type 4       4.81       x1/[         Windows Type 5       7.72       x1/[	$\frac{1}{(3.1) + 0.04} = 29.89$ $\frac{1}{(3.1) + 0.04} = 13.27$ $\frac{1}{(3.1) + 0.04} = 21.29$ (27)
Windows Type 3       10.836       x1/[         Windows Type 4       4.81       x1/[         Windows Type 5       7.72       x1/[         Windows Type 6       7.32       x1/[	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ (27)
Windows Type 3       10.836       x1/[i         Windows Type 4       4.81       x1/[i         Windows Type 5       7.72       x1/[i         Windows Type 6       7.32       x1/[i         Walls Type 1       337.79       75.17       262.62       x	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ $0.6 = 157.57$ (27)
Windows Type 3       10.836       x1/[i         Windows Type 4       4.81       x1/[i         Windows Type 5       7.72       x1/[i         Windows Type 6       7.32       x1/[i         Walls Type1       337.79       75.17       262.62       x         Walls Type2       58.52       0       58.52       x	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ $0.6 = 157.57$ $0.48 = 28.32$ (27) (27) (29)
Windows Type 3       10.836       x1/[]         Windows Type 4       4.81       x1/[]         Windows Type 5       7.72       x1/[]         Windows Type 6       7.32       x1/[]         Walls Type 1       337.79       75.17       262.62       x []         Walls Type 2       58.52       0       58.52       x []         Total area of elements, m²       396.31	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ $0.6 = 157.57$ $0.48 = 28.32$ (27) (27) (29) (29)
Windows Type 3       10.836       x1/[]         Windows Type 4       4.81       x1/[]         Windows Type 5       7.72       x1/[]         Windows Type 6       7.32       x1/[]         Walls Type1       337.79       75.17       262.62       x         Walls Type2       58.52       0       58.52       x         Total area of elements, m²       396.31         Party wall       11.35       x	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ $0.6 = 157.57$ $0.48 = 28.32$ $(27)$ $(27)$ $(29)$ $(31)$
Windows Type 3       10.836       x1/[]         Windows Type 4       4.81       x1/[]         Windows Type 5       7.72       x1/[]         Windows Type 6       7.32       x1/[]         Walls Type 1       337.79       75.17       262.62       x []         Walls Type 2       58.52       0       58.52       x []         Total area of elements, m²       396.31         Party wall       11.35       x []         Party floor       251.47	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ $0.6 = 157.57$ $0.48 = 28.32$ $(27)$ $(27)$ $(29)$ $(31)$ $0 = 0$ $(32a)$ $(32b)$
Windows Type 3  Windows Type 4  Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using the strict of	1/(3.1) + 0.04] = 29.89 $1/(3.1) + 0.04] = 13.27$ $1/(3.1) + 0.04] = 21.29$ $1/(3.1) + 0.04] = 20.19$ $0.6 = 157.57$ $0.48 = 28.32$ $(27)$ $(27)$ $(29)$ $(31)$ $0 = 0$ $(32a)$ $(32b)$
Windows Type 3  Windows Type 4  Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using the strict of	1/(3.1) + 0.04] = 29.89 (27) 1/(3.1) + 0.04] = 13.27 (27) 1/(3.1) + 0.04] = 21.29 (27) 1/(3.1) + 0.04] = 20.19 (27) 0.6 = 157.57 (29) 0.48 = 28.32 (29) 0.48 = 0.48 (32) 0 = 0 (32) 0 = 0 (32) 0 = 0 (32) 0 = 0 (32)
Windows Type 3       10.836       x1/[]         Windows Type 4       4.81       x1/[]         Windows Type 5       7.72       x1/[]         Windows Type 6       7.32       x1/[]         Walls Type 1       337.79       75.17       262.62       x []         Walls Type 2       58.52       0       58.52       x []         Total area of elements, m²       396.31         Party wall       11.35       x []         Party floor       251.47         Party ceiling       251.47         * for windows and roof windows, use effective window U-value calculated using the include the areas on both sides of internal walls and partitions         Fabric heat loss, W/K = S (A x U)	1/(3.1) + 0.04] = 29.89 (27) 1/(3.1) + 0.04] = 13.27 (27) 1/(3.1) + 0.04] = 21.29 (27) 1/(3.1) + 0.04] = 20.19 (27) 0.6 = 157.57 (29) 0.48 = 28.32 (29) 0.48 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32) 0.048 = 0.04 (32)
Windows Type 3  Windows Type 4  Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using the include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)  Heat capacity Cm = S(A x k)	1/(3.1) + 0.04] = 29.89 (27) 1/(3.1) + 0.04] = 13.27 (27) 1/(3.1) + 0.04] = 21.29 (27) 1/(3.1) + 0.04] = 20.19 (27) 0.6 = 157.57 (29) 0.48 = 28.32 (29) 0.48 = 0.04 (32) 0.048 = 0.04 (33) 0.048 = 0.04 (33) 0.048 = 0.04 (32) 0.048 = 0.04 (33) 0.048 = 0.04 (34) 0.048 = 0.04 (35) 0.048 = 0.04 (35) 0.048 = 0.04 (35) 0.048 = 0.04 (36) 0.048 = 0.04 (37) 0.048 = 0.04 (38) 0.048
Windows Type 3  Windows Type 4  Windows Type 5  Windows Type 6  Walls Type 1  337.79  75.17  262.62  Walls Type 2  58.52  Total area of elements, m²  Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using the include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)  Heat capacity Cm = S(A x k)  Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K  For design assessments where the details of the construction are not known pre-	1/(3.1) + 0.04] = 29.89 (27) 1/(3.1) + 0.04] = 13.27 (27) 1/(3.1) + 0.04] = 21.29 (27) 1/(3.1) + 0.04] = 20.19 (27) 0.6 = 157.57 (29) 0.48 = 28.32 (29) 0.48 = 0.04 (32) 0.048 = 0.04 (33) 0.048 = 0.04 (33) 0.048 = 0.04 (32) 0.048 = 0.04 (33) 0.048 = 0.04 (34) 0.048 = 0.04 (35) 0.048 = 0.04 (35) 0.048 = 0.04 (35) 0.048 = 0.04 (36) 0.048 = 0.04 (37) 0.048 = 0.04 (38) 0.048



Total fabric he	at loss							(33) +	(36) =			452.64	(37)
Ventilation he	at loss ca	alculated	monthly	У				(38)m	= 0.33 × (	(25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 338.77	332.69	326.73	298.73	293.49	269.1	269.1	264.59	278.5	293.49	304.09	315.17		(38)
Heat transfer	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m= 791.42	785.33	779.37	751.37	746.13	721.75	721.75	717.23	731.14	746.13	756.73	767.81		
		II D) \ \	/ 014						_	Sum(39) <sub>1</sub> .	12 /12=	751.35	(39)
Heat loss para	<del></del>	<del>-                                    </del>		0.07	0.00	1 000	1 0 00		= (39)m ÷	<u>`                                    </u>	2.00		
(40)m= 3.15	3.13	3.11	2.99	2.97	2.88	2.88	2.86	2.91	2.97	3.02 Sum(40) <sub>1.</sub>	3.06	2.99	(40)
Number of day	ys in moi	nth (Tab	le 1a)					•	Average =	Sulli(40) <sub>1.</sub>	12 / 12=	2.99	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
		ı											
4. Water hea	tina enei	rav reau	irement:								kWh/ye	ear:	
Assumed occi if TFA > 13.			[1 - AVD	( <u>-</u> 0 0003	2/0 v /TF	-Δ <sub>-</sub> 13 Ω	)2)]	1013 v (*	TFΔ <sub>-</sub> 13		07		(42)
if TFA £ 13.		T 1.70 A	II - exb	(-0.000	743 X (11	A -13.3	<i>)</i> 2)] + 0.0	) X C10C	11 A - 13.	.9)			
Annual averag											7.07		(43)
Redu <mark>ce the annu</mark> not more that 125					_	-	to achieve	a water us	se target o	f			
							Δυσ	Con	Oct	Nov	Doo		
Jan Hot water usage	Feb in litres per	Mar day for ea	Apr ach month	May $Vd, m = fa$	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 117.77	113.49	109.21	104.93	100.64	96.36	96.36	100.64	104.93	109.21	113.49	117.77		
(11)	116.76		101.00	130.01	33.33	/ /	100.01			m(44) <sub>112</sub> =	l .	1284.81	(44)
Energy content of	f hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600						
(45)m= 174.66	152.75	157.63	137.43	131.86	113.79	105.44	120.99	122.44	142.69	155.76	169.14		
						•			Total = Su	m(45) <sub>112</sub> =	=	1684.59	(45)
If instantaneous v	vater heatii		of use (no	hot water	r storage),	enter 0 in	boxes (46	) to (61)		T	I		
(46)m= 26.2 Water storage	22.91	23.64	20.61	19.78	17.07	15.82	18.15	18.37	21.4	23.36	25.37		(46)
Storage volum		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		210		(47)
If community h	` ,		•			_			00.		210		(11)
Otherwise if n	•			•			` ,	ers) ente	er '0' in (	47)			
Water storage			,					•	·	•			
a) If manufac	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	factor fro	m Table	2b								0		(49)
Energy lost fro		_	-				(48) x (49)	) =		2	10		(50)
<ul><li>b) If manufact</li><li>Hot water stor</li></ul>			-										(54)
If community h	-			e z (KVV	ii/iiiie/ua	ay <i>)</i>				0.	02		(51)
Volume factor	_									0.	83		(52)
Temperature t	factor fro	m Table	2b								.6		(53)
Energy lost fro	om water	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	59		(54)
Enter (50) or	(54) in (5	55)								1.	59		(55)



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22	(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= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 54.55 49.27 54.55 52.79 54.55 36.09 37.3 37.3 36.09 54.55 52.79 54.55	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 278.43 246.49 261.4 237.85 235.64 197.51 191.96 207.51 206.17 246.47 256.19 272.92	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 278.43 246.49 261.4 237.85 235.64 197.51 191.96 207.51 206.17 246.47 256.19 272.92	
Output from water heater (annual) <sub>112</sub> 2838.53	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 141.09 125.78 135.43 126.03 126.86 104.82 104.27 109.44 107.69 130.46 132.13 139.26	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 153.4 15	(66) (67)
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= 153.4 15	` ,
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= 153.4 1	` ,
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= 153.4 1	(67)
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= 153.4 15	(67)
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= 153.4 15	(67) (68)
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= 153.4 15	(67) (68)
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= 153.4 15	(67) (68) (69)
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= 153.4 15	(67) (68) (69)
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= 153.4 15	(67) (68) (69) (70)
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= 153.4 15	(67) (68) (69) (70)
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= 153.4 15	(67) (68) (69) (70) (71)
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= 153.4 15	(67) (68) (69) (70) (71)

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

6. Solar gains:



Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	X	10.84	x	11.28	x	0.76	x	0.65	] =	29.35	(75)
Northeast 0.9x	0.77	X	4.81	х	11.28	x	0.76	X	0.65	=	18.58	(75)
Northeast 0.9x	0.77	X	7.72	x	11.28	x	0.76	x	0.65	] =	29.82	(75)
Northeast 0.9x	0.77	X	7.32	x	11.28	x	0.76	x	0.65	=	28.27	(75)
Northeast 0.9x	0.54	X	10.84	x	22.97	х	0.76	x	0.65	] =	59.75	(75)
Northeast 0.9x	0.77	X	4.81	х	22.97	x	0.76	X	0.65	=	37.82	(75)
Northeast 0.9x	0.77	X	7.72	x	22.97	x	0.76	X	0.65	=	60.7	(75)
Northeast 0.9x	0.77	X	7.32	x	22.97	x	0.76	X	0.65	=	57.55	(75)
Northeast 0.9x	0.54	X	10.84	x	41.38	x	0.76	X	0.65	=	107.65	(75)
Northeast 0.9x	0.77	X	4.81	x	41.38	x	0.76	x	0.65	=	68.14	(75)
Northeast 0.9x	0.77	X	7.72	x	41.38	x	0.76	x	0.65	=	109.36	(75)
Northeast 0.9x	0.77	X	7.32	x	41.38	x	0.76	x	0.65	=	103.69	(75)
Northeast 0.9x	0.54	X	10.84	x	67.96	x	0.76	x	0.65	=	176.79	(75)
Northeast 0.9x	0.77	X	4.81	x	67.96	x	0.76	x	0.65	=	111.9	(75)
Northeast 0.9x	0.77	X	7.72	x	67.96	x	0.76	X	0.65	=	179.6	(75)
Northeast 0.9x	0.77	X	7.32	X	67.96	Х	0.76	X	0.65	=	170.29	(75)
Northeast 0.9x	0.54	X	10.84	x	91.35	х	0.76	x	0.65	=	237.64	(75)
Northeast <sub>0.9x</sub>	0.77	X	4.81	х	91.35	×	0.76	x	0.65	=	150.42	(75)
Northeast <sub>0.9x</sub>	0.77	X	7.72	x	91.35	x	0.76	x	0.65	=	241.42	(75)
Northeast <sub>0.9x</sub>	0.77	X	7.32	x	91.35	Х	0.76	x	0.65	=	228.91	(75)
Northeast 0.9x	0.54	X	10.84	x	97.38	х	0.76	x	0.65	=	253.35	(75)
Northeast 0.9x	0.77	X	4.81	х	97.38	x	0.76	x	0.65	] =	160.36	(75)
Northeast 0.9x	0.77	X	7.72	х	97.38	x	0.76	X	0.65	] =	257.38	(75)
Northeast 0.9x	0.77	X	7.32	x	97.38	x	0.76	X	0.65	] =	244.04	(75)
Northeast 0.9x	0.54	X	10.84	x	91.1	x	0.76	X	0.65	=	237	(75)
Northeast 0.9x	0.77	X	4.81	x	91.1	x	0.76	X	0.65	=	150.01	(75)
Northeast 0.9x	0.77	X	7.72	x	91.1	x	0.76	X	0.65	=	240.77	(75)
Northeast 0.9x	0.77	X	7.32	X	91.1	X	0.76	X	0.65	=	228.29	(75)
Northeast 0.9x	0.54	X	10.84	x	72.63	x	0.76	X	0.65	=	188.94	(75)
Northeast 0.9x	0.77	X	4.81	x	72.63	x	0.76	X	0.65	=	119.59	(75)
Northeast 0.9x	0.77	X	7.72	x	72.63	x	0.76	X	0.65	=	191.94	(75)
Northeast 0.9x	0.77	X	7.32	x	72.63	x	0.76	X	0.65	=	182	(75)
Northeast 0.9x	0.54	X	10.84	X	50.42	x	0.76	X	0.65	=	131.17	(75)
Northeast 0.9x	0.77	X	4.81	X	50.42	x	0.76	X	0.65	] =	83.03	(75)
Northeast 0.9x	0.77	X	7.72	x	50.42	x	0.76	X	0.65	=	133.26	(75)
Northeast 0.9x	0.77	X	7.32	x	50.42	x	0.76	x	0.65	] =	126.35	(75)
Northeast 0.9x	0.54	X	10.84	x	28.07	x	0.76	x	0.65	=	73.02	(75)
Northeast 0.9x	0.77	X	4.81	x	28.07	x	0.76	X	0.65	=	46.22	(75)
Northeast 0.9x	0.77	X	7.72	x	28.07	х	0.76	x	0.65	=	74.18	(75)



Northeast 0.9x 0.77		x	7.32	x	28.07	X	0.76	x	0.65	=	70.33	(75)
Northeast 0.9x 0.54	. ;	x	10.84	x	14.2	x	0.76	x	0.65	=	36.93	(75)
Northeast 0.9x 0.77		x	4.81	x	14.2	x	0.76	x	0.65	=	23.38	(75)
Northeast 0.9x 0.77		x	7.72	x	14.2	x	0.76	x	0.65	=	37.52	(75)
Northeast 0.9x 0.77		х	7.32	x	14.2	X	0.76	x	0.65	=	35.58	(75)
Northeast 0.9x 0.54	. :	х	10.84	x	9.21	X	0.76	x	0.65	=	23.97	(75)
Northeast 0.9x 0.77		x	4.81	x	9.21	x	0.76	x	0.65	=	15.17	(75)
Northeast 0.9x 0.77		х	7.72	x	9.21	X	0.76	x	0.65	=	24.35	(75)
Northeast 0.9x 0.77		x	7.32	x	9.21	x	0.76	x	0.65	=	23.09	(75)
Southwest <sub>0.9x</sub> 0.77		x	14.91	x	36.79		0.76	x	0.65	=	187.81	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	36.79		0.76	x	0.65	=	372.47	(79)
Southwest <sub>0.9x</sub> 0.77	- :	x	14.91	x	62.67		0.76	x	0.65	=	319.91	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	62.67		0.76	x	0.65	=	634.45	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	x	85.75		0.76	x	0.65	=	437.71	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	85.75		0.76	x	0.65	=	868.08	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	x	106.25	]	0.76	x	0.65	=	542.34	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	106.25		0.76	x	0.65	=	1075.59	(79)
Southwest <sub>0.9x</sub> 0.77		X	14.91	X	119.01		0.76	X	0.65	=	607.47	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	119.01		0.76	x	0.65		1204.75	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	х	118.15		0.76	x	0.65	=	603.08	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	X	118.15		0.76	x	0.65	=	1196.04	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	x	113.91		0.76	x	0.65	=	581.43	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	113.91		0.76	x	0.65	=	1153.11	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	х	104.39		0.76	x	0.65	=	532.84	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	104.39		0.76	x	0.65	=	1056.75	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	x	92.85		0.76	X	0.65	=	473.95	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	92.85		0.76	x	0.65	=	939.94	(79)
Southwest <sub>0.9x</sub> 0.77		х	14.91	x	69.27	]	0.76	X	0.65	=	353.56	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	69.27		0.76	x	0.65	=	701.2	(79)
Southwest <sub>0.9x</sub> 0.77		x	14.91	x	44.07		0.76	x	0.65	=	224.95	(79)
Southwest <sub>0.9x</sub> 0.77		х	29.57	x	44.07	]	0.76	X	0.65	=	446.13	(79)
Southwest <sub>0.9x</sub> 0.77	- :	x	14.91	x	31.49		0.76	x	0.65	=	160.72	(79)
Southwest <sub>0.9x</sub> 0.77		x	29.57	x	31.49		0.76	X	0.65	=	318.75	(79)
Solar gains in watts, c	alculate	ed	for each mont	th_		(83)m	n = Sum(74)m	.(82)m			•	
` ′	1694.62		<u> </u>		714.24 2590.62	2272	2.07 1887.7	1318.5	1 804.49	566.06		(83)
Total gains – internal a			· · · · · ·	<u> </u>	<del></del>	1					1	
(84)m= 1415.35 1914.01	2411.93	3	2932.52 3304.0	3 32	291.15 3145.46	283	6.6 2476.09	1967.0	1 1499.19	1296		(84)
7. Mean internal tem	peratur	e (	heating seasc	n)								
Temperature during I	neating	pe	eriods in the liv	ving	area from Tab	ole 9	, Th1 (°C)				21	(85)
Utilisation factor for g	ains fo	r li	ving area, h1,	m (s	ee Table 9a)		<del>, , , , , , , , , , , , , , , , , , , </del>		<del>, , ,</del>		1	
Jan Feb	Mar	.	Apr May	/	Jun Jul	Α	ug Sep	Oct	Nov	Dec		



(86)m=														
	1	0.99	0.98	0.96	0.92	0.83	0.73	0.78	0.91	0.98	0.99	1		(86)
Mear	n interna	l temper	ature in	living are	ea T1 (fc	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	17.76	18.04	18.54	19.24	19.9	20.46	20.75	20.69	20.21	19.36	18.48	17.78		(87)
Temp	perature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.42	19.43	19.45	19.5	19.51	19.56	19.56	19.57	19.54	19.51	19.49	19.47		(88)
Utilis	ation fac	tor for g	ains for	rest of d	welling, l	n2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.88	0.75	0.57	0.64	0.86	0.97	0.99	1		(89)
Mear	n interna	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)	-			
(90)m=	16.53	16.82	17.31	18.05	18.69	19.25	19.47	19.44	19.02	18.18	17.29	16.57		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.17	(91)
Mear	n interna	l temper	ature (fc	or the wh	ole dwel	ling) = fl	LA × T1	+ (1 – fL	.A) × T2			'		
(92)m=	16.74	17.02	17.52	18.25	18.9	19.45	19.68	19.65	19.22	18.38	17.49	16.78		(92)
Apply	/ adjustn	nent to t	he mear	n internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	16.74	17.02	17.52	18.25	18.9	19.45	19.68	19.65	19.22	18.38	17.49	16.78		(93)
	ace hea													
				mperatur using Ta		ed at ste	ep 11 of	Table 9l	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
uieu	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilis	ation fac			_	iviay	Juli	Jul	Aug	ОСР	Oct	1407	DCC		
(94)m=	0.99	0.98	0.97	0.93	0.86	0.75	0.59	0.65	0.85	0.96	0.99	0.99		(94)
Us <mark>ef</mark>	ul gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	1405.22	1885.25	2337.68	2739.14	2857.73	2452.35	1855.75	1843	2104.65	1883.49	1480.96	1288.78		(95)
Mont	hly 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)
				nal tempe		Lm , W =	=[(39)m :		<del>-                                    </del>					(07)
(97)m=	1 9842 871		l							1 E8U/ 06	7862.26	9656.87		
_			8589.34				2226.04		3746.37	L				(97)
	e heatin	g require	ement fo	r each m	nonth, k\	Wh/mont	th = 0.02	4 x [(97	)m – (95	)m] x (4 <sup>-</sup>	1)m			(91)
Spac (98)m=			<u> </u>	r each m				4 x [(97	)m — (95 0	)m] x (4 <sup>-</sup> 2917.58	1)m 4594.54	6225.86	34756 56	
(98)m=	e heatin	g require 5131.77	ement fo 4651.24	or each m 3087.51	nonth, k\ 1870.46	Wh/mont	th = 0.02	4 x [(97	)m – (95	)m] x (4 <sup>-</sup> 2917.58	1)m 4594.54	6225.86	34756.56	(98)
(98)m=	e heating	g require 5131.77 g require	ement fo 4651.24 ement in	3087.51 kWh/m²	nonth, k\ 1870.46 /year	Vh/mont 0	th = 0.02	0 Tota	)m - (95 0	)m] x (4 <sup>-</sup> 2917.58	1)m 4594.54	6225.86	34756.56 138.53	
(98)m= Space 9a. Er	e heating 6277.6 e heating ergy reconstruction	g require 5131.77 g require	ement fo 4651.24 ement in	or each m 3087.51	nonth, k\ 1870.46 /year	Vh/mont 0	th = 0.02	0 Tota	)m - (95 0	)m] x (4 <sup>-</sup> 2917.58	1)m 4594.54	6225.86		(98)
(98)m= Space 9a. Er <b>Space</b>	e heating 6277.6 e heating receive heating rec	g require 5131.77 g require quiremen	ement for 4651.24 ement in hts – Ind	or each m 3087.51 kWh/m² ividual h	nonth, kl 1870.46 Vyear eating sy	Wh/mont 0	th = 0.02 0	0 Tota	)m - (95 0	)m] x (4 <sup>-</sup> 2917.58	1)m 4594.54	6225.86	138.53	(98)
(98)m= Space 9a. Er Space Frace	e heating 6277.6  e heating record re	g require  g require  guirement	ement for 4651.24 ement in the last from s	or each m 3087.51 kWh/m² ividual ho	nonth, kV 1870.46 Vyear eating sy	Wh/mont 0	th = 0.02 0	0 Total	)m - (95 0 al per year CHP)	)m] x (4 <sup>-</sup> 2917.58	1)m 4594.54	6225.86	138.53	(98) (99) (201)
Space 9a. Er Space Fract Fract	e heating 6277.6  e heating receive heating ion of spino	g require  g require  guirement  ng:  hace head	ement for 4651.24 ement in the line of the	or each m 3087.51 kWh/m² ividual ho econdary	nonth, kV 1870.46 E/year eating sy y/supple em(s)	Wh/mont 0	th = 0.02 0	0 Tota  micro-C	)m - (95 0 al per year CHP)	)m] x (4 2917.58 (kWh/year	1)m 4594.54	6225.86	0	(98) (99) (201) (202)
Space 9a. Er Space Fract Fract Fract	e heating for the heating received heating ion of spinon of to the heating ion of to the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion of the heating ion ion of the heating ion ion ion ion ion ion ion ion ion ion	g require  5131.77  g require  uirement  pace head  bace head  tal heati	ement for 4651.24 ement in the line of the	or each m 3087.51 kWh/m² ividual he econdary nain system	nonth, kl 1870.46 E/year eating sy y/supple em(s)	Wh/mont 0	th = 0.02 0	0 Tota micro-C	)m - (95 0 al per year CHP)	)m] x (4 2917.58 (kWh/year	1)m 4594.54	6225.86	0 1 1	(98) (99) (201) (202) (204)
Space 9a. Er Space Fract Fract Fract Effici	e heating fergy receive heating ion of spinon of to ency of received and the ency of received an	g require 5131.77 g require quirement pace hea pace hea tal heati	ement for 4651.24 ement in the Industrian set from many from mace heat	or each m 3087.51 kWh/m² ividual he econdary nain systemain systemain system	nonth, kl 1870.46 E/year eating sy y/supple em(s) stem 1	Vh/mont 0 ystems in mentary	th = 0.02 0 ncluding	0 Tota micro-C	)m - (95 0 al per year CHP)	)m] x (4 2917.58 (kWh/year	1)m 4594.54	6225.86	138.53 0 1 1 75	(98) (99) (201) (202) (204) (206)
Space 9a. Er Space Fract Fract Fract Effici	e heating fergy receive heating ion of spinon of to ency of received and the ency of received an	g require 5131.77 g require quirement pace heat pace heat pace heat pace heat pace heat pace heat pace heat	ement for 4651.24 ement in the Industrian set from many from mace heat	or each m 3087.51 kWh/m² ividual he econdary nain system	nonth, kl 1870.46 E/year eating sy y/supple em(s) stem 1	Vh/mont 0 ystems in mentary	th = 0.02 0 ncluding	0 Tota micro-C	)m - (95 0 al per year CHP) - (201) = 02) × [1 - 1	)m] x (4 2917.58 (kWh/year	1)m 4594.54	6225.86	0 1 1	(98) (99) (201) (202) (204)
Space Space Space Fract Fract Effici Effici	e heating for the heating ion of spin of too ency of senc	g require  5131.77  g require  uiremer  ng:  bace hea  bace hea  tal heati  main spa  seconda  Feb	ement for 4651.24 ement in the sement in the	ividual homain systemain systementary	eating sy y/supple em(s) stem 1 em 1 y heating	Vh/mont 0  ystems in mentary g system Jun	th = 0.02 0 ncluding	0 Tota micro-C	)m - (95 0 al per year CHP)	)m] x (4 2917.58 (kWh/year	1)m 4594.54	6225.86	138.53 0 1 1 75	(98) (99) (201) (202) (204) (206) (208)
Space Space Space Fract Fract Effici Effici	e heating 6277.6  e heating receive heating ion of spring ion of to ency of spring ency of sprin	g require 5131.77 g require quirement pace hea	ement for 4651.24 ement in the India at from some from the form th	ividual he econdary nain systemain systemain systementary Apr	y/supple em(s) stem 1 y heating May d above)	ystems in mentary g system Jun	ncluding system n, % Jul	14 x [(97] 0 Total micro-C (202) = 1 (204) = (2	)m - (95 0 al per year CHP) - (201) = 02) × [1 -	)m] x (4' 2917.58 (kWh/year	1)m 4594.54 ) = Sum(9	6225.86 8) <sub>15,912</sub> =	138.53 0 1 1 75 0	(98) (99) (201) (202) (204) (206) (208)
Space Space Space Fract Fract Effici Effici	e heating for the heating ion of spinon of the heating ion of spinon of the heating for the heating for heating fo	g require  5131.77  g require  uirement  pace head  tal heati  main space  seconda  Feb  g require  5131.77	ement for 4651.24 ement in the India at from many from the acce heat ry/supplement (c) 4651.24	ividual homain systemain systementary  Apr calculated	whonth, kly 1870.46 stylear sylvestem 1 sylvestem 1 may deabove) 1870.46	Vh/mont 0  ystems in mentary g system Jun	th = 0.02 0 ncluding system	0 Total micro-C (202) = 1 (204) = (2	)m - (95 0 al per year CHP) - (201) = 02) × [1 - 1	)m] x (4 2917.58 (kWh/year	1)m 4594.54 ) = Sum(9	6225.86 8) <sub>15,912</sub> =	138.53 0 1 1 75 0	(98) (99) (201) (202) (204) (206) (208)
Space Space Space Fract Fract Effici Effici	e heating for the heating ion of spring ion of the heating ion of the heating for the heating for the heating for the heating form is the heating form in the heating form in the heating form is the heating form in the heating form is the heating form in the heating form in the heating form is the heating form in the heating	g require 5131.77 g require quirement pace hea	ement for 4651.24 ement in the last from some from the last from mace heat ry/supplement (content of the last from	ividual he econdary nain systemain systementary Apr calculated 3087.51	eating sy y/supple em(s) stem 1 em 1 y heating May d above) 1870.46	ystems in mentary  g system  Jun  0	ncluding system  Jul	14 x [(97) 0 Total micro-C (202) = 1 (204) = (2	)m - (95 0 1 per year CHP) - (201) = 02) × [1 - 1	)m] x (4' 2917.58 (kWh/year  (203)] =  Oct	1)m 4594.54 ) = Sum(9 Nov 4594.54	6225.86 8) <sub>15,912</sub> = Dec	138.53 0 1 1 75 0	(98) (99) (201) (202) (204) (206) (208)
Space Space Space Fract Fract Effici Effici	e heating for the heating ion of spring ion of the heating ion of the heating for the heating for the heating for the heating form is the heating form in the heating form in the heating form is the heating form in the heating form is the heating form in the heating form in the heating form is the heating form in the heating	g require 5131.77 g require quirement pace hea	ement for 4651.24 ement in the last from some from the last from mace heat ry/supplement (content of the last from	ividual homain systemain systementary  Apr calculated	eating sy y/supple em(s) stem 1 em 1 y heating May d above) 1870.46	ystems in mentary g system Jun	ncluding system n, % Jul	24 x [(97] 0 Total micro-C (202) = 1 - (204) = (2	)m - (95 0 al per year CHP) - (201) = 02) × [1 -	)m] x (4' 2917.58 (kWh/year  (203)] =  Oct 2917.58	Nov 4594.54 1) = Sum(9	6225.86 8) <sub>15,912</sub> = Dec 6225.86	138.53 0 1 1 75 0	(98) (99) (201) (202) (204) (206) (208)



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		
			Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	F	0	(215)
Water heating									_
Output from water heater (calculated above)	I	101.00	007.54	000.47	0.40.47	050.40	070.00	1	
278.43   246.49   261.4   237.85   235.64   19 Efficiency of water heater	97.51	191.96	207.51	206.17	246.47	256.19	272.92	G.F.	(216)
(217)m= 74.51 74.47 74.39 74.18 73.73	65	65	65	65	74.11	74.4	74.52	65	(217)
Fuel for water heating, kWh/month	00	00	00	00	74.11	/	74.02		(211)
$(219)$ m = $(64)$ m × $100 \div (217)$ m									
(219)m= 373.66 330.97 351.39 320.62 319.59 30	03.87	295.32	319.25	317.18	332.56	344.36	366.24		_
			Tota	I = Sum(21				3975.01	(219)
Annual totals					k\	Wh/year	•	kWh/yea	<u>'</u>
Space heating fuel used, main system 1								46342.08	╡
Water heating fuel used								3975.01	
Electricity for pumps, fans and electric keep-hot									
central heating pump:							120	]	(230c)
central heating pump:  Total electricity for the above, kWh/year			sum	of (230a).	(230g) =		120	120	(230c)
			sum	of (230a).	(230g) =		120	120 1116.56	_
Total electricity for the above, kWh/year	s inclu	ding mid			(230g) =		120		(231)
Total electricity for the above, kWh/year  Electricity for lighting	Ene	ding mid				ion fac			(231)
Total electricity for the above, kWh/year  Electricity for lighting	Ene	e <b>rgy</b> h/year			Emiss	<b>ion fac</b> 2/kWh		1116.56 Emissions	(231)
Total electricity for the above, kWh/year  Electricity for lighting  12a. CO2 emissions – Individual heating systems	<b>Ene</b> kWl	ergy h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions	(231) (232)
Total electricity for the above, kWh/year  Electricity for lighting  12a. CO2 emissions – Individual heating systems  Space heating (main system 1)	Ene kWI (211)	ergy h/year ) x			Emiss kg CO	ion fac 2/kWh 16	tor	1116.56  Emissions kg CO2/ye  10009.89	(231) (232) (232) (261)
Total electricity for the above, kWh/year  Electricity for lighting  12a. CO2 emissions – Individual heating systems  Space heating (main system 1)  Space heating (secondary)	Ene kWI (211) (215) (219)	ergy h/year ) x ) x			Emiss kg CO2	ion fac 2/kWh 16	tor = =	1116.56  Emissions kg CO2/ye 10009.89	(231) (232) (232) (261) (263)
Total electricity for the above, kWh/year  Electricity for lighting  12a. CO2 emissions – Individual heating systems  Space heating (main system 1)  Space heating (secondary)  Water heating	Ene kWI (211) (215) (219)	ergy h/year ) x ) x ) x	cro-CHP		Emiss kg CO2	ion fac 2/kWh 16 19	tor = =	1116.56  Emissions kg CO2/ye  10009.89  0  858.6	(231) (232) (232) (261) (263) (264)
Total electricity for the above, kWh/year  Electricity for lighting  12a. CO2 emissions – Individual heating systems  Space heating (main system 1)  Space heating (secondary)  Water heating  Space and water heating	Ene kWI (211) (215) (219) (261)	ergy h/year ) x ) x ) x ) + (262) -	cro-CHP		Emiss kg CO2 0.2 0.5 0.2	ion fac 2/kWh 16 19	tor = = =	1116.56  Emissions kg CO2/ye  10009.89  0  858.6  10868.49	(231) (232) (232) (261) (263) (263) (264) (265)
Total electricity for the above, kWh/year  Electricity for lighting  12a. CO2 emissions – Individual heating systems  Space heating (main system 1)  Space heating (secondary)  Water heating  Space and water heating  Electricity for pumps, fans and electric keep-hot	Ene kWl (211) (215) (219) (261) (231)	ergy h/year ) x ) x ) x ) + (262) -	cro-CHP	264) =	Emiss kg CO2 0.2 0.5 0.5	ion fac 2/kWh 16 19 16	tor	1116.56  Emissions kg CO2/ye  10009.89  0  858.6  10868.49  62.28	(231) (232) (232) (232) (261) (263) (264) (265) (265)

El rating (section 14)

(274)



			User D	etails:						
Assessor Name:				Stroma	a Num	ber:				
Software Name:	Stroma FSAP 20	12		Softwa	are Vei	rsion:		Versio	n: 1.0.4.23	
		Pr	operty A	Address:	: Flat 16	- Existin	g - 3B4F	P - MF		
Address :	Branch Hill House,	Branch H	lill, LON	DON, N	W3 7LS					
1. Overall dwelling dimer	nsions:									
			Area	a(m²)		Av. Hei	ight(m)		Volume(m³)	_
Ground floor			2	270	(1a) x	3.	.28	(2a) =	885.6	(3a)
Total floor area TFA = (1a	ı)+(1b)+(1c)+(1d)+(1	e)+(1n	)	270	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	885.6	(5)
2. Ventilation rate:										
		secondary heating	y	other		total			m³ per hour	•
Number of chimneys	0 +	0	+	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	] + [	0	] = [	0	x 2	20 =	0	(6b)
Number of intermittent far	าร					3	x ′	10 =	30	(7a)
Number of passive vents					Ī	0	x ′	10 =	0	(7b)
Number of flueless gas fir	es					0	X 4	10 =	0	(7c)
					_			Air ch	anges per ho	ur
Letter Constitution		C=2 + (Ch) + (7-	-> . (=/-> . /=	7						_
Infiltration due to chimney  If a pressurisation test has be					continuo fr	30		÷ (5) =	0.03	(8)
Number of storeys in th		lea, proceed	110 (17), 0	ou iei wise c	Jonanae III	om ( <del>9)</del> to (	10)	ı	0	(9)
Additional infiltration	3(1)						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.3	25 for steel or timber	frame or	0.35 for	masonr	y constr	uction	ı		0	(11)
if both types of wall are pre		sponding to	the greate	er wall are	a (after			•		_
deducting areas of opening  If suspended wooden fl	3 // 1	aled) or 0	مادمی) 1	معام (امر	enter N			í	0	(12)
If no draught lobby, ent	•	dica) or o.	i (Scalc	.u), cisc	CITICI O				0	(13)
Percentage of windows		stripped							0	(14)
Window infiltration	g			0.25 - [0.2	x (14) ÷ 1	00] =		ļ	0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =	i	0	(16)
Air permeability value, o	q50, expressed in cu	bic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	15	(17)
If based on air permeabili	ty value, then (18) = [(	17) ÷ 20]+(8	), otherwi	se (18) = (	16)				0.78	(18)
Air permeability value applies	s if a pressurisation test ha	as been done	e or a deg	gree air pei	rmeability	is being us	sed			_
Number of sides sheltered	d			(20)					1	(19)
Shelter factor				(20) = 1 -		9)] =		ļ	0.92	(20)
Infiltration rate incorporati	_			(21) = (18)	) x (20) =			l	0.73	(21)
Infiltration rate modified for	<del></del>	1 1				_				
	Mar   Apr   May	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	)m ÷ 4									
(22a)m= 1.27 1.25 1	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		



Adjuste	ed infiltr	ation rat	e (allowir	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m						
	0.92	0.91	0.89	0.8	0.78	0.69	0.69	0.67	0.73	0.78	0.82	0.85			
		<i>ctive air</i> al ventila	change n	ate for t	he appli	cable ca	ise	-	-			-			(3a)
			using Appe	ndix N. (2	3b) = (23a	a) × Fmv (e	eguation (I	N5)) . othe	rwise (23b	) = (23a)			0		3b)
			overy: effici	,	, ,	,	. ,		,	, (===,			0		.3c)
			anical ve	•	Ū		,		,	2b)m + (2	23b) <b>x</b> [1	1 – (23c)		(2	30)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(2	(4a)
L	balance	d mech	anical ve	ntilation	without	heat red	covery (N	иV) (24t	m = (22)	2b)m + (2	23b)				
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(2	24b)
c) If v	whole h	ouse ex	tract ven	tilation c	or positiv	re input v	ventilatio	on from o	outside						
			(23b), th		-	-				5 × (23b	)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(2	(4c)
,			on or who en (24d)r		•	•				0.5]					
(24d)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86		(2	24d)
Effec	tive air	change	rate - en	ter (24a	or (24b	o) or (24	c) or (24	d) in bo	x (25)			-			
(25)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86		(2	5)
3. Hea	at losse	s and he	eat loss p	aramete	er:						_	_	_	_	
ELEM		Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/k	()	k-value		A X k kJ/K	
Windov	vs Type					22.26		/[1/( 3.1 )+	0.04] =	61.39	<u></u>			(2	.7)
Windov	vs Type	2				2.47	<sub>x</sub> 1	/[1/( 3.1 )+	0.04] =	6.81				(2	.7)
Windov	vs Type	3				2.47	x1	/[1/( 3.1 )+	0.04] =	6.81	=			(2	.7)
Windov	vs Type	4				3.861	x1	/[1/( 3.1 )+	0.04] =	10.65	=			(2	7)
Windov	vs Type	5				7.356	3 x1	/[1/( 3.1 )+	0.04] =	20.29	=			(2	27)
Windov	vs Type	6				10.78	2 x1	/[1/( 3.1 )+	0.04] =	29.74	=			(2	7)
Windov	vs Type	· 7				4.904	1 x1	/[1/( 3.1 )+	0.04] =	13.53	Ħ			(2	7)
Walls T	ype1	258.	53	54.1		204.4	3 X	0.6		122.66	7 [		П Г	(2	9)
Walls T	ype2	40.2	28	0		40.28	3 x	0.48	<u> </u>	19.49	T i		i i	(2	9)
Total a	rea of e	lements	, m²			298.8	1							(3	1)
Party w	/all					17.06	3 x	0		0			П Г	(3	2)
Party fl	oor					271.8	3						<b>7</b> F	(3.	(2a)
Party c	eiling					271.8	3				Ī		<b>7</b> F	(3.	32b)
			ows, use et sides of int				lated using	g formula 1	/[(1/U-valu	ie)+0.04] as	s given in	paragraph	3.2		
Fabric	heat los	s, W/K :	= S (A x l	U)	,			(26)(30)	) + (32) =				291.	36 (3	3)
Heat ca	apacity	Cm = S(	(Axk)						((28)	(30) + (32	) + (32a).	(32e) =	36922	2.87 (3	4)
Therma	al mass	parame	ter (TMP	e Cm ÷	-TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	0 (3	5)
			ere the det		constructi	ion are no	t known pi	ecisely the	e indicative	values of	TMP in Ta	able 1f			
			tailed calcu x Y) calc		ısina An	nendiy l	K					1	11.5	32 (3	(6)



	of therma	0 0	are not kn	own (36) =	= 0.05 x (3	11)			(33) ±	(36) =			220.40	(37)
			alculated	l monthly	./				. ,	` '	(25)m x (5)	1	336.18	(37)
VOITHIC	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(38)m=	271.01	266.16	261.41	239.08	234.9	215.46	215.46	211.86	222.95	234.9	243.35	252.19	<u> </u>	(38)
, ,	ransfer o		l			<u> </u>			<u> </u>	= (37) + (	<u> </u>		J	
(39)m=	607.19	602.35	597.59	575.26	571.09	551.64	551.64	548.04	559.13	571.09	579.54	588.37	1	
(00)111=	007.10	002.00	007.00	070.20	07 1.00	001.04	001.04	040.04	l .		Sum(39) <sub>1</sub>		575.24	(39)
Heat lo	oss para	meter (H	HLP), W	m²K						= (39)m ÷	` '		0.0.2	` ′
(40)m=	2.25	2.23	2.21	2.13	2.12	2.04	2.04	2.03	2.07	2.12	2.15	2.18		
						•	•	•		Average =	Sum(40) <sub>1</sub>	12 /12=	2.13	(40)
Numbe			nth (Tab	· ·									1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ene	rgy requi	irement:								kWh/y	ear:	
Assum	ned occu	ıpancv. İ	N								3	.09	1	(42)
if TF	A > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13		.03	J	(42)
	A £ 13.9												1	
								(25 x N) to achieve		se target o		7.66		(43)
		\	person per			_	-		Trailer at	o target e				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage ii	n litres per	day for ea		_	l .								
(44)m=	118.42	114.12	109.81	105.5	101.2	96.89	96.89	101.2	105.5	109.81	114.12	118.42		
								<u> </u>		rotal = Su	m(44) <sub>112</sub> =	=	1291.89	(44)
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,i	m x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		_
(45)m=	175.62	153.6	158.5	138.18	132.59	114.41	106.02	121.66	123.11	143.48	156.62	170.08		
										Total = Su	m(45) <sub>112</sub> =	=	1693.87	(45)
It instan		ater heatıı	ng at point	of use (no	not water	r storage),	enter 0 in	boxes (46	to (61)	ı	1	1	1	
(46)m=	26.34	23.04	23.77	20.73	19.89	17.16	15.9	18.25	18.47	21.52	23.49	25.51		(46)
	storage		includir	na anv sa	olar or M	/WHRS	storana	within sa	ame ves	امء		210	1	(47)
•		` ,	ind no ta	•			_		arric ves	301		210	J	(47)
	-	_			•			mbi boil	ers) ente	er '0' in <i>(</i>	47)			
	storage			(					,		, ,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWl	n/day):					0	]	(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	) =		2	10	]	(50)
,			eclared o	-				:					1	
		-	factor fr		e 2 (kW	h/litre/da	ay)				0.	.02		(51)
	munity n e factor	_	ee secti ble 2a	011 4.3								.83	1	(52)
			m Table	2b							-	.83 1.6	1	(52)
			storage		ear			(47) x (51)	) x (52) x (	53) =		.59	, ]	(54)
٠.	(50) or (		_	, <b>y</b> .				, , , , , , , , , , , , , , , , , , ,	, (,(	• /		.59		(55)
	` , - \	, (-	,								L		1	()



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22	(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= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 54.55 49.27 54.55 52.79 54.55 36.09 37.3 37.3 36.09 54.55 52.79 54.55	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 279.39 247.33 262.27 238.61 236.36 198.14 192.54 208.18 206.84 247.25 257.04 273.85	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 279.39 247.33 262.27 238.61 236.36 198.14 192.54 208.18 206.84 247.25 257.04 273.85	
Output from water heater (annual) <sub>112</sub> 2847.81	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 141.41 126.06 135.72 126.29 127.1 105.02 104.47 109.67 107.92 130.73 132.42 139.57	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 154.65 154.6	(66) (67)
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= 154.65 154.6	` '
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= 154.65 154.6	` '
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= 154.65 154.6	(67)
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= 154.65 154.6	(67)
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= 154.65 154.6	(67) (68)
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	(67) (68)
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	(67) (68) (69)
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= 154.65 154.6	(67) (68) (69)
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= 154.65 154.6	(67) (68) (69) (70)
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	(67) (68) (69) (70)
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= 154.65 154.6	(67) (68) (69) (70) (71)
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	(67) (68) (69) (70) (71)

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

6. Solar gains:



Northeast 0.9x	Orientation:	Access Factor Table 6d	•	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	x	11.28	x	0.76	x	0.65	] =	14.91	(75)
Northeast 0.sx	Northeast 0.9x	0.54	X	7.36	х	11.28	x	0.76	x	0.65	=	19.93	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	х	11.28	x	0.76	x	0.65	] =	41.65	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	11.28	x	0.76	x	0.65	=	13.28	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	x	22.97	х	0.76	x	0.65	] =	30.36	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	х	22.97	x	0.76	x	0.65	=	40.56	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	x	22.97	x	0.76	x	0.65	=	84.77	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	22.97	x	0.76	X	0.65	=	27.04	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	х	41.38	x	0.76	x	0.65	] =	54.69	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	x	41.38	x	0.76	x	0.65	=	73.08	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	x	41.38	x	0.76	x	0.65	=	152.73	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	41.38	x	0.76	x	0.65	=	48.72	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	x	67.96	x	0.76	x	0.65	=	89.82	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	х	67.96	x	0.76	x	0.65	] =	120.01	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	x	67.96	x	0.76	x	0.65	] =	250.83	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	X	67.96	Х	0.76	X	0.65	=	80.01	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	х	91.35	х	0.76	x	0.65	-	120.74	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.54	X	7.36	х	91.35	×	0.76	x	0.65	] =	161.32	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.77	X	10.78	x	91.35	x	0.76	x	0.65	] =	337.17	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.9	x	91.35	Х	0.76	x	0.65	] =	107.55	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.77	X	3.86	x	97.38	x	0.76	x	0.65	] =	128.72	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	х	97.38	x	0.76	x	0.65	] <b>=</b>	171.99	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	х	97.38	x	0.76	X	0.65	=	359.46	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	97.38	x	0.76	x	0.65	=	114.66	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	x	91.1	x	0.76	x	0.65	=	120.42	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	x	91.1	x	0.76	X	0.65	=	160.89	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	x	91.1	x	0.76	X	0.65	=	336.27	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	91.1	x	0.76	X	0.65	=	107.26	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	х	72.63	x	0.76	x	0.65	=	96	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	x	72.63	х	0.76	x	0.65	] =	128.26	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	10.78	x	72.63	х	0.76	x	0.65	] =	268.08	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	72.63	x	0.76	x	0.65	] =	85.51	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	x	50.42	x	0.76	x	0.65	=	66.65	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	x	50.42	x	0.76	x	0.65	j =	89.05	(75)
Northeast 0.9x 0.77	Northeast 0.9x	0.77	X	10.78	х	50.42	x	0.76	x	0.65	j =	186.11	(75)
Northeast 0.9x 0.54 x 7.36 x 28.07 x 0.76 x 0.65 = 49.57 (75)	Northeast 0.9x	0.54	X	4.9	x	50.42	x	0.76	x	0.65	] =	59.36	(75)
	Northeast 0.9x	0.77	X	3.86	x	28.07	x	0.76	x	0.65	] =	37.1	(75)
Northeast 0.9x 0.77 x 10.78 x 28.07 x 0.76 x 0.65 = 103.6 (75)	Northeast <sub>0.9x</sub>	0.54	X	7.36	x	28.07	x	0.76	x	0.65	j =	49.57	(75)
	Northeast <sub>0.9x</sub>	0.77	X	10.78	x	28.07	x	0.76	x	0.65	<u> </u>	103.6	(75)



Northeast 0.9x													
Northeast 0.5%	Northeast <sub>0.9x</sub>	0.54	X	4.9	x	28.07	X	0.76	X	0.65	=	33.05	(75)
Northeast 0.9x	Northeast 0.9x	0.77	X	3.86	x	14.2	x	0.76	x	0.65	=	18.77	(75)
Northeast 0 ax	Northeast <sub>0.9x</sub>	0.54	X	7.36	X	14.2	X	0.76	x	0.65	=	25.07	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.77	X	10.78	x	14.2	x	0.76	x	0.65	=	52.4	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.9	x	14.2	x	0.76	x	0.65	=	16.71	(75)
Northeast 0.9x	Northeast 0.9x	0.77	x	3.86	x	9.21	x	0.76	x	0.65	=	12.18	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	7.36	x	9.21	x	0.76	x	0.65	=	16.27	(75)
South	Northeast 0.9x	0.77	X	10.78	x	9.21	X	0.76	x	0.65	=	34.01	(75)
South	Northeast <sub>0.9x</sub>	0.54	X	4.9	X	9.21	X	0.76	x	0.65	=	10.85	(75)
South	South 0.9x	0.77	X	2.47	x	46.75	X	0.76	x	0.65	=	39.53	(78)
South	South 0.9x	0.77	X	2.47	x	76.57	X	0.76	x	0.65	=	64.74	(78)
South	South 0.9x	0.77	X	2.47	x	97.53	X	0.76	x	0.65	=	82.47	(78)
South	South 0.9x	0.77	X	2.47	x	110.23	X	0.76	x	0.65	=	93.21	(78)
South 0.9x 0.77	South 0.9x	0.77	X	2.47	x	114.87	X	0.76	x	0.65	=	97.13	(78)
South 0.9x 0.77	South 0.9x	0.77	X	2.47	x	110.55	X	0.76	x	0.65	=	93.48	(78)
South 0.9x 0.77	South 0.9x	0.77	X	2.47	x	108.01	X	0.76	x	0.65	=	91.33	(78)
South 0.9x 0.77	South 0.9x	0.77	X	2.47	X	104.89	X	0.76	X	0.65	=	88.7	(78)
South 0.9% 0.77	South 0.9x	0.77	X	2.47	×	101.89	X	0.76	X	0.65	=	86.15	(78)
South 0.9x 0.77	South 0.9x	0.77	X	2.47	х	82.59	X	0.76	x	0.65	=	69.83	(78)
Southwest 0.9x	South 0.9x	0.77	x	2.47	x	55.42	×	0.76	x	0.65	=	46.86	(78)
Southwest0.9x	South 0.9x	0.7 <mark>7</mark>	X	2.47	X	40.4	X	0.76	x	0.65	=	34.16	(78)
Southwesto.9x         0.77         x         22.26         x         85.75         0.76         x         0.65         =         653.48         (79)           Southwesto.9x         0.77         x         22.26         x         106.25         0.76         x         0.65         =         809.69         (79)           Southwesto.9x         0.77         x         22.26         x         119.01         0.76         x         0.65         =         809.69         (79)           Southwesto.9x         0.77         x         22.26         x         118.15         0.76         x         0.65         =         906.92         (79)           Southwesto.9x         0.77         x         22.26         x         113.91         0.76         x         0.65         =         900.37         (79)           Southwesto.9x         0.77         x         22.26         x         104.39         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         527.86         (79)           Southwesto.9x <td< td=""><td>Southwest<sub>0.9x</sub></td><td>0.77</td><td>x</td><td>22.26</td><td>x</td><td>36.79</td><td></td><td>0.76</td><td>x</td><td>0.65</td><td>=</td><td>280.39</td><td>(79)</td></td<>	Southwest <sub>0.9x</sub>	0.77	x	22.26	x	36.79		0.76	x	0.65	=	280.39	(79)
Southwesto.9x         0.77         x         22.26         x         106.25         0.76         x         0.65         =         809.69         (79)           Southwesto.9x         0.77         x         22.26         x         119.01         0.76         x         0.65         =         906.92         (79)           Southwesto.9x         0.77         x         22.26         x         118.15         0.76         x         0.65         =         900.37         (79)           Southwesto.9x         0.77         x         22.26         x         113.91         0.76         x         0.65         =         900.37         (79)           Southwesto.9x         0.77         x         22.26         x         104.39         0.76         x         0.65         =         868.05         (79)           Southwesto.9x         0.77         x         22.26         x         92.85         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         527.86         (79)           Southwesto.9x <td< td=""><td>Southwest<sub>0.9x</sub></td><td>0.77</td><td>x</td><td>22.26</td><td>x</td><td>62.67</td><td></td><td>0.76</td><td>x</td><td>0.65</td><td>=</td><td>477.61</td><td>(79)</td></td<>	Southwest <sub>0.9x</sub>	0.77	x	22.26	x	62.67		0.76	x	0.65	=	477.61	(79)
Southwesto.9x         0.77         x         22.26         x         119.01         0.76         x         0.65         =         906.92         (79)           Southwesto.9x         0.77         x         22.26         x         118.15         0.76         x         0.65         =         900.37         (79)           Southwesto.9x         0.77         x         22.26         x         113.91         0.76         x         0.65         =         868.05         (79)           Southwesto.9x         0.77         x         22.26         x         104.39         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         527.86         (79)           Southwesto.9x	Southwest <sub>0.9x</sub>	0.77	X	22.26	х	85.75		0.76	x	0.65	=	653.48	(79)
Southwesto.9x         0.77         x         22.26         x         118.15         0.76         x         0.65         =         900.37         (79)           Southwesto.9x         0.77         x         22.26         x         113.91         0.76         x         0.65         =         868.05         (79)           Southwesto.9x         0.77         x         22.26         x         104.39         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         527.86         (79)           West         0.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         239.95         (79)           West         <	L	0.77	X	22.26	x	106.25		0.76	X	0.65	=	809.69	(79)
Southwesto.9x         0.77         x         22.26         x         113.91         0.76         x         0.65         =         868.05         (79)           Southwesto.9x         0.77         x         22.26         x         104.39         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         239.95         (79)           We	<u> </u>	0.77	X	22.26	X	119.01		0.76	X	0.65	=	906.92	(79)
Southwesto.9x         0.77         x         22.26         x         104.39         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         92.85         0.76         x         0.65         =         795.51         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         335.84         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         16.61         (80)	L	0.77	X	22.26	X	118.15		0.76	X	0.65	=	900.37	(79)
Southwesto.9x         0.77         x         22.26         x         92.85         0.76         x         0.65         =         707.58         (79)           Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         16.61         (80)           West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         53.5 <td>Southwest<sub>0.9x</sub></td> <td>0.77</td> <td>X</td> <td>22.26</td> <td>X</td> <td>113.91</td> <td></td> <td>0.76</td> <td>X</td> <td>0.65</td> <td>=</td> <td>868.05</td> <td>(79)</td>	Southwest <sub>0.9x</sub>	0.77	X	22.26	X	113.91		0.76	X	0.65	=	868.05	(79)
Southwesto.9x         0.77         x         22.26         x         69.27         0.76         x         0.65         =         527.86         (79)           Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         335.84         (79)           Southwesto.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         16.61         (80)           West         0.9x         0.77         x         2.47         x         38.42         x         0.76         x         0.65         =         32.49         (80)           West         0.9x         0.77         x         2.47         x         92.28         x         0.76         x         0.65         <	Southwest <sub>0.9x</sub>	0.77	X	22.26	X	104.39		0.76	X	0.65	=	795.51	(79)
Southwesto.9x         0.77         x         22.26         x         44.07         0.76         x         0.65         =         335.84         (79)           Southwesto.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         16.61         (80)           West         0.9x         0.77         x         2.47         x         38.42         x         0.76         x         0.65         =         32.49         (80)           West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         32.49         (80)           West         0.9x         0.77         x         2.47         x         92.28         x         0.76         x         0.65         =         78.03         (80)           West         0.9x         0.77         x         2.47         x         113.09         x         0.76         x	<u> </u>	0.77	X	22.26	X	92.85		0.76	X	0.65	=	707.58	(79)
Southwesto.9x         0.77         x         22.26         x         31.49         0.76         x         0.65         =         239.95         (79)           West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         16.61         (80)           West         0.9x         0.77         x         2.47         x         38.42         x         0.76         x         0.65         =         32.49         (80)           West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         53.5         (80)           West         0.9x         0.77         x         2.47         x         92.28         x         0.76         x         0.65         =         78.03         (80)           West         0.9x         0.77         x         2.47         x         113.09         x         0.76         x         0.65         =         97.89         (80)           West         0.9x         0.77         x         2.47         x         115.77         x	<u> </u>	0.77	X	22.26	X	69.27		0.76	X	0.65	=	527.86	(79)
West         0.9x         0.77         x         2.47         x         19.64         x         0.76         x         0.65         =         16.61         (80)           West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         32.49         (80)           West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         53.5         (80)           West         0.9x         0.77         x         2.47         x         92.28         x         0.76         x         0.65         =         78.03         (80)           West         0.9x         0.77         x         2.47         x         113.09         x         0.76         x         0.65         =         95.63         (80)           West         0.9x         0.77         x         2.47         x         115.77         x         0.76         x         0.65         =         97.89         (80)           West         0.9x         0.77         x         2.47         x         110.22	<u> </u>	0.77	X	22.26	X	44.07		0.76	X	0.65	=	335.84	(79)
West         0.9x         0.77         x         2.47         x         38.42         x         0.76         x         0.65         =         32.49         (80)           West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         53.5         (80)           West         0.9x         0.77         x         2.47         x         113.09         x         0.76         x         0.65         =         78.03         (80)           West         0.9x         0.77         x         2.47         x         113.09         x         0.76         x         0.65         =         95.63         (80)           West         0.9x         0.77         x         2.47         x         115.77         x         0.76         x         0.65         =         97.89         (80)           West         0.9x         0.77         x         2.47         x         110.22         x         0.76         x         0.65         =         97.89         (80)	Southwest <sub>0.9x</sub>	0.77	X	22.26	X	31.49		0.76	X	0.65	=	239.95	(79)
West         0.9x         0.77         x         2.47         x         63.27         x         0.76         x         0.65         =         53.5         (80)           West         0.9x         0.77         x         2.47         x         92.28         x         0.76         x         0.65         =         78.03         (80)           West         0.9x         0.77         x         2.47         x         113.09         x         0.76         x         0.65         =         95.63         (80)           West         0.9x         0.77         x         2.47         x         115.77         x         0.76         x         0.65         =         97.89         (80)           West         0.9x         0.77         x         2.47         x         110.22         x         0.76         x         0.65         =         93.2         (80)	West 0.9x	0.77	X	2.47	X	19.64	X	0.76	X	0.65	=	16.61	(80)
West       0.9x       0.77       x       2.47       x       92.28       x       0.76       x       0.65       =       78.03       (80)         West       0.9x       0.77       x       2.47       x       113.09       x       0.76       x       0.65       =       95.63       (80)         West       0.9x       0.77       x       2.47       x       115.77       x       0.76       x       0.65       =       97.89       (80)         West       0.9x       0.77       x       2.47       x       110.22       x       0.76       x       0.65       =       93.2       (80)	West 0.9x	0.77	X	2.47	x	38.42	X	0.76	X	0.65	=	32.49	(80)
West       0.9x       0.77       x       2.47       x       113.09       x       0.76       x       0.65       =       95.63       (80)         West       0.9x       0.77       x       2.47       x       115.77       x       0.76       x       0.65       =       97.89       (80)         West       0.9x       0.77       x       2.47       x       110.22       x       0.76       x       0.65       =       93.2       (80)	West 0.9x	0.77	X	2.47	x	63.27	X	0.76	x	0.65	=	53.5	(80)
West 0.9x 0.77 x 2.47 x 115.77 x 0.76 x 0.65 = 97.89 (80) West 0.9x 0.77 x 2.47 x 110.22 x 0.76 x 0.65 = 93.2 (80)	<u>L</u>	0.77	×	2.47	x	92.28	X	0.76	x	0.65	=	78.03	(80)
West 0.9x 0.77 x 2.47 x 110.22 x 0.76 x 0.65 = 93.2 (80)	<u>L</u>	0.77	×	2.47	x	113.09	X	0.76	x	0.65	=	95.63	(80)
N/	<u>L</u>	0.77	×	2.47	x	115.77	X	0.76	x	0.65	=	97.89	(80)
West $0.9x$ $0.77$ $\times$ $2.47$ $\times$ $94.68$ $\times$ $0.76$ $\times$ $0.65$ = $80.06$ (80)	<u> </u>	0.77	×	2.47	x	110.22	X	0.76	X	0.65	=	93.2	(80)
	West 0.9x	0.77	X	2.47	X	94.68	X	0.76	X	0.65	=	80.06	(80)



West 0.9x 0.77 x 2.47 x 45.59 x 0.76 x 0.65 = 38.55	(80)
5.77	
	(80)
West 0.9x 0.77 x 2.47 x 24.49 x 0.76 x 0.65 = 20.71	(80)
West 0.9x 0.77 x 2.47 x 16.15 x 0.76 x 0.65 = 13.66	(80)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m	
()	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts	(O.1)
(84)m= 1196.48 1522.25 1855.71 2215.69 2476.24 2458.45 2346.59 2121.29 1861.28 1525.46 1230.22 1111.53	(84)
7. Mean internal temperature (heating season)	
Temperature during heating periods in the living area from Table 9, Th1 (°C)	(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 1 0.99 0.98 0.95 0.88 0.78 0.83 0.95 0.99 1 1	(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	
(87)m= 18.41 18.62 19.01 19.59 20.13 20.59 20.82 20.77 20.38 19.69 18.99 18.43	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)	
	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)	
	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90)m= 17.48 17.7 18.1 18.7 19.23 19.7 19.89 19.86 19.5 18.81 18.1 17.53	(90)
	(91)
	,
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 17.63 17.85 18.24 18.84 19.38 19.84 20.04 20.01 19.64 18.95 18.24 17.67	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate	(02)
	(93)
8. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate	
the utilisation factor for gains using Table 9a	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Utilisation factor for gains, hm:	(0.4)
	(94)
Useful gains, hmGm , W = (94)m x (84)m  (95)m= 1193.53   1514.18   1833.26   2147.37   2284.29   2024.73   1592.65   1567.02   1699.54   1497.82   1224.9   1109.46	(95)
Monthly average external temperature from Table 8	(00)
	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]	. ,
	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	
(98)m= 5132.51 4223.32 3856.47 2570.94 1561.53 0 0 0 2432.72 3766.39 5071.14	
Total per year (kWh/year) = Sum(98) <sub>15,912</sub> = 28615.02	(98)



9a. Energy requirements – Individual heating sysi	tems <u>includina</u>	micro-CHF	P)				
Space heating:			,				
Fraction of space heat from secondary/supplemental						0	(201)
Fraction of space heat from main system(s)		(202) = 1 - (202)	01) =			1	(202)
Fraction of total heating from main system 1		(204) = (202) :	× [1 – (203)] =			1	(204)
Efficiency of main space heating system 1						75	(206)
Efficiency of secondary/supplementary heating s	system, %					0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug	Sep Oct	Nov	Dec	kWh/y	/ear
Space heating requirement (calculated above)	<u> </u>	<del> </del>	- 1			ſ	
5132.51 4223.32 3856.47 2570.94 1561.53	0 0	0	0 2432.72	3766.39	5071.14		
$(211)$ m = {[(98)m x (204)]} x 100 ÷ (206)		I				1	(211)
6843.35 5631.09 5141.96 3427.93 2082.03	0 0	O Total (W)	0 3243.62 Wh/year) =Sum(2		6761.52		(
		Total (KV	/vri/year) =5um(2	2 I I) <sub>15,1012</sub>	F	38153.36	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)							
$ \frac{(215)m}{(215)m} = 0  0  0  0  0 $	0 0	0	0 0	0	0		
	<u> </u>	Total (kV	Wh/year) =Sum(2	215) <sub>15,1012</sub>	<u> </u>	0	(215)
Water heating							
Output from water heater (calculated above)							
	98.14 192.54	208.18 20	06.84 247.25	257.04	273.85		
Efficiency of water heater	05 05	05	05 70 05	74.07		65	(216)
(217)m= 74.41 74.37 74.27 74.03 73.51	65 65	65	65 73.95	74.27	74.41		(217)
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$							
	296.21		18.22 334.35	346.09	368.01		
		Total = S	Sum(219a) <sub>112</sub> =			3992.99	(219)
Annual totals			k\	Wh/year		kWh/ye	ar
Space heating fuel used, main system 1						38153.36	_
Water heating fuel used						3992.99	
Electricity for pumps, fans and electric keep-hot							
central heating pump:					120		(2300
Total electricity for the above, kWh/year		sum of (	230a)(230g) =			120	(231)
Electricity for lighting						1187.24	(232)
12a. CO2 emissions – Individual heating system	ns including mi	cro-CHP					
	Energy		Emice	ion fac	tor	Emission	10
	kWh/year		kg CO2		loi	kg CO2/y	_
Space heating (main system 1)	(211) x		0.2		=	8241.13	(261)
Space heating (secondary)	(215) x		0.5		=	0	(263)
Water heating	(219) x		0.2		=	862.49	(264)
Space and water heating	(261) + (262) -	+ (263) + (264		10			
•		. (200) 1 (204)			_	9103.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	62.28	(267)



Electricity for lighting (232) x 0.519 = 616.18 (268) Total CO2, kg/year sum of (265)...(271) = 9782.07 (272) 9782.07 (273) EI rating (section 14) 58 (274)





User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 24 Existing - 3B4P - TF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 229 (1a) x (2a) =632.04 (3a) 2.76 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)229 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =632.04 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.06 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.81 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.75 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
0.96	
Calculate effective air change rate for the applicable case  If mechanical ventilation:	(225)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0 (23b) 0 (23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 − (23c) ÷ 100]	
$ \frac{250}{(24a)m} = 0  0  0  0  0  0  0  0  0  0$	) (24a)
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	(24b)
c) If whole house extract ventilation or positive input ventilation from outside	
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (22b)m + 0.5 \times (23b)$	
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0	(24c)
d) If natural ventilation or whole house positive input ventilation from loft if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$	
(24d)m= 0.96	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
(25)m= 0.96 0.94 0.92 0.84 0.83 0.76 0.76 0.74 0.78 0.83 0.86 0.89	(25)
2. Heat leaves and heat less never paters	
3. Heat losses and heat loss parameter:  ELEMENT 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
Windows Type 1 $5.71$ $\times 1/[1/(3.1) + 0.04] = 15.75$	(27)
Windows Type 2 $1.13$ $x^{1/[1/(3.1)+0.04]} = 3.12$	(27)
Windows Type 3 $7.2$ $x^{1/[1/(3.1)+0.04]} = 19.86$	(27)
Windows Type 4 $3.08   x^{1/[1/(3.1) + 0.04]} = 8.49$	(27)
Windows Type 5 $3.29$ $x^{1/[1/(3.1) + 0.04]} = 9.07$	(27)
Windows Type 6 $2.67$ $x^{1/[1/(3.1) + 0.04]} = 7.36$	(27)
Windows Type 7 $8.172$ $x^{1/[1/(3.1) + 0.04]} = 22.54$	(27)
Walls Type1 220.77 31.25 189.52 x 0.6 = 113.71	(29)
Walls Type2 31.6 0 31.6 x 0.48 = 15.29	(29)
Roof 222.14 0 222.14 x 0.68 = 151.06	(30)
Total area of elements, m <sup>2</sup> 474.51	(31)
Party wall 14.63 x 0 = 0	(32)
Party floor 222.14	(32a)
* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2  ** include the areas on both sides of internal walls and partitions	
	66.25 (33)
(10) (20) (20) (20) (20)	021.66 (34)
The street in each parameter (TMD). Const. TEA) in It (Intel®)	250 (35)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f	
can be used instead of a detailed calculation.  Thermal bridges: S (I x Y) calculated using Appendix K	71 18 (36)



	of therma	0 0	are not kn	own (36) =	= 0.05 x (3	11)			(22) 1	(36) =				7(07)
			alculated	l monthly	A.				. ,	` '	25)m x (5)		437.43	(37)
Veritile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	200.23	196.51	192.85	175.7	172.49	157.55	157.55	154.79	163.31	172.49	178.98	185.77		(38)
, ,	ansfer c	oefficier	1 nt \///K	<u> </u>		l	l	<u> </u>	(39)m	= (37) + (37)	1		l	
(39)m=	637.66	633.93	630.28	613.13	609.92	594.98	594.98	592.21	600.74	609.92	616.41	623.2		
(00)	557.55	000.00	000.20	0.0	000.02	0000	0000	002.2		l .	Sum(39) <sub>1</sub> .		613.11	(39)
Heat Id	oss para	meter (H	HLP), W	/m²K						= (39)m ÷				`
(40)m=	2.78	2.77	2.75	2.68	2.66	2.6	2.6	2.59	2.62	2.66	2.69	2.72		
NIl.	( . ) .		- (l. / <b>T</b> - l.							Average =	Sum(40) <sub>1</sub> .	12 /12=	2.68	(40)
Numbe	i		nth (Tab	<del>-                                    </del>			<del></del>					_	1	
(44)	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. Wa	ater heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
Assum	ed occu	pancy, I	N								3.	04	]	(42)
			+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.				
	A £ 13.9		tor usa	no in litre	se par de	y Vd ay	orago –	(25 x N)	± 36		100	2.00	1	(42)
								to achieve		se target o		5.39		(43)
not m <mark>ore</mark>	e that 125	litres per p	person per	r day (all w	rater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ir	iltres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)				_		
(44)m=	117.03	112.77	108.52	104.26	100.01	95.75	95.75	100.01	104.26	108.52	112.77	117.03		
Energy (	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,ı	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1276.69	(44)
(45)m=	173.55	151.79	156.63	136.56	131.03	113.07	104.77	120.23	121.67	141.79	154.78	168.08		
			<u> </u>	<u> </u>	ļ	<u> </u>	<u> </u>	<u>!</u>		rotal = Su	<u></u>	<u> </u>	1673.95	(45)
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)	) to (61)			'		
(46)m= Water	26.03 storage	22.77 loss:	23.5	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21		(46)
Storag	e volum	e (litres)	includin	ng any so	olar or W	WHRS	storage	within sa	ame ves	sel		210		(47)
If com	munity h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)					•	
Otherv	vise if no	stored	hot wate	er (this ir	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
	storage												1	
,			eclared l		or is kno	wn (kWl	n/day):					0		(48)
			m Table									0		(49)
			storage	-		au !a ma4		(48) x (49)	) =		2	10		(50)
,			eclared of factor fr	•							0	02	1	(51)
		_	ee secti		- (1177	, 5, 40	-J /				<u>U.</u>	υ <b>∠</b>	I	(01)
	e factor	_									0.	83		(52)
Tempe	erature fa	actor fro	m Table	2b							0	.6		(53)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (	53) =	1.	59		(54)



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22	(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= 49.22 44.46 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22 47.63 49.22	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 54.55 49.27 54.55 52.79 54.55 36.09 37.3 37.3 36.09 54.55 52.79 54.55	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 277.33 245.52 260.41 236.98 234.8 196.8 191.29 206.75 205.39 245.56 255.2 271.85	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 277.33 245.52 260.41 236.98 234.8 196.8 191.29 206.75 205.39 245.56 255.2 271.85	
Output from water heater (annual) <sub>112</sub> 2827.89	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 140.73 125.46 135.1 125.75 126.59 104.58 104.05 109.19 107.44 130.16 131.8 138.9	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98	(66) (67)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	` '
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	` '
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67)
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= 151.98 151.9	(67)
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= 151.98 151.9	(67) (68)
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= 151.98 151.9	(67) (68)
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	(67) (68) (69)
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	(67) (68) (69)
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	(67) (68) (69) (70)
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= 151.98 151.9	(67) (68) (69) (70)
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	(67) (68) (69) (70) (71)
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	(67) (68) (69) (70) (71)

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

6. Solar gains:



Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	X	3.08	x	11.28	x	0.76	x	0.65	<b>=</b>	11.9	(75)
Northeast 0.9x	0.54	X	3.29	х	11.28	х	0.76	x	0.65	=	8.91	(75)
Northeast 0.9x	0.77	X	2.67	х	11.28	х	0.76	x	0.65	=	10.31	(75)
Northeast 0.9x	0.54	X	8.17	x	11.28	x	0.76	x	0.65	] =	22.14	(75)
Northeast 0.9x	0.77	X	3.08	x	22.97	x	0.76	x	0.65	] =	24.22	(75)
Northeast 0.9x	0.54	X	3.29	x	22.97	x	0.76	x	0.65	] =	18.14	(75)
Northeast 0.9x	0.77	X	2.67	х	22.97	x	0.76	x	0.65	=	20.99	(75)
Northeast 0.9x	0.54	X	8.17	х	22.97	х	0.76	x	0.65	=	45.06	(75)
Northeast 0.9x	0.77	X	3.08	x	41.38	х	0.76	x	0.65	=	43.63	(75)
Northeast 0.9x	0.54	X	3.29	х	41.38	x	0.76	x	0.65	=	32.68	(75)
Northeast 0.9x	0.77	X	2.67	x	41.38	x	0.76	x	0.65	=	37.82	(75)
Northeast 0.9x	0.54	X	8.17	x	41.38	x	0.76	X	0.65	=	81.18	(75)
Northeast 0.9x	0.77	X	3.08	х	67.96	x	0.76	x	0.65	=	71.65	(75)
Northeast 0.9x	0.54	X	3.29	x	67.96	х	0.76	x	0.65	=	53.68	(75)
Northeast 0.9x	0.77	X	2.67	х	67.96	x	0.76	x	0.65	<b>=</b>	62.12	(75)
Northeast 0.9x	0.54	X	8.17	X	67.96	Х	0.76	X	0.65	=	133.33	(75)
Northeast 0.9x	0.77	X	3.08	х	91.35	х	0.76	x	0.65	_	96.32	(75)
Northeast 0.9x	0.54	X	3.29	х	91.35	×	0.76	x	0.65	=	72.15	(75)
Northeast 0.9x	0.77	X	2.67	x	91.35	x	0.76	x	0.65	=	83.5	(75)
Northeast 0.9x	0.54	X	8.17	x	91.35	х	0.76	x	0.65	] =	179.22	(75)
Northeast 0.9x	0.77	X	3.08	x	97.38	x	0.76	x	0.65	] =	102.68	(75)
Northeast 0.9x	0.54	X	3.29	х	97.38	x	0.76	x	0.65	] =	76.92	(75)
Northeast 0.9x	0.77	X	2.67	х	97.38	х	0.76	x	0.65	<u> </u>	89.01	(75)
Northeast 0.9x	0.54	X	8.17	x	97.38	x	0.76	x	0.65	=	191.07	(75)
Northeast 0.9x	0.77	X	3.08	x	91.1	x	0.76	x	0.65	=	96.06	(75)
Northeast 0.9x	0.54	X	3.29	x	91.1	x	0.76	x	0.65	=	71.96	(75)
Northeast 0.9x	0.77	X	2.67	x	91.1	x	0.76	X	0.65	=	83.27	(75)
Northeast 0.9x	0.54	X	8.17	x	91.1	x	0.76	X	0.65	=	178.74	(75)
Northeast 0.9x	0.77	X	3.08	x	72.63	x	0.76	X	0.65	=	76.58	(75)
Northeast 0.9x	0.54	X	3.29	x	72.63	x	0.76	x	0.65	<b>=</b>	57.37	(75)
Northeast 0.9x	0.77	X	2.67	x	72.63	x	0.76	x	0.65	] =	66.38	(75)
Northeast 0.9x	0.54	X	8.17	x	72.63	x	0.76	x	0.65	] =	142.49	(75)
Northeast 0.9x	0.77	X	3.08	x	50.42	x	0.76	x	0.65	] =	53.16	(75)
Northeast 0.9x	0.54	X	3.29	x	50.42	x	0.76	x	0.65	] =	39.83	(75)
Northeast 0.9x	0.77	X	2.67	x	50.42	×	0.76	x	0.65	j =	46.09	(75)
Northeast 0.9x	0.54	X	8.17	x	50.42	x	0.76	x	0.65	=	98.92	(75)
Northeast 0.9x	0.77	X	3.08	x	28.07	x	0.76	x	0.65	j =	29.59	(75)
Northeast 0.9x	0.54	X	3.29	x	28.07	×	0.76	x	0.65	j =	22.17	(75)
Northeast 0.9x	0.77	x	2.67	x	28.07	×	0.76	x	0.65	] =	25.65	(75)



		1				ı						_
Northeast <sub>0.9x</sub>	0.54	X	8.17	Х	28.07	Х	0.76	X	0.65	=	55.07	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	X	14.2	X	0.76	X	0.65	=	14.97	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.29	X	14.2	X	0.76	X	0.65	=	11.21	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	X	14.2	X	0.76	X	0.65	=	12.98	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	X	14.2	X	0.76	X	0.65	=	27.85	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	X	9.21	X	0.76	X	0.65	=	9.72	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.29	X	9.21	х	0.76	X	0.65	=	7.28	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	X	9.21	X	0.76	X	0.65	=	8.42	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	X	9.21	X	0.76	X	0.65	=	18.08	(75)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	36.79		0.76	X	0.65	=	71.92	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	36.79		0.76	X	0.65	=	14.23	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	36.79		0.76	X	0.65	=	90.69	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	x	62.67		0.76	X	0.65	=	122.51	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	62.67		0.76	X	0.65	=	24.25	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	62.67		0.76	X	0.65	=	154.48	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	85.75		0.76	X	0.65	=	167.63	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	85.75		0.76	X	0.65	=	33.17	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	X	85.75		0.76	X	0.65	=	211.37	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	106.25		0.76	x	0.65	=	207.7	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	х	106.25		0.76	x	0.65	=	41.1	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	106.25		0.76	x	0.65	=	261.9	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	119.01		0.76	x	0.65	=	232.64	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	119.01		0.76	x	0.65	=	46.04	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	х	119.01		0.76	x	0.65	=	293.34	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	118.15		0.76	X	0.65	=	230.96	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	118.15		0.76	X	0.65	=	45.71	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	118.15		0.76	X	0.65	=	291.22	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	113.91		0.76	X	0.65	=	222.67	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	113.91		0.76	x	0.65	=	44.07	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	113.91		0.76	X	0.65	=	280.77	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	104.39		0.76	X	0.65	=	204.06	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	104.39		0.76	X	0.65	=	40.38	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	104.39		0.76	X	0.65	=	257.31	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	92.85		0.76	X	0.65	=	181.5	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	92.85		0.76	X	0.65	=	35.92	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	92.85		0.76	x	0.65	j =	228.87	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	69.27		0.76	x	0.65	j =	135.4	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	69.27		0.76	x	0.65	j =	26.8	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	69.27		0.76	x	0.65	j =	170.74	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	44.07		0.76	x	0.65	j =	86.15	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	44.07		0.76	X	0.65	j =	17.05	(79)



Southwest <sub>0.9x</sub> 0.77	x	7.:	2	X Z	14.07		0.76	х	0.65	=	108.63	(79)
Southwest <sub>0.9x</sub> 0.77	X	5.7	<u>'1</u>	x 3	31.49		0.76	_ x _	0.65	=	61.55	(79)
Southwest <sub>0.9x</sub> 0.77	X	1.1	3	x 3	31.49		0.76	x	0.65	=	12.18	(79)
Southwest <sub>0.9x</sub> 0.77	X	7.:	2	x (	31.49		0.76	x	0.65		77.61	(79)
												_
Solar gains in watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m= 230.11 409.65	607.49	831.47	1003.2	1027.57	977.53	844.57	684.29	465.42	278.84	194.84		(83)
Total gains – internal a	nd solar	(84)m =	= (73)m -	+ (83)m	, watts						•	
(84)m= 962.89 1136.59	1307.77	1490.87	1620.87	1589.78	1518.67	1396	1259.73	1100.53	959.29	909.49		(84)
7. Mean internal temp	erature	(heating	season	)								
Temperature during h	eating p	eriods ir	n the livir	ng area	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisation factor for g	ains for I	iving are	ea, h1,m	(see Ta	able 9a)		, ,					
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 1 1	1	0.99	0.98	0.95	0.89	0.92	0.97	0.99	1	1		(86)
Mean internal temper	ature in l	living ar	22 T1 (fc	llow ste	ns 3 to 7	in Tahl	e 9c)					
(87)m= 17.94 18.13	18.51	19.09	19.69	20.25	20.59	20.53	20.06	19.31	18.56	17.95		(87)
` '	l l			<u> </u>	<u> </u>	<u> </u>						
Temperature during h (88)m= 19.61 19.62	19.62	eriods ir	19.67	aweiling	19.7	19.71	19.69	19.67	19.65	19.64		(88)
							19.09	19.07	19.05	19.04		(00)
Utilisation factor for g				<u> </u>		_				1		(00)
(89)m= 1 1	0.99	0.99	0.97	0.91	0.8	0.85	0.96	0.99	1	1		(89)
Me <mark>an int</mark> ernal temper	ature in t	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9 <mark>c)</mark>				
(90)m= 16.83 17.02	17.41	18.02	18.61	19.19	19.5	19.45	18.99	18.24	17.48	16.86		(90)
							f	LA = Livin	g area ÷ (4	4) =	0.15	(91)
Mean internal temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	_A) × T2					
(92)m= 16.99 17.18	17.57	18.18	18.77	19.35	19.66	19.61	19.15	18.4	17.64	17.02		(92)
Apply adjustment to t	he mean	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m= 16.99 17.18	17.57	18.18	18.77	19.35	19.66	19.61	19.15	18.4	17.64	17.02		(93)
8. Space heating requ	uirement											
Set Ti to the mean int		•		ed at st	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation factor for Jan Feb	Mar	Apr	May	Jun	Jul	Λιια	Sep	Oct	Nov	Dec		
Utilisation factor for g		•	iviay	Juli	Jui	Aug	l Seb	Oct	INOV	Dec		
(94)m= 1 1	0.99	0.98	0.96	0.9	0.8	0.84	0.95	0.99	1	1		(94)
Useful gains, hmGm	L		L 4)m	<u> </u>	<b>!</b>	<u> </u>		<u> </u>				
(95)m= 959.96 1130.91		<u> </u>	1549.62	1431.22	1212.38	1169.4	1192.46	1085.1	954.8	907.21		(95)
Monthly average exte	rnal tem	perature	from Ta	able 8		<u> </u>		<u> </u>	<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 [(93)m	– (96)m	]				
(97)m= 8093.54 7787.82	6980.31	5687.96	4312.14	2824	1821.14	1903.8	3034.62	4757.64	6499.29	7991.68		(97)
Space heating 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= 5307.39 4473.44	4229.24	3042.54	2055.31	0	0	0	0	2732.37	3992.04	5270.84		
						Tota	ıl per year	(kWh/year	r) = Sum(9	8)15,912 =	31103.17	(98)
Space heating require	ement in	kWh/m²	<sup>2</sup> /year								135.82	(99)



9a. Energy requirements – Individual heating syst	ems includina	micro-CHP)					
Space heating:							
Fraction of space heat from secondary/supplement	entary system					0	(201)
Fraction of space heat from main system(s)		(202) = 1 - (201	1) =			1	(202)
Fraction of total heating from main system 1		(204) = (202) ×	[1 - (203)] =			1	(204)
Efficiency of main space heating system 1						75	(206)
Efficiency of secondary/supplementary heating s	ystem, %					0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug S	ep Oct	Nov	Dec	kWh/y	ear
Space heating requirement (calculated above)	_   _	<del> </del>	1	l	l	1	
5307.39 4473.44 4229.24 3042.54 2055.31	0 0	0 0	2732.37	3992.04	5270.84		
$(211)$ m = {[(98)m x (204)] } x 100 ÷ (206)	<u> </u>		1004040	5000 74	7007 70	Ī	(211)
7076.52 5964.59 5638.99 4056.72 2740.42	0 0	O O	13643.16 h/year) =Sum(	5322.71	7027.79	44.470.00	(211)
Space heating fuel (secondary), kW/h/month		Total (KVVI	inycar) –odm(z	- 1 /15,1012	2	41470.89	(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 (kWI	h/year) =Sum(	215),5,101	2=	0	(215)
Water heating							
Output from water heater (calculated above)	00.0 1.04.00	200.75	20 245 50	255.0	074.05		
277.33 245.52 260.41 236.98 234.8 1 Efficiency of water heater	96.8 191.29	206.75 205	.39 245.56	255.2	271.85	65	(216)
(217)m= 74.43 74.4 74.34 74.18 73.84	65 65	65 69	5 74.06	74.31	74.44	00	(217)
Fuel for water heating, kWh/month		00   0.	7 4.00	74.01	11.11		(= ,
$(219)$ m = $(64)$ m x $100 \div (217)$ m					1		
(219)m= 372.59 329.98 350.31 319.49 318.01 3	02.76 294.3	318.07 315		343.41	365.2		_
		lotal = Su	ım(219a) <sub>112</sub> =			3961.7	(219)
Annual totals Space heating fuel used, main system 1			K	Wh/yeaı	ſ	kWh/yea 41470.89	ar
Water heating fuel used						3961.7	=
ŭ						3901.7	
Electricity for pumps, fans and electric keep-hot						i	
central heating pump:					120		(230c) 
Total electricity for the above, kWh/year		sum of (23	30a)(230g) =			120	(231)
Electricity for lighting						1186.84	(232)
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP					
	Energy		Emiss	ion fac	tor	Emission	s
	kWh/year		kg CO	2/kWh		kg CO2/ye	ear
Space heating (main system 1)	(211) x		0.2	16	=	8957.71	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2		=	855.73	(264)
Space and water heating		+ (263) + (264) :		. ~			(265)
	(231) x	(==5) . (==5)			_	9813.44	=
Electricity for pumps, fans and electric keep-hot	(201) X		0.5	19	=	62.28	(267)



Electricity for lighting (232) x 0.519 = 615.97 (268) Total CO2, kg/year sum of (265)...(271) = 10491.69 (272) **Dwelling CO2 Emission Rate** (272)  $\div$  (4) = 45.82 (273) El rating (section 14)



# **APPENDIX X – BE-LEAN DER WORKSHEETS (REFURB)**



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 1 - Existing Be Lean - 3B6P - GF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x 2.9 (2a) =516.2 (3a) 178 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)178 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =516.2 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)3 30 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.06 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.81 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.75 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



· —		e (allowi				<del>`                                    </del>	<del>`</del>	<u> </u>	1			1	
0.95 Calculate effe	0.93 Ctive air	0.92 Change i	0.82 rate for t	0.8 <b>he appli</b>	0.71 <b>cable ca</b>	0.71 S <b>e</b>	0.69	0.75	0.8	0.84	0.88	J	
If mechanica		•										0	(2
If exhaust air h	eat pump (	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	wise (23b	) = (23a)			0	(2
If balanced with	n heat reco	overy: effici	iency in %	allowing f	or in-use fa	actor (from	n Table 4h	) =				0	(
a) If balance	ed mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	)m = (22	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
b) If balance	ed mech	anical ve	ntilation	without	heat rec	overy (N	ЛV) (24b	)m = (22	2b)m + (2	23b)		1	
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
c) If whole h if (22b)n			ntilation on the control of the cont	•	•				5 × (23b	<b>)</b> )			
c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	
d) If natural if (22b)n			ole hous m = (22k		•				0.5]				
d)m= 0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89	]	(
Effective air	change	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in box	(25)			•	•	
5)m= 0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89		(
. Heat losse	s and he	eat loss r	naramet	er.					_				
EMENT	Gros area	SS	Openin	gs	Net Ar A ,n		U-valı W/m2		A X U (W/I		k-value		A X k kJ/K
ndows Type		(111-)	"		10.69		/[1/( 1.8 )+		17.96	(X)	KJ/1111		NJ/IN
ndows Type					3.14		/[1/( 1.8 )+	, L	5.27	Ħ			
indows Type					3.61		/[1/( 1.8 )+	, i	6.06	Ħ			(
oor	, 0				178.5			= [		<u></u>			(
alls	134.	20	17.45		116.9	_	0.25		44.6275	<u>'</u>		╡	<del></del>
oof	51.4		0	<u></u>	51.42	=			8.23	북 ¦		╡	(
ital area of e						_	0.16	[	0.23				`` `
rty wall	,iciticitis	, 111			364.3	=				— r			
rty wall					54.81	_	0	= [	0			╡	(
or windows and	roof wind	ows, use e	effective wi	ndow U-va	127.0		ı formula 1	/[(1/U-valu	ie)+0.04] a	] as given in	paragraph		
nclude the area	as on both	sides of in	nternal wall	ls and par	titions								
bric heat los		•	U)				(26)(30)	+ (32) =				123.08	(
eat capacity	^	,						((28)	.(30) + (32	2) + (32a).	(32e) =	34562.19	(
ermal mass	•	`		,					tive Value			250	(
r design assess n be used inste				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
ermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix k	<						54.65	
etails of therma		are not kn	own (36) =	= 0.05 x (3	1)								
tal fabric he								` '	(36) =			177.73	(
entilation hea	r	l 1	r i			_			= 0.33 × (		1	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3)m= 162.54	159.54	156.59	142.76	140.17	128.12	128.12	125.89	132.76	140.17	145.41	150.88	]	(
eat transfer of 340.27	337.26	nt, VV/K 334.32	320.49	317.9	305.85	305.85	303.62	(39)m 310.49	= (37) + (3	38)m 323.13	328.61	1	



at loss para	meter (H	HLP), W/	m²K		_	_		(40)m	= (39)m ÷	· (4)			
m= 1.91	1.89	1.88	1.8	1.79	1.72	1.72	1.71	1.74	1.79	1.82	1.85		
mber of day	e in moi	oth (Tab	lo 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	1.8	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
					<u> </u>	<u> </u>							
Water heat	ing enei	rgy requi	irement:								kWh/ye	ar:	
sumed occu TFA > 13.9 TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		97		(4
nual averag luce the annua more that 125	l average	hot water	usage by	5% if the c	lwelling is	designed i			se target o		4.81		(-
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
water usage ir	i litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	_					
m= 115.29	111.1	106.91	102.72	98.52	94.33	94.33	98.52	102.72	106.91	111.1	115.29		_
rgy content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd.r	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b. 1		1257.76	
m= 170.98	149.54	154.31	134.53	129.09	111.39	103.22	118.45	119.86	139.69	152.48	165.58		
11 0.00	1 10.01	10 1.01	101.00	120.00	111.00	100.22	1,0.10			m(45) <sub>112</sub> =		1649.12	
stantaneous w	ater he <mark>atii</mark>	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46				_		
m= 25.65	22.43	23.15	20.18	19.36	16.71	15.48	17.77	17.98	20.95	22.87	24.84		(
iter storage rage volum		íncludir	na any sa	olar or M	WHDS	etorago	within c	amo voc	col		005		,
ommunity h	,							arric ves	301		305		(
erwise if no	_			_				ers) ente	er '0' in (	47)			
ter storage													
If manufact				or is kno	wn (kWł	n/day):				1.	63		
mperature fa										0	.6		(
ergy lost fro If manufact		_	-		or is not		(48) x (49	) =		0.	98		(
t water stora			-								0		(
ommunity h	•		on 4.3										
ume factor			2h							<b>—</b>	0		(
mperature fa							(47) (54	) ( <b>50</b> ) (	F0\		0		(
ergy lost fro Iter (50) or (		-	, KVVII/ye	ear			(47) x (51	) X (52) X (	oo) =	-	98		(
ter storage	, ,	•	for each	month			((56)m = (	(55) × (41)	m	0.	30		•
m= 30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(
linder contains												хH	'
m= 30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(
L!											0		(
mary circuit mary circuit	•	•			59)m = (	(58) ÷ 36	65 × (41)	ım			U		(
•				,	•	` '	, ,		r thormo	otot)			
modified by	iacioi ii	UIII I ab		11616 12 3	oual wa	ıcı neam	ny and a	i cymnu <del>c</del>	i illellille	isiai)			



Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$												
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	0	0 1)111 =	00) + 3	0 × (41)	0	0	0	T 0	0	1	(61)
Total heat required for		<u> </u>									[ .(50)m + (61)m	(- )
(62)m= 255.85 226.2	239.18	216.67	213.96	176.83	170.84	186.06		224.56	234.61	250.46	]	(62)
Solar DHW input calculated					l						J	(/
(add additional lines if								ii continou	tion to wat	or ricating)		
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from water hea	ıter					<u> </u>	Į				J	
(64)m= 255.85 226.2	239.18	216.67	213.96	176.83	170.84	186.06	185.3	224.56	234.61	250.46	]	
		l	l		<u> </u>	Oı	<b></b> itput from w	ater heate	er (annual)	112	2580.51	(64)
Heat gains from water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m		-
(65)m= 124.75 111.05	119.21	110.44	110.82	89.39	88.41	93.48	<del>-</del>	114.34	<del> </del>	122.95	اُ	(65)
include (57)m in cal	culation of	of (65)m	only if c	vlinder i	s in the o	dwellin	g or hot w	ater is f	rom com	munity h	ı neating	
5. Internal gains (see		. ,		-			<u> </u>			,	, and the second	
Metabolic gains (Table			,									
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 148.66 148.66	148.66	148.66	148.66	148.66	148.66	148.66	148.66	148.66	148.66	148.66		(66)
Lighting gains (calcula	ted in A	pendix	L, equati	ion L9 o	r L9a), <mark>a</mark>	lso se	Table 5					
(67)m= 36.99 32.86	26.72	20.23	15.12	12.77	13.79	17.93	24.07	30.56	35.67	38.02		(67)
Appliances gains (calc	culated in	Append	dix L, eq	uation L	13 or L1	3a), al	so see Ta	ble 5				
(68)m= 349.62 353.25	344.11	324.65	300.08	276.99	261.56	257.93	3 267.07	286.54	311.11	334.2		(68)
Cooking gains (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)	), also	see Table	5		•		
(69)m= 37.87 37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87		(69)
Pumps and fans gains	(Table 5	 5а)								•	• —	
(70)m= 3 3	3	3	3	3	3	3	3	3	3	3	]	(70)
Losses e.g. evaporation	on (nega	tive valu	es) (Tab	le 5)	•	•	-	•	•	•	•	
(71)m= -118.93 -118.93	-118.93	-118.93	-118.93	-118.93	-118.93	-118.9	3 -118.93	-118.93	-118.93	-118.93	]	(71)
Water heating gains (	Table 5)				•		-		-		•	
(72)m= 167.67 165.25	160.22	153.39	148.95	124.15	118.84	125.64	128.06	153.69	161.68	165.26	]	(72)
Total internal gains =	•			(66	)m + (67)m	ı + (68)n	n + (69)m +	(70)m + (	71)m + (72)	)m	-	
(73)m= 624.89 621.96	601.65	568.86	534.75	484.5	464.79	472.1	489.8	541.38	579.05	608.08	]	(73)
6. Solar gains:												
Solar gains are calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to	convert to th	ne applica		tion.		
Orientation: Access I		Area m²		Flu	ıx ble 6a		g_ Table 6b	7	FF		Gains	
Table 6c	ı 				DIE Ga	. –	Table 60	_ '	able 6c		(W)	7
Northeast 0.9x 0.77	X	3.1	14	X	11.28	X	0.55	x	0.65	=	8.78	(75)
Northeast 0.9x 0.54	. X	3.6	61	Χ .	11.28	×	0.55	x	0.65	=	7.08	(75)
Northeast 0.9x 0.77	X	3.1	14	x 2	22.97	x	0.55	x	0.65	=	17.87	(75)
Northeast 0.9x 0.54	X	3.6	61	x 2	22.97	x	0.55	x [	0.65	=	14.41	(75)
Northeast 0.9x 0.77	×	3.1	14	X Z	41.38	X	0.55	X	0.65	=	32.19	(75)

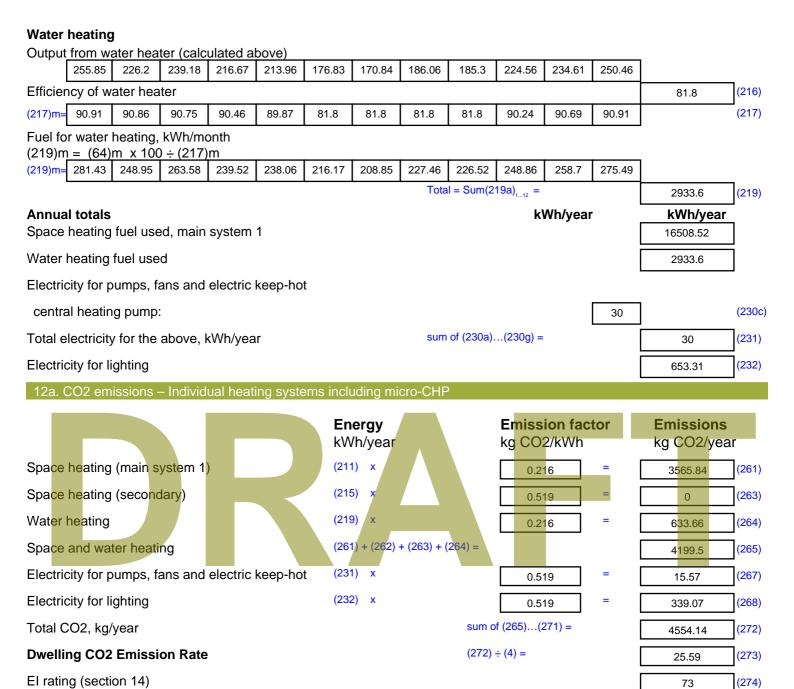


Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	4	1.38	x		0.55	X		0.65		=	25.95	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	6	7.96	X		0.55	X		0.65		=	52.86	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	6	7.96	X		0.55	X		0.65		=	42.62	(75)
Northeast 0.9x	0.77	X	3.1	4	x	9	1.35	x		0.55	X		0.65		=	71.06	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	9	1.35	X		0.55	x		0.65		=	57.29	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	9	7.38	X		0.55	x		0.65		=	75.76	(75)
Northeast 0.9x	0.54	X	3.6	51	x	9	7.38	X		0.55	X		0.65		=	61.08	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	9	1.1	x		0.55	X	Ī	0.65		=	70.87	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	9	1.1	x		0.55	X	Ī	0.65		=	57.14	(75)
Northeast 0.9x	0.77	X	3.1	4	x	7.	2.63	X		0.55	X		0.65		=	56.5	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	7	2.63	x		0.55	X	Ī	0.65		=	45.55	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	5	0.42	x		0.55	X		0.65		=	39.22	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	5	0.42	x		0.55	X		0.65		=	31.62	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	2	8.07	x		0.55	X	Ī	0.65		=	21.83	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	2	8.07	x		0.55	X	Ī	0.65		=	17.6	(75)
Northeast <sub>0.9x</sub>	0.77	x	3.1	4	x	1	4.2	x		0.55	X	Ī	0.65		=	11.04	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	1	4.2	x		0.55	X	Ī	0.65		=	8.9	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	×	9	).21	Х		0.55	Х		0.65		=	7.17	(75)
Northeast <sub>0.9x</sub>	0.54	x	3.6	1	х	9	).21	x		0.55	х	Ē	0.65		=	5.78	(75)
Southwest <sub>0.9x</sub>	0.77	x	10.	.7	х	3	6.79			0.55	х	Ē	0.65		=	97.52	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	6	2.67			0.55	Х	Ē	0.65		=	166.11	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.	.7	x [	8	5.7 <mark>5</mark>			0.55	х	Ē	0.65		=	227.28	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.	.7	x	10	06.25			0.55	х	Ē	0.65		=	281.61	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	х	11	9.01			0.55	Х	Ē	0.65		=	315.43	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	11	8.15			0.55	X		0.65		=	313.15	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	11	3.91			0.55	x		0.65		=	301.91	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	1(	)4.39			0.55	X		0.65		=	276.68	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	9	2.85			0.55	X		0.65		=	246.1	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	6	9.27			0.55	x		0.65		=	183.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	4	4.07			0.55	X		0.65		=	116.8	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	3	1.49			0.55	X		0.65		=	83.46	(79)
																	_
Solar gains in		1			$\overline{}$			È	_	ım(74)m .	<u> </u>					ı	
(83)m= 113.37	198.38	285.42	377.1	443.78		9.98	429.92	378	.73	316.94	223.	03	136.75	96.	4		(83)
Total gains – ir	-		<u> </u>		·								1			ı	( <b>5</b> .4)
(84)m= 738.26	820.34	887.07	945.96	978.53	93	34.48	894.7	850	.83	806.74	764.	41	715.8	704.	48		(84)
7. Mean inter	nal temp	erature	(heating	seasor	า)												
Temperature	during h	eating p	eriods ir	the liv	ing a	area f	rom Tab	ole 9,	Th1	1 (°C)						21	(85)
Utilisation fac					Ť					ı						I	
Jan	Feb	Mar	Apr	May	+-	Jun	Jul	<del>                                     </del>	ug	Sep	0		Nov	De			(00)
(86)m= 1	1	1	1	0.99	1 0	.96	0.91	0.9	93	0.98	1		1	1			(86)
Mean interna				` `	_			1		9c)						ı	
(87)m= 18.71	18.86	19.15	19.61	20.06	2	0.5	20.75	20.	71	20.36	19.	8	19.22	18.7	74		(87)



					-0 (00)	LIA O TI	Τ.	ali a 113-a ai		المال الماليات		al		Т
(88)		19.44	19.46	19.48	12 (°C) 19.51	19.54	19.53	19.53	19.48	19.47	neating p	auring r	19.39	emp 88)m=
(00)		10.44	13.40	13.40	10.01					<u> </u>	<u> </u>			L
(89)			4	0.00	0.06			<u> </u>			ains for i			
(69)		1	1	0.99	0.96	0.83	0.79	0.93	0.98	0.99	1	1	1	89)m=
					î			<del> </del>			ature in	· ·		
(90)		16.49	17.2	18.05	18.88	19.36	19.39	19.08	18.43	17.78	17.07	16.63	16.41	90)m=
(91)	0.28	1) =	g area ÷ (4	LA = Livin	Ť									
					A) x T2	+ (1 – fL	_A × T1	ling) = fl	ole dwel	r the wh	ature (fo	l temper	interna	Mean
(92)		17.12	17.77	18.54	19.29	19.74	19.77	19.48	18.89	18.29	17.66	17.26	17.05	92)m=
				priate	re appro	4e, whe	m Table	ature fro	tempera	internal	he mean	nent to t	adjustn	Apply
(93)		16.97	17.62	18.39	19.14	19.59	19.62	19.33	18.74	18.14	17.51	17.11	16.9	93)m=
											uirement			•
	ulate	d re-calc	76)m and	t Ti,m=(7	), so tha	Table 9b	ep 11 of	ed at ste						
		Dec	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	or gains Mar	Feb	Jan	the ut
		Dec	INOV	Oct	Sep	Aug	Jui	Juli	iviay		ains, hm			] Seilitli
(94)		1	1	0.99	0.96	0.84	0.8	0.92	0.97	0.99	0.99	1	1	94)m=
									4)m		, W = (9 <sup>4</sup>	hmGm	I gains.	L
(95)		703.36	713.56	756.63	770.46	711.23	715.63	858.81	949.65	934.98	882.2	817.8	736.77	95)m=
								able 8	from Ta	perature	ernal tem	age exte	lly avera	Month
(96)		4.2	7.1	10.6	14.1	16.4	16.6	14.6	11.7	8.9	6.5	4.9	4.3	96)m=
				]	- (96)m	k [(93)m-	=[(39)m :	_m , W =	erature,	al tempe	an intern	e for me	os <mark>s rate</mark>	Heat
(97)		4196.59	3398.57	2476.8	1566.4	969.2	924.92	1445.74	2237.19	2962.52	3680.02	4117.28	4288.87	97)m=
			)m	)m] x (41	m – (95	4 x [(97)	h = 0.02	Wh/mon	nonth, k	r each m	ement fo	g require	heatin	Space
		2598.96	1933.21	1279.81	0	0	0	0	957.93	1459.83	2081.58	2217.25	2642.76	98)m=
3 (98)	15171.33	8) <sub>15,912</sub> =	) = Sum(98	(kWh/year	per year	Tota								
(99)	85.23	ſ							/year	kWh/m²	ement in	g require	heatin	Space
		_			HP)	micro-C	ncluding	ystems i	eating sy	ividual h	nts – Indi	uiremer	ergy rec	a. En
							J					ng:	e heatir	Space
(201)	0	[					system	mentary	y/supple	econdar	at from se	ace hea	on of sp	Fracti
(202)	1	Γ			- (201) =	(202) = 1 -			em(s)	nain syst	at from m	ace hea	on of sp	Fracti
(204)	1	Ī		(203)] =	)2) × [1 – (	(204) = (20			stem 1	main sys	ng from	tal heati	on of to	Fracti
(206)	91.9	Ī							em 1	ing syste	ace heati	main spa	ncy of r	Efficie
(208)	0	Ì					ı, %	g system	v heating	ementar	ry/supple	seconda	ency of s	Efficie
 n/year	k\Λ/h/	Dec	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan	ſ
ı/ yeai	KVVII/	Dec	1407	Oct	Оер	Aug	Jui			<u> </u>	ement (c			Space
		2598.96	1933.21	1279.81	0	0	0	0	<del> </del>		2081.58	<del></del>		
(211)										00 ÷ (20	)4)] } x 1	\m v (20	- 11(08	l '211\m
(211)		2828.03	2103.6	1392.61	0	0	0	0	1042.36	1588.5	2265.05	<u>`</u>		_
2 (211)	16508.52			ar) =Sum(2										Ĺ
	10000.02	L	· 10,1012	•					month	v) k\//h/	econdar	م الما (م	heatin	Space
									111011111	y /, INVVII/	coordal	g iuci (S	, n <del>c</del> allil	upaut
										• •	00 ÷ (20	)1)]		•
		0	0	0	0	0	0	0	0	• •	00 ÷ (20	01)] } x 1		•







User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 2 - Existing Be Lean - 4B8P - GF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 227.6 (1a) x (2a) =(3a) 2.9 660.04 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)227.6 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =660.04 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)5 50 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.08 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.83 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)2  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.85  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.7 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjusted	l infiltra	tion rat	e (allowii	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
	0.89	0.88	0.86	0.77	0.75	0.67	0.67	0.65	0.7	0.75	0.79	0.82		
Calculate	<i>e effect</i> hanical		_	ate for t	he appli	cable ca	se			•				(22-)
			using Appe	ndix N (2	3h) <i>– (</i> 23a	a) × Fmv (e	equation (	N5)) othe	rwise (23h	n) = (23a)		[	0	(23a)
			overy: effici		, ,	,	•	,,	•	) = (23a)		l I	0	(23b) (23c)
			•		Ū		,		,	2h)m + (	23h) <b>√</b> ['	l 1 – (23c)	0 1001	(230)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	- 100]	(24a)
· · ·	alancec		anical ve		without	heat red	covery (	<u> </u>	<u> </u>	L	23h)			, ,
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,			tract ven (23b), tl		•	•				.5 × (23b	) )			
(24c)m=	0	0	0	0	0	0	0	0	0	O	0	0		(24c)
ے d) If na	atural v	entilatio	on or who	ole hous	e positiv	/e input	ventilati	on from	loft		l .			
if (	(22b)m	= 1, the	en (24d)ı	m = (22k)	o)m othe	· `	24d)m =	<del>- `</del>	22b)m² x	0.5]				
(24d)m=	0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(24d)
			rate - en		, ,	<del>´`</del>	c) or (24	<del>,                                    </del>	x (25)					
(25)m=	0.9	0.88	0.87	8.0	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(25)
3. Heat	osses	and he	eat loss p	aramete	er:									
ELEME	NT	Gros area		Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I		k-value kJ/m²-k		A X k kJ/K
Windows	s Type	1				3.77	x <sup>'</sup>	/[1/( 1.8 )+	- 0.04] =	6.33				(27)
Windows	S Type :	2				3.77	X.	/[1/( 1.8 )+	- 0.04] =	6.33				(27)
Windows	s Type	3				3.77	X'	/[1/( 1.8 )+	- 0.04] =	6.33				(27)
Windows	s Type	4				4.94	x′	/[1/( 1.8 )+	- 0.04] =	8.29				(27)
Floor						227.5	5 x	0.25	=	56.875				(28)
Walls Ty	rpe1	94.6	8	16.2	5	78.43	3 X	0.35	=	27.45				(29)
Walls Ty	pe2	53.4	8	0		53.48	3 X	0.31	=	16.42				(29)
Roof		104.	54	0		104.5	4 x	0.16	=	16.73				(30)
Total are	ea of ele	ements	, m²			480.2	2							(31)
Party wa	all					83.58	3 x	0	=	0				(32)
Party cei	iling					122.9	6							(32b)
			ows, use e sides of in				lated usin	g formula 1	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	3.2	
Fabric he	eat loss	s, W/K =	= S (A x	U)				(26)(30	) + (32) =			[	144.70	6 (33)
Heat cap	oacity C	m = S(	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	42649.4	(34)
Thermal	mass p	oarame	ter (TMP	? = Cm ÷	- TFA) ir	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
For design can be use					constructi	ion are no	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal	bridges	s : S (L	x Y) cald	culated u	using Ap	pendix I	K						72.03	(36)
if details of			are not kno	own (36) =	= 0.05 x (3	1)			(33) +	- (36) =		آ	216.79	9 (37)



Ventilation hea	nt loss ca	alculated	monthly	/				(38)m	= 0.33 × (	(25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 196.13	192.74	189.42	173.83	170.91	157.33	157.33	154.81	162.56	170.91	176.81	182.98		(38)
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (	38)m			
(39)m= 412.91	409.53	406.21	390.61	387.7	374.12	374.12	371.6	379.35	387.7	393.6	399.77		
Heat loss para	meter (H	HLP), W/	m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> . (4)	12 /12=	390.6	(39)
(40)m= 1.81	1.8	1.78	1.72	1.7	1.64	1.64	1.63	1.67	1.7	1.73	1.76		
Number of day	s in moi	nth (Tabl	e 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	1.72	(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	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)	)2)] + 0.0	0013 x (	ΓFA -13.		.04		(42)
if TFA £ 13.9 Annual averag	•	atar usac	a in litra	se nar de	v Vd av	erane –	(25 v N)	<b>⊥</b> 36		40	0.05		(42)
Reduce the annua	al average	hot water	usage by	5% if the a	welling is	designed t			se target o		6.35		(43)
not more that 125	litres per	person per	day (all w	ater use, l	not and co	ld)		ı					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in													
(44)m= 116.98	112.73	108.47	104.22	99.97	95.71	95.71	99.97	104.22	108.47	112.73	116.98	1070.10	7(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1276.18	(44)
(45)m= 173.48	151.73	156.57	136.5	130.98	113.02	104,73	120.18	121.62	141.73	154.71	168.01		
If instantaneous w	ater heati	na at noint	of use (no	hot water	storage)	enter () in	hoxes (46		Γotal = Su	m(45) <sub>112</sub> =	=	1673.27	(45)
(46)m= 26.02	22.76	23.49	20.48	19.65	16.95	15.71	18.03	18.24	21.26	23.21	25.2		(46)
Water storage		20.10	20.10	10.00	10.00	10.71	10.00	10.21	21.20	20.21	20.2		(12)
Storage volum	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		305		(47)
If community h	stored			_			' '	ers) ente	er '0' in (	47)			
Water storage a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/dav):				1	.63		(48)
Temperature fa					`	,					1.6		(49)
Energy lost fro				ear			(48) x (49)	) =			.98		(50)
b) If manufact			-										<i>(</i> <b>-</b> <i>t</i> )
Hot water stora  If community h	_			e z (KVVI	n/iitre/da	ıy)					0		(51)
Volume factor	_										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 (	, ,	,								0.	.98		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m				
(56)m= 30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(56)



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H	
(57)m= 30.32 27.38 30.32 29.34 30.32 29.34 30.32 29.34 30.32 29.34 30.32	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 54.55 49.27 54.55 52.79 54.55 36.09 37.3 37.3 36.09 54.55 52.79 54.55	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	1
(62)m= 258.35 228.39 241.44 218.64 215.85 178.46 172.35 187.8 187.05 226.6 236.85 252.88	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 258.35   228.39   241.44   218.64   215.85   178.46   172.35   187.8   187.05   226.6   236.85   252.88	_
Output from water heater (annual) <sub>112</sub> 2604.65	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 125.58 111.78 119.96 111.09 111.45 89.93 88.92 94.05 92.79 115.02 117.15 123.76	(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):	
o. Internal gains (see Table C and oa).	
Metabolic gains (Table 5), Watts	
Metabolic gains (Table 5), Watts	(66)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       151.89	(66) (67)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	, ,
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       151.89	, ,
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 151.89 151	(67)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 151.89 151	(67)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m= 151.89 151	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68)
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       151.89	(67) (68) (69)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         151.89	(67) (68) (69) (70)
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         151.89	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       151.89	(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.	(67) (68) (69) (70) (71) (72)

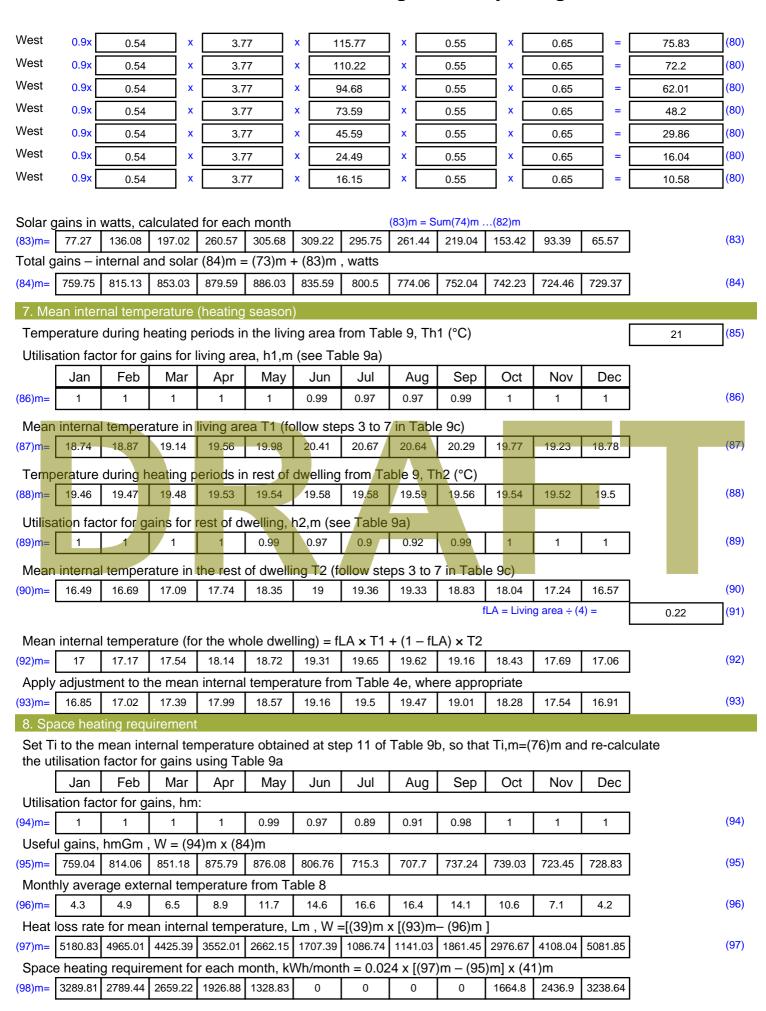
Orientation: Access Factor Area Flux  $g_-$  FF Table 6d  $m^2$  Table 6a Table 6b Table 6c

Gains (W)



Northeast 0.0x			,				1						_
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.94	X	11.28	X	0.55	X	0.65	=	9.68	(75)
Northeast 0.8x	<u>_</u>	0.54	X	4.94	X	22.97	X	0.55	X	0.65	=	19.71	(75)
Northeast 0.sk	L	0.54	X	4.94	X	41.38	X	0.55	X	0.65	<u> </u>	35.52	(75)
Northeast 0.5x	<u>L</u>	0.54	X	4.94	X	67.96	X	0.55	X	0.65	] =	58.33	(75)
Northeast 0.9x	<u>L</u>	0.54	X	4.94	x	91.35	X	0.55	X	0.65	=	78.4	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.94	x	97.38	X	0.55	X	0.65	=	83.59	(75)
Northeast 0,9x	<u>L</u>	0.54	X	4.94	X	91.1	X	0.55	X	0.65	=	78.19	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.94	X	72.63	X	0.55	X	0.65	=	62.34	(75)
Northeast 0.5x	<u>L</u>	0.54	X	4.94	X	50.42	X	0.55	X	0.65	=	43.28	(75)
Northeast 0.9x	<u>L</u>	0.54	X	4.94	X	28.07	X	0.55	X	0.65	=	24.09	(75)
South	<u>L</u>	0.54	X	4.94	X	14.2	X	0.55	X	0.65	=	12.19	(75)
South 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.94	X	9.21	X	0.55	X	0.65	=	7.91	(75)
South	South 0.9x	0.54	x	3.77	x	46.75	X	0.55	X	0.65	=	30.62	(78)
South 0.8x 0.54 x 3.77 x 110.23 x 0.55 x 0.65 = 72.21 (78)  South 0.9x 0.54 x 3.77 x 1114.87 x 0.55 x 0.65 = 75.24 (78)  South 0.9x 0.54 x 3.77 x 110.55 x 0.55 x 0.65 = 75.24 (78)  South 0.9x 0.54 x 3.77 x 110.89 x 0.55 x 0.65 = 70.75 (78)  South 0.9x 0.54 x 3.77 x 104.89 x 0.55 x 0.65 = 68.71 (78)  South 0.9x 0.54 x 3.77 x 101.89 x 0.55 x 0.65 = 68.71 (78)  South 0.9x 0.54 x 3.77 x 82.59 x 0.65 x 0.65 = 66.74 (78)  South 0.9x 0.54 x 3.77 x 82.59 x 0.65 x 0.65 = 66.74 (78)  South 0.9x 0.54 x 3.77 x 40.4 x 0.55 x 0.65 = 26.41 (78)  South 0.9x 0.54 x 3.77 x 40.4 x 0.55 x 0.65 = 26.48 (78)  South 0.9x 0.54 x 3.77 x 106.25 x 0.55 x 0.65 = 26.48 (78)  Southwesto, 9x 0.54 x 3.77 x 106.25 x 0.55 x 0.65 = 24.1 (79)  Southwesto, 9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 69.6 (79)  Southwesto, 9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79)  Southwesto, 9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65	South 0.9x	0.54	x	3.77	X	76.57	X	0.55	X	0.65	=	50.15	(78)
South 0.9x 0.54	South 0.9x	0.54	X	3.77	X	97.53	x	0.55	X	0.65	=	63.89	(78)
South 0.9x 0.54	South 0.9x	0.54	X	3.77	x	110.23	X	0.55	X	0.65	=	72.21	(78)
South 0.9x 0.54 x 3.77 x 108.01 x 0.55 x 0.65 = 70.75 (78) South 0.9x 0.54 x 3.77 x 104.89 x 0.55 x 0.65 = 68.71 (78) South 0.9x 0.54 x 3.77 x 101.89 x 0.55 x 0.65 = 68.71 (78) South 0.9x 0.54 x 3.77 x 8.2.59 x 0.55 x 0.65 = 68.74 (78) South 0.9x 0.54 x 3.77 x 8.2.59 x 0.55 x 0.65 = 54.1 (78) South 0.9x 0.54 x 3.77 x 36.79 x 0.55 x 0.65 = 26.46 (78) Southwest0.9x 0.54 x 3.77 x 8.5.75 x 0.65 = 24.1 (79) Southwest0.9x 0.54 x 3.77 x 106.25 x 0.65 x 0.65 = 24.1 (79) Southwest0.9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 69.6 (79) Southwest0.9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.95 (79) Southwest0.9x 0.54 x 3.77 x 118.15 x 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0	South 0.9x	0.54	x	3.77	X	114.87	x	0.55	X	0.65	=	75.24	(78)
South 0.9x 0.54 x 3.77 x 101.89 x 0.55 x 0.65 = 68.71 (78) South 0.9x 0.54 x 3.77 x 101.89 x 0.55 x 0.65 = 66.74 (78) South 0.9x 0.54 x 3.77 x 62.59 x 0.55 x 0.65 = 54.1 (78) South 0.9x 0.54 x 3.77 x 36.79 x 0.55 x 0.65 = 26.46 (78) Southwest0.9x 0.54 x 3.77 x 85.75 x 0.65 x 0.65 = 24.1 (79) Southwest0.9x 0.54 x 3.77 x 119.01 x 105.5 x 0.65 = 56.17 (79) Southwest0.9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 69.6 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 31.49 x 0.55 x 0.65 = 25.17 (80) West 0.9x 0.54 x 3.77 x 38.42 x 0.55 x 0.65 = 25.17 (80) West 0.9x 0.54 x 3.77 x 38.42 x 0.55 x 0.65 = 25.17 (80) West 0.9x 0.54 x 3.77 x 38.42 x 0.55 x 0.65 = 25.17 (80)	South 0.9x	0.54	x	3.77	X	110.55	Х	0.55	X	0.65	-	72.41	(78)
South 0.9x 0.54 x 3.77 x 101.89 x 0.55 x 0.65 = 66.74 (78) South 0.9x 0.54 x 3.77 x 82.59 x 0.55 x 0.65 = 54.1 (78) South 0.9x 0.54 x 3.77 x 40.4 x 0.55 x 0.65 = 26.46 (78) South 0.9x 0.54 x 3.77 x 40.4 x 0.55 x 0.65 = 26.46 (78) Southwest0.9x 0.54 x 3.77 x 62.67 0.55 x 0.65 = 24.1 (79) Southwest0.9x 0.54 x 3.77 x 85.75 0.55 x 0.65 = 41.05 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 69.6 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.01 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 104.07 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 113.49 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 22.63 (79) West 0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 22.617 (80) West 0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 22.617 (80) West 0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 22.617 (80) West 0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 22.617 (80) West 0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 22.617 (80) West 0.9x 0.54 x 3.77 x 113.64 x 0.55 x 0.65 = 60.45 (80)	South 0.9x	0.54	x	3.77	х	108.01	X	0.55	x	0.65	=	70.75	(78)
South 0.9x 0.54 x 3.77 x 82.59 x 0.55 x 0.65 = 54.1 (78) South 0.9x 0.54 x 3.77 x 40.4 x 0.55 x 0.65 = 26.48 (78) South 0.9x 0.54 x 3.77 x 40.4 x 0.55 x 0.65 = 26.48 (78) Southwesto.9x 0.54 x 3.77 x 62.67 0.55 x 0.65 = 24.1 (79) Southwesto.9x 0.54 x 3.77 x 106.25 0.55 x 0.65 = 56.17 (79) Southwesto.9x 0.54 x 3.77 x 119.01 0.55 x 0.65 = 69.6 (79) Southwesto.9x 0.54 x 3.77 x 119.01 0.55 x 0.65 = 77.95 (79) Southwesto.9x 0.54 x 3.77 x 118.15 0.55 x 0.65 = 77.95 (79) Southwesto.9x 0.54 x 3.77 x 118.15 0.55 x 0.65 = 77.39 (79) Southwesto.9x 0.54 x 3.77 x 119.01 0.55 x 0.65 = 77.39 (79) Southwesto.9x 0.54 x 3.77 x 119.01 0.55 x 0.65 = 69.6 (79) Southwesto.9x 0.54 x 3.77 x 119.01 0.55 x 0.65 = 77.39 (79) Southwesto.9x 0.54 x 3.77 x 119.01 0.55 x 0.65 = 68.38 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwesto.9x 0.54 x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79)	South 0.9x	0.54	x	3.77	х	104.89	x	0.55	x	0.65	=	68.71	(78)
South         0.9x         0.54         x         3.77         x         55,42         x         0.55         x         0.65         =         36.3         (78)           South         0.9x         0.54         x         3.77         x         40.4         x         0.55         x         0.65         =         26.46         (78)           Southwest0.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         24.1         (79)           Southwest0.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwest0.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwest0.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         69.6         (79)           Southwest0.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79) <t< td=""><td>South 0.9x</td><td>0.54</td><td>x</td><td>3.77</td><td>X</td><td>101.89</td><td>X</td><td>0.55</td><td>x</td><td>0.65</td><td>=</td><td>66.74</td><td>(78)</td></t<>	South 0.9x	0.54	x	3.77	X	101.89	X	0.55	x	0.65	=	66.74	(78)
South         0.9x         0.54         x         3.77         x         40.4         x         0.55         x         0.65         =         26.46         (78)           Southwesto.9x         0.54         x         3.77         x         36.79         0.55         x         0.65         =         24.1         (79)           Southwesto.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwesto.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.95         (79)           Southwesto.9x <td>South 0.9x</td> <td>0.54</td> <td>x</td> <td>3.77</td> <td>x</td> <td>82.59</td> <td>Х</td> <td>0.55</td> <td>x</td> <td>0.65</td> <td>=</td> <td>54.1</td> <td>(78)</td>	South 0.9x	0.54	x	3.77	x	82.59	Х	0.55	x	0.65	=	54.1	(78)
Southwesto.9x         0.54         x         3.77         x         36.79         0.55         x         0.65         =         24.1         (79)           Southwesto.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwesto.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         56.17         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54	South 0.9x	0.54	x	3.77	x	55.42	X	0.55	x	0.65	=	36.3	(78)
Southwesto.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwesto.9x         0.54         x         3.77         x         85.75         0.55         x         0.65         =         56.17         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         77.461         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54	South 0.9x	0.54	x	3.77	х	40.4	X	0.55	x	0.65	=	26.46	(78)
Southwest0.9x         0.54         x         3.77         x         85.75         0.55         x         0.65         =         56.17         (79)           Southwest0.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwest0.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         77.95         (79)           Southwest0.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.95         (79)           Southwest0.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.95         (79)           Southwest0.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         74.61         (79)           Southwest0.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         60.82         (79)           Southwest0.9x         0.54	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	36.79		0.55	x	0.65	=	24.1	(79)
Southwesto.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         92.85         0.55         x         0.65         =         60.82         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           Southwesto.9x         0.54	Southwest <sub>0.9x</sub>	0.54	x	3.77	X	62.67		0.55	x	0.65	=	41.05	(79)
Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         92.85         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         45.37         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           West         0.9x         0	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	85.75		0.55	x	0.65	=	56.17	(79)
Southwest0.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwest0.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwest0.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwest0.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         60.82         (79)           Southwest0.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         45.37         (79)           Southwest0.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           West         0.9x         0.54         x         3.77         x         19.64         x         0.55         x         0.65         =         20.63         (79)           West	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	106.25		0.55	x	0.65	=	69.6	(79)
Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         60.82         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         45.37         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           Southwesto.9x         0.54         x         3.77         x         31.49         0.55         x         0.65         =         28.87         (79)           West         0.9x         0.54         x         3.77         x         19.64         x         0.55         x         0.65         =         20.63         (79)           West	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	119.01		0.55	X	0.65	=	77.95	(79)
Southwest0.9x       0.54       x       3.77       x       104.39       0.55       x       0.65       =       68.38       (79)         Southwest0.9x       0.54       x       3.77       x       92.85       0.55       x       0.65       =       60.82       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       45.37       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       63.27       x	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	118.15		0.55	X	0.65	=	77.39	(79)
Southwesto.9x         0.54         x         3.77         x         92.85         0.55         x         0.65         =         60.82         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         45.37         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           Southwesto.9x         0.54         x         3.77         x         31.49         0.55         x         0.65         =         20.63         (79)           West         0.9x         0.54         x         3.77         x         19.64         x         0.55         x         0.65         =         20.63         (79)           West         0.9x         0.54         x         3.77         x         19.64         x         0.55         x         0.65         =         12.86         (80)           West         0.9x         0.54         x         3.77         x         63.27         x         0.55         x         0.65         =         25.17	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	113.91		0.55	x	0.65	=	74.61	(79)
Southwest0.9x       0.54       x       3.77       x       69.27       0.55       x       0.65       =       45.37       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)         West       0.9x       0.54       x       3.77       x       92.28       x       0.55       x       0.65       =       60.45       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	104.39		0.55	x	0.65	=	68.38	(79)
Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)         West       0.9x       0.54       x       3.77       x       92.28       x       0.55       x       0.65       =       60.45       (80)	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	92.85		0.55	x	0.65	] =	60.82	(79)
Southwesto.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)         West       0.9x       0.54       x       3.77       x       92.28       x       0.55       x       0.65       =       60.45       (80)	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	69.27		0.55	x	0.65	=	45.37	(79)
West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)         West       0.9x       0.54       x       3.77       x       92.28       x       0.55       x       0.65       =       60.45       (80)	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	44.07		0.55	x	0.65	=	28.87	(79)
West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)         West       0.9x       0.54       x       3.77       x       92.28       x       0.55       x       0.65       =       60.45       (80)	Southwest <sub>0.9x</sub>	0.54	x	3.77	x	31.49		0.55	x	0.65	=	20.63	(79)
West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)         West       0.9x       0.54       x       3.77       x       92.28       x       0.55       x       0.65       =       60.45       (80)	West 0.9x	0.54	x	3.77	x	19.64	x	0.55	x	0.65	] =	12.86	(80)
West 0.9x 0.54 x 3.77 x 92.28 x 0.55 x 0.65 = 60.45 (80)	West 0.9x	0.54	x	3.77	x	38.42	x	0.55	x	0.65	=	25.17	(80)
0.01	West 0.9x	0.54	x	3.77	x	63.27	x	0.55	x	0.65	=	41.45	(80)
West $0.9x$ 0.54 $\times$ 3.77 $\times$ 113.09 $\times$ 0.55 $\times$ 0.65 = 74.08 (80)	West 0.9x	0.54	x	3.77	x	92.28	x	0.55	x	0.65	] =	60.45	(80)
	West 0.9x	0.54	×	3.77	x	113.09	×	0.55	x	0.65	=	74.08	(80)







			Tota	l per year	(kWh/year	r) = Sum(9	08)15,912 =	19334.53	(98)
Space heating requirement in kWh/m²/yea	r							84.95	(99)
9a. Energy requirements – Individual heatin	g systems i	ncluding	micro-C	CHP)					
Space heating:		1					ı	_	¬(004)
Fraction of space heat from secondary/sup		•		(204)				0	(201)
Fraction of space heat from main system(s	,		(202) = 1		(202)]			1	(202)
Fraction of total heating from main system	1		(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1		. 0/						91.9	(206)
Efficiency of secondary/supplementary hea	<del>- i</del>		Ι.	_	I -	I	I _	0	(208)
	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calculated about 3289.81 2789.44 2659.22 1926.88 1328	<u> </u>	0	0	0	1664.8	2436.9	3238.64		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$							1		(211)
3579.77 3035.3 2893.6 2096.72 1445	5.96 0	0	0	0	1811.54	2651.69	3524.09		(211)
	<b>I</b>	!	Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,101</sub>		21038.67	(211)
Space heating fuel (secondary), kWh/mont	th						!		_
$= \{[(98)m \times (201)]\} \times 100 \div (208)$									
(215)m= 0 0 0 0 0	0	0	0 Tota	0 I (kWh/yea	0	0	0		7(045)
W. C. C. C. C. C. C. C. C. C. C. C. C. C.			Tota	i (kwii/yea	ar) =5um(2	213) <sub>15,101</sub>	2=	0	(215)
Water heating Output from water heater (calculated above									
258.35 228.39 241.44 218.64 215.		172.35	187.8	187.05	226.6	236.85	252.88		
Efficiency of water heater								81.8	(216)
(217)m= 91.08 91.05 90.97 90.76 90.3	34 81.8	81.8	81.8	81.8	90.56	90.91	91.09		(217)
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$									
	.93 218.16	210.69	229.58	228.67	250.23	260.54	277.63		
		!	Tota	I = Sum(2	19a) <sub>112</sub> =		!	2955.25	(219)
Annual totals					k\	Wh/yea	r	kWh/yea	<u></u>
Space heating fuel used, main system 1								21038.67	
Water heating fuel used								2955.25	
Electricity for pumps, fans and electric keep	-hot								
central heating pump:							30		(230c)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =		-	30	(231)
Electricity for lighting								804.3	(232)
12a. CO2 emissions – Individual heating s	vstems incl	udina mi	cro-CHF						
		J							
		<b>lergy</b> /h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	Emission kg CO2/ye	
Space heating (main system 1)		1) x					=		(261)
		5) x			0.2			4544.35	=
Space heating (secondary)	(21:	·, ^			0.5	19	=	0	(263)



Water heating	(219) x	0.216	- [	638.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5182.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	- [	15.57	(267)
Electricity for lighting	(232) x	0.519	- [	417.43	(268)
Total CO2, kg/year	sum	of (265)(271) =		5615.69	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =		24.67	(273)
El rating (section 14)				72	(274)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 7 - Existing Be Lean- 3B6P - MF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 250.9 (1a) x (2a) =(3a) 4.4 1103.96 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)250.9 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =1103.96 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.04 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)O Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.79 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.73 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) = $(2$	21a) x (22a)m
0.93 0.91 0.89 0.8 0.78 0.69 0.69	0.67 0.73 0.78 0.82 0.85
Calculate effective air change rate for the applicable case If mechanical ventilation:	(220)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)	0   (23a) )) otherwise (23b) = (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from T	
	(=55)
a) If balanced mechanical ventilation with heat recovery (MVHF	$(24a) = (22b) + (23b) \times [1 - (23c) \div 100]$ $0  0  0  0  0  (24a)$
b) If balanced mechanical ventilation without heat recovery (MV	
(24b)m= 0 0 0 0 0 0 0 0	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
c) If whole house extract ventilation or positive input ventilation	
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c)$	
(24c)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilation	from loft
if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.8$	
(24d)m= 0.93 0.91 0.9 0.82 0.81 0.74 0.74	0.73 0.76 0.81 0.83 0.87 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d)	in box (25)
(25)m= 0.93 0.91 0.9 0.82 0.81 0.74 0.74	0.73 0.76 0.81 0.83 0.87 (25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross area (m²) Openings Net Area A ,m²	U-value A X U k-value A X k W/m2K (W/K) kJ/m²-K kJ/K
	$/(1.8) + 0.04] = 25.04 \tag{27}$
	/(1.8) + 0.04] = 49.65  (27)
	40.00
(0.000	/(1.8) + 0.04] = 18.19 (27)
Windows Type 4 4.81 x1/[1.	/(1.8) + 0.04] =
Windows Type 5 7.72 x1/[1.	/(1.8) + 0.04] = 8.08   (27)
Windows Type 5 7.72 x1/[1.	/(1.8) + 0.04] = 8.08 $/(1.8) + 0.04] = 12.96 $ (27)
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]	/(1.8) + 0.04] = 8.08 $/(1.8) + 0.04] = 12.96$ $/(1.8) + 0.04] = 12.29$ (27)
Windows Type 5       7.72       x1/[1/2]         Windows Type 6       7.32       x1/[1/2]         Walls Type 1       337.79       75.17       262.62       x	/(1.8) + 0.04] = 8.08 $ /(1.8) + 0.04] = 12.96 $ $ /(1.8) + 0.04] = 12.29 $ $ 0.35 = 91.92 $ $ (27) $ $ (29)$
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type 1       337.79       75.17       262.62       x         Walls Type 2       58.52       0       58.52       x	
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type 1       337.79       75.17       262.62       x         Walls Type 2       58.52       0       58.52       x         Total area of elements, m²       396.31	
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type 1       337.79       75.17       262.62       x         Walls Type 2       58.52       0       58.52       x         Total area of elements, m²       396.31         Party wall       11.35       x	
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type1       337.79       75.17       262.62       x         Walls Type2       58.52       0       58.52       x         Total area of elements, m²       396.31         Party wall       11.35       x         Party floor       251.47	
Windows Type 5  Windows Type 6  T.72  X1/[1]  Windows Type 6  Walls Type 1  337.79  75.17  262.62  X  Walls Type 2  58.52  Total area of elements, m <sup>2</sup> Party wall  Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for ** include the areas on both sides of internal walls and partitions	
Windows Type 5  Windows Type 6  T.72  X1/[1, Windows Type 6  Walls Type 1  337.79  75.17  262.62  X  Walls Type 2  58.52  Total area of elements, m <sup>2</sup> Party wall  Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for ** include the areas on both sides of internal walls and partitions	
Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  S8.52  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for ** include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)   7.72  x1/[1]  x1/[	J(1.8) + 0.04] = 8.08 (27) J(1.8) + 0.04] = 12.96 (27) J(1.8) + 0.04] = 12.29 (27) J(1.8) + 0.04] = 12.29 (29) J(1.8) + 0.04] = 12.29 (31) J(1.8) + 0.04] = 12.29 (32) J(1.8) + 0.04] = 12.29 (33)
Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  58.52  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for the include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)  Heat capacity Cm = S(A x k)	J(1.8) + 0.04] = 8.08 (27) J(1.8) + 0.04] = 12.96 (27) J(1.8) + 0.04] = 12.29 (27) J(1.8) + 0.04] = 12.29 (29) J(1.8) + 0.04] = 12.29 (31) J(1.8) + 0.04] = 12.29 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (34) J(1.8) + 0.04 (35) J(1.8) + 0.04 (36) J(1.8) + 0.04 (37) J(1.8) + 0.04 (38) J(1.8) + 0.04 (39) J(1.8) + 0.04 (30) J(1.8) + 0.04 (31) J(1.8) + 0.04 (32)
Windows Type 5	J(1.8) + 0.04] = 8.08 (27) J(1.8) + 0.04] = 12.96 (27) J(1.8) + 0.04] = 12.29 (27) J(1.8) + 0.04] = 12.29 (29) J(1.8) + 0.04] = 12.29 (31) J(1.8) + 0.04] = 12.29 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (34) J(1.8) + 0.04 (35) J(1.8) + 0.04 (36) J(1.8) + 0.04 (37) J(1.8) + 0.04 (38) J(1.8) + 0.04 (38) J(1.8) + 0.04 (39) J(1.8) + 0.04 (30) J(1.8) + 0.04 (31) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (34) J(1.8) + 0.04 (35)



	()	F		_
Total fabric heat loss	(33) + (36) =	)E\m v (E)	295.54	(37)
Ventilation heat loss calculated monthly  Jan Feb Mar Apr May Jun Jul	$(38)m = 0.33 \times (200)$ Aug Sep Oct	Nov Dec		
(38)m= 338.77 332.69 326.73 298.73 293.49 269.1 269.1	264.59 278.5 293.49	304.09 315.17		(38)
Heat transfer coefficient, W/K	(39)m = $(37)$ + $(3$			, ,
(39)m= 634.31 628.23 622.27 594.27 589.03 564.65 564.65	560.13 574.04 589.03	599.63 610.71		
		Sum(39) <sub>112</sub> /12=	594.25	(39)
Heat loss parameter (HLP), W/m²K	(40)m = $(39)$ m ÷	(4)		_
(40)m= 2.53 2.5 2.48 2.37 2.35 2.25 2.25	2.23 2.29 2.35	2.39 2.43		<b>-</b>
Number of days in month (Table 1a)	Average = S	Sum(40) <sub>112</sub> /12=	2.37	(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/ye	ear:	
Assumed occupancy, N		3.07		(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)	)2)] + 0.0013 x (TFA -13.			(12)
if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average =	(25 v N) + 26			(40)
Reduce the annual average hot water usage by 5% if the dwelling is designed		107.07		(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		1		
(44)m= 117.77 113.49 109.21 104.93 100.64 96.36 96.36	100.64 104.93 109.21	113.49   117.77		7
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x E	Total = Sun Trm / 3600 kWh/month (see Tal	· ,	1284.81	(44)
(45)m= 174.66 152.75 157.63 137.43 131.86 113.79 105.44	120.99 122.44 142.69	155.76 169.14		_
If instantaneous water heating at point of use (no het water storage) enter 0 in	Total = Sun	n(45) <sub>112</sub> =	1684.59	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in		00.00		(46)
(46)m= 26.2 22.91 23.64 20.61 19.78 17.07 15.82 Water storage loss:	18.15 18.37 21.4	23.36 25.37		(46)
Storage volume (litres) including any solar or WWHRS storage	within same vessel	305		(47)
If community heating and no tank in dwelling, enter 110 litres in	(47)			
Otherwise if no stored hot water (this includes instantaneous co	ombi boilers) enter '0' in (4	17)		
Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day):		4.00		(40)
Temperature factor from Table 2b		1.63		(48) (49)
·	(48) x (49) =	0.6		(50)
b) If manufacturer's declared cylinder loss factor is not known:	(40) X (40) =	0.98		(30)
Hot water storage loss factor from Table 2 (kWh/litre/day)		0		(51)
If community heating see section 4.3				(==)
Volume factor from Table 2a Temperature factor from Table 2b		0		(52) (53)
	(47) x (51) x (52) x (53) =			(54)
Enter (50) or (54) in (55)	( ) x (0.) x (02) x (00) =	0.98		(54) (55)
		0.00		` '



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$													
(56)m= 30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)r	n = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(57)
Primary circui	t loss (ar	nual) fro	m Table	3							0		(58)
Primary circui	loss cal	culated t	for each	month (	59)m = (	(58) ÷ 36	55 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 54.55	49.27	54.55	52.79	54.55	36.09	37.3	37.3	36.09	54.55	52.79	54.55		(59)
Combi loss ca	lculated	for each	month (	61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat req	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 259.53	229.41	242.5	219.56	216.73	179.22	173.06	188.61	187.87	227.56	237.89	254.02		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	v) (enter '0	' if no sola	r contribut	on to wate	er heating)		
(add additiona	I 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= 259.53	229.41	242.5	219.56	216.73	179.22	173.06	188.61	187.87	227.56	237.89	254.02		_
							Outp	out from w	ater heate	r (annual) <sub>1</sub>	12	2615.97	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.25	5 [0.85	× (45)m	+ (61)m	1] + 0.8 x	((46)m	+ (57)m	+ (59)m	]	
(65)m= 125.97	112.12	120.31	111.4	111.74	90.18	89.15	94.32	93.06	115.34	117.5	124.14		(65)
in <mark>clude</mark> (57)	m 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	<mark>mu</mark> nity h	eating	
include (57)  5. Internal g					ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal g	ains (see	Table 5	and 5a)		ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
	ains (see	Table 5	and 5a)		ylinder is Jun	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal g	ains (see	Table 5	and 5a)	:								eating	(66)
5. Internal g  Metabolic gair  Jan	rains (see	5), Wat Mar 153.4	and 5a) ts Apr 153.4	May 153.4	Jun 153.4	Jul 153.4	Aug 153.4	Sep 153.4	Oct	Nov	Dec	eating	(66)
5. Internal g  Metabolic gair  Jan  (66)m= 153.4	rains (see	5), Wat Mar 153.4	and 5a) ts Apr 153.4	May 153.4	Jun 153.4	Jul 153.4	Aug 153.4	Sep 153.4	Oct	Nov	Dec	eating	(66)
5. Internal g Metabolic gain  Jan  (66)m= 153.4  Lighting gains (67)m= 37.19	reb 153.4 (calcula 33.03	Table 5 5), Wat Mar 153.4 ted in Ap	ts Apr 153.4 ppendix l 20.34	May 153.4 L, equati	Jun 153.4 ion L9 or 12.83	Jul 153.4 r L9a), a 13.87	Aug 153.4 Iso see	Sep 153.4 Table 5 24.2	Oct 153.4	Nov 153.4	Dec 153.4	eating	, ,
5. Internal g  Metabolic gain  Jan  (66)m= 153.4  Lighting gains	res (Table Feb 153.4 (calcula 33.03 )	Table 5 5), Wat Mar 153.4 ted in Ap	ts Apr 153.4 ppendix l 20.34	May 153.4 L, equati	Jun 153.4 ion L9 or 12.83	Jul 153.4 r L9a), a 13.87	Aug 153.4 Iso see	Sep 153.4 Table 5 24.2	Oct 153.4	Nov 153.4	Dec 153.4	eating	, ,
5. Internal g  Metabolic gain  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17	res (Table Feb 153.4 (calcula 33.03 tins (calcula 421.5	Table 5 5), Wat Mar 153.4 ted in Ap 26.86 ulated in 410.59	Apr 153.4 ppendix 1 20.34 Appendix 1 387.36	May 153.4 L, equati 15.2 dix L, equ	Jun 153.4 ion L9 of 12.83 uation L 330.5	Jul 153.4 r L9a), a 13.87 13 or L1 312.09	Aug 153.4 Iso see 18.03 3a), also	Sep 153.4 Table 5 24.2 see Ta 318.67	Oct 153.4 30.72 ble 5 341.89	Nov 153.4 35.86	Dec 153.4 38.22	eating	(67)
5. Internal g  Metabolic gain  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains	reb 153.4 (calcula 33.03 ins (calcula 421.5 (calcula	Table 5 5), Wat Mar 153.4 ted in Ap 26.86 ulated in 410.59	Apr 153.4 ppendix 1 20.34 Appendix 1 387.36	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat	Jun 153.4 ion L9 or 12.83 uation L 330.5 ion L15	Jul 153.4 r L9a), a 13.87 13 or L1 312.09	Aug 153.4 Iso see 18.03 3a), also	Sep 153.4 Table 5 24.2 see Ta 318.67	Oct 153.4 30.72 ble 5 341.89	Nov 153.4 35.86	Dec 153.4 38.22	eating	(67)
5. Internal g  Metabolic gain  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34	res (Table Feb 153.4 (calcula 33.03 ins (calcula 421.5 c (calcula 38.34	Table 5 Mar 153.4 ted in Ap 26.86 ulated in 410.59 tted in Ap	Apr 153.4 opendix l 20.34 Appendix l 387.36 opendix 38.34	May 153.4 L, equati 15.2 dix L, equ	Jun 153.4 ion L9 of 12.83 uation L 330.5	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a)	Aug 153.4 Iso see 18.03 3a), also 307.76	Sep 153.4 Table 5 24.2 See Ta 318.67	Oct 153.4 30.72 ble 5 341.89	Nov 153.4 35.86	Dec 153.4 38.22 398.76	eating	(67) (68)
5. Internal g  Metabolic gair  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa	res (Table Feb 153.4 (calcula 33.03 ins (calcula 421.5 c (calcula 38.34	Table 5 Mar 153.4 ted in Ap 26.86 ulated in 410.59 tted in Ap	Apr 153.4 opendix l 20.34 Appendix l 387.36 opendix 38.34	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat	Jun 153.4 ion L9 or 12.83 uation L 330.5 ion L15	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a)	Aug 153.4 Iso see 18.03 3a), also 307.76	Sep 153.4 Table 5 24.2 See Ta 318.67	Oct 153.4 30.72 ble 5 341.89	Nov 153.4 35.86	Dec 153.4 38.22 398.76	eating	(67) (68)
5. Internal g Metabolic gair  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3	res (Table Feb 153.4 (calcula 33.03 ins (calcula 421.5 calcula 38.34 rs gains 3	Table 5 5), Wat Mar 153.4 ted in Ap 26.86 ulated in 410.59 ted in Ap 38.34 (Table 5	Apr 153.4 ppendix I 20.34 Appendix 387.36 ppendix 38.34 5a)	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34	Jun 153.4 ion L9 or 12.83 uation L 330.5 ion L15 38.34	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34	Aug 153.4 Iso see 18.03 3a), also 307.76 , also se 38.34	Sep 153.4 Table 5 24.2 see Ta 318.67 ee Table 38.34	Oct 153.4 30.72 ble 5 341.89 5 38.34	Nov 153.4 35.86 371.21	Dec 153.4 38.22 398.76	eating	(67) (68) (69)
Metabolic gain  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3  Losses e.g. ev	res (Table Feb 153.4 (calcula 33.03 ins (calcula 38.34 res gains 3 response)	Table 5  5), Wat Mar  153.4  ted in Ap  26.86  ulated in  410.59  ted in Ap  38.34  (Table 5	Apr 153.4 opendix l 20.34 Appendix l 387.36 opendix 38.34 5a) 3	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34	Jun 153.4 ion L9 of 12.83 uation L 330.5 ion L15 38.34 3 le 5)	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34	Aug 153.4 Iso see 18.03 307.76 307.76 , also se 38.34	Sep 153.4 Table 5 24.2 See Ta 318.67 ee Table 38.34	Oct 153.4 30.72 ble 5 341.89 5 38.34	Nov 153.4 35.86 371.21 38.34	Dec 153.4 38.22 398.76 38.34	eating	(67) (68) (69)
5. Internal g  Metabolic gair  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3  Losses e.g. et  (71)m= -122.72	reportion in the control of the cont	Table 5 Mar 153.4 ted in Ap 26.86 ulated in 410.59 tted in Ap 38.34 (Table 5	Apr 153.4 opendix l 20.34 Appendix l 387.36 opendix 38.34 5a) 3	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34	Jun 153.4 ion L9 of 12.83 uation L 330.5 ion L15 38.34 3 le 5)	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34	Aug 153.4 Iso see 18.03 3a), also 307.76 , also se 38.34	Sep 153.4 Table 5 24.2 see Ta 318.67 ee Table 38.34	Oct 153.4 30.72 ble 5 341.89 5 38.34	Nov 153.4 35.86 371.21	Dec 153.4 38.22 398.76 38.34	eating	(67) (68) (69) (70)
Metabolic gair  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3  Losses e.g. ev  (71)m= -122.72  Water heating	reportion of the control of the cont	Table 5 Mar 153.4 ted in Ap 26.86 ulated in 410.59 ted in A 38.34 (Table 5 3 on (negation) -122.72	Apr 153.4 opendix I 20.34 Appendix 387.36 opendix 38.34 5a) 3 tive value	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34 3 es) (Tab	Jun 153.4 ion L9 or 12.83 uation L 330.5 ion L15 38.34 3 le 5)	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34	Aug 153.4 Iso see 18.03 3a), also 307.76 , also se 38.34	Sep 153.4 Table 5 24.2 See Ta 318.67 ee Table 38.34	Oct 153.4 30.72 ble 5 341.89 5 38.34 3	Nov 153.4 35.86 371.21 38.34	Dec 153.4 38.22 398.76 38.34 3	eating	(67) (68) (69) (70) (71)
Metabolic gain  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3  Losses e.g. ev  (71)m= -122.72  Water heating  (72)m= 169.32	res (Table Feb 153.4 (calcula 33.03 ins (calcula 38.34 res gains 3 response) and the second s	Table 5  153.4  ted in Ap 26.86  ulated in 410.59  ted in Ap 38.34  (Table 5 3  on (negation of the context) 161.71	Apr 153.4 opendix l 20.34 Appendix l 387.36 opendix 38.34 5a) 3	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34	Jun 153.4 ion L9 or 12.83 uation L 330.5 ion L15 38.34 3 le 5) -122.72	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34	Aug 153.4 Iso see 18.03 307.76 , also se 38.34 3	Sep 153.4 Table 5 24.2 See Ta 318.67 See Table 38.34	Oct 153.4 30.72 ble 5 341.89 5 38.34 3 -122.72	Nov 153.4 35.86 371.21 38.34 3	Dec 153.4 38.22 398.76 38.34 3	eating	(67) (68) (69) (70)
Metabolic gair  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3  Losses e.g. et  (71)m= -122.72  Water heating  (72)m= 169.32  Total internal	ins (see Feb 153.4 (calcula 33.03 ins (calcula 38.34 ns gains 3 /aporatic -122.72 gains (Table 166.84 gains =	Table 5 5), Wat Mar 153.4 ted in Ap 26.86 ulated in 410.59 tted in A 38.34 (Table 5 3 on (negation) 161.71	and 5a) ts  Apr 153.4 ppendix l 20.34 Appendix 387.36 ppendix 38.34 5a) 3 tive value -122.72	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34 3 es) (Tab -122.72	Jun 153.4 ion L9 of 12.83 uation L 330.5 ion L15 38.34 3 le 5) -122.72	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34 3 -122.72 119.83 m + (67)m	Aug 153.4 Iso see 18.03 3a), also 307.76 38.34 3 -122.72	Sep 153.4 Table 5 24.2 See Ta 318.67 See Table 38.34 3 -122.72 129.25 + (69)m +	Oct 153.4 30.72 ble 5 341.89 5 38.34 3 -122.72 155.03 (70)m + (7	Nov 153.4 35.86 371.21 38.34 3 -122.72 163.19 1)m + (72)	Dec 153.4 38.22 398.76 38.34 3 -122.72 166.85	eating	(67) (68) (69) (70) (71)
Metabolic gain  Jan  (66)m= 153.4  Lighting gains  (67)m= 37.19  Appliances ga  (68)m= 417.17  Cooking gains  (69)m= 38.34  Pumps and fa  (70)m= 3  Losses e.g. ev  (71)m= -122.72  Water heating  (72)m= 169.32	ains (see Feb 153.4 (calcula 33.03 ins (calcula 38.34 ns gains 3 //aporatio -122.72 gains (Table 166.84 gains = 693.39	Table 5  153.4  ted in Ap 26.86  ulated in 410.59  ted in Ap 38.34  (Table 5 3  on (negation of the context) 161.71	Apr 153.4 opendix I 20.34 Appendix 387.36 opendix 38.34 5a) 3 tive value	May 153.4 L, equati 15.2 dix L, equ 358.05 L, equat 38.34 3 es) (Tab	Jun 153.4 ion L9 or 12.83 uation L 330.5 ion L15 38.34 3 le 5) -122.72	Jul 153.4 r L9a), a 13.87 13 or L1 312.09 or L15a) 38.34	Aug 153.4 Iso see 18.03 307.76 , also se 38.34 3	Sep 153.4 Table 5 24.2 See Ta 318.67 See Table 38.34	Oct 153.4 30.72 ble 5 341.89 5 38.34 3 -122.72	Nov 153.4 35.86 371.21 38.34 3	Dec 153.4 38.22 398.76 38.34 3	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				
Northeast <sub>0.9x</sub> 0.54	x	10.84	x	11.28	x	0.55	x	0.65	=	21.24	(75)
Northeast 0.9x 0.77	x	4.81	x	11.28	x	0.55	X	0.65	=	13.45	(75)
Northeast 0.9x 0.77	x	7.72	x	11.28	x	0.55	X	0.65	=	21.58	(75)
Northeast 0.9x 0.77	x	7.32	х	11.28	x	0.55	x	0.65	=	20.46	(75)
Northeast 0.9x 0.54	X	10.84	x	22.97	x	0.55	x	0.65	=	43.24	(75)
Northeast 0.9x 0.77	X	4.81	x	22.97	x	0.55	x	0.65	=	27.37	(75)
Northeast 0.9x 0.77	X	7.72	x	22.97	x	0.55	x	0.65	=	43.93	(75)
Northeast 0.9x 0.77	x	7.32	x	22.97	x	0.55	X	0.65	=	41.65	(75)
Northeast 0.9x 0.54	x	10.84	x	41.38	x	0.55	x	0.65	=	77.9	(75)
Northeast 0.9x 0.77	x	4.81	x	41.38	x	0.55	X	0.65	=	49.31	(75)
Northeast 0.9x 0.77	x	7.72	x	41.38	x	0.55	X	0.65	=	79.14	(75)
Northeast 0.9x 0.77	x	7.32	х	41.38	x	0.55	X	0.65	=	75.04	(75)
Northeast 0.9x 0.54	x	10.84	х	67.96	x	0.55	x	0.65	=	127.94	(75)
Northeast 0.9x 0.77	x	4.81	x	67.96	x	0.55	X	0.65	=	80.98	(75)
Northeast 0.9x 0.77	x	7.72	х	67.96	x	0.55	x	0.65	=	129.97	(75)
Northeast 0.9x 0.77	X	7.32	X	67.96	Х	0.55	X	0.65		123.24	(75)
Northeast 0.9x 0.54	X	10.84	х	91.35	х	0.55	x	0.65		171.98	(75)
Northeast 0.9x 0.77	x	4.81	х	91.35	×	0.55	x	0.65	=	108.85	(75)
Northeast 0.9x 0.77	x	7.72	x	91.35	x	0.55	x	0.65	=	174.71	(75)
Northeast 0.9x 0.77	x	7.32	x	91.35	Х	0.55	x	0.65	=	165.66	(75)
Northeast <sub>0.9x</sub> 0.54	x	10.84	x	97.38	х	0.55	x	0.65	j =	183.35	(75)
Northeast 0.9x 0.77	x	4.81	х	97.38	x	0.55	x	0.65	=	116.05	(75)
Northeast 0.9x 0.77	x	7.72	х	97.38	x	0.55	x	0.65	=	186.26	(75)
Northeast 0.9x 0.77	x	7.32	x	97.38	x	0.55	x	0.65	=	176.61	(75)
Northeast <sub>0.9x</sub> 0.54	x	10.84	x	91.1	x	0.55	x	0.65	=	171.52	(75)
Northeast 0.9x 0.77	x	4.81	x	91.1	x	0.55	x	0.65	=	108.56	(75)
Northeast <sub>0.9x</sub> 0.77	x	7.72	х	91.1	x	0.55	x	0.65	=	174.24	(75)
Northeast 0.9x 0.77	X	7.32	x	91.1	x	0.55	X	0.65	=	165.21	(75)
Northeast 0.9x 0.54	X	10.84	х	72.63	x	0.55	X	0.65	=	136.73	(75)
Northeast 0.9x 0.77	x	4.81	х	72.63	х	0.55	x	0.65	=	86.55	(75)
Northeast 0.9x 0.77	x	7.72	x	72.63	х	0.55	x	0.65	=	138.91	(75)
Northeast 0.9x 0.77	x	7.32	x	72.63	x	0.55	x	0.65	=	131.71	(75)
Northeast 0.9x 0.54	x	10.84	x	50.42	x	0.55	x	0.65	=	94.93	(75)
Northeast 0.9x 0.77	x	4.81	x	50.42	x	0.55	x	0.65	j =	60.08	(75)
Northeast 0.9x 0.77	x	7.72	x	50.42	x	0.55	x	0.65	j =	96.44	(75)
Northeast 0.9x 0.77	x	7.32	x	50.42	x	0.55	x	0.65	j =	91.44	(75)
Northeast <sub>0.9x</sub> 0.54	x	10.84	x	28.07	x	0.55	x	0.65	j =	52.84	(75)
Northeast 0.9x 0.77	x	4.81	x	28.07	x	0.55	x	0.65	j =	33.45	(75)
Northeast <sub>0.9x</sub> 0.77	X	7.72	х	28.07	х	0.55	X	0.65	=	53.68	(75)



Northeast <sub>0.9x</sub>	0.77	X	7.3	32	X	2	8.07	x		0.55	X		0.65		=	50.9	(75)
Northeast <sub>0.9x</sub>	0.54	х	10.	84	X	1	4.2	X		0.55	X		0.65		=	26.73	(75)
Northeast <sub>0.9x</sub>	0.77	х	4.8	31	x .		4.2	X		0.55	X		0.65		=	16.92	(75)
Northeast <sub>0.9x</sub>	0.77	x	7.7	'2	x		4.2	X		0.55	×		0.65		=	27.15	(75)
Northeast <sub>0.9x</sub>	0.77	x	7.3	32	x	1	4.2	x		0.55	X	Ī	0.65		=	25.75	(75)
Northeast <sub>0.9x</sub>	0.54	x	10.	84	x	9	9.21	x		0.55	X	Ī	0.65		=	17.35	(75)
Northeast <sub>0.9x</sub>	0.77	x	4.8	31	X	9	).21	x		0.55	X		0.65		=	10.98	(75)
Northeast <sub>0.9x</sub>	0.77	x	7.7	2	x	9	).21	x		0.55	X	Ī	0.65		=	17.62	(75)
Northeast <sub>0.9x</sub>	0.77	х	7.3	32	X	9	).21	X		0.55	X		0.65		=	16.71	(75)
Southwest <sub>0.9x</sub>	0.77	х	14.9	91	X	3	6.79			0.55	X		0.65		=	135.91	(79)
Southwest <sub>0.9x</sub>	0.77	х	29.	57	X	3	6.79			0.55	X	Ē	0.65		=	269.55	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.9	91	x	6	2.67			0.55	X	Ī	0.65		=	231.51	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	x	6	2.67			0.55	X		0.65		=	459.14	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.9	91	X	8	5.75			0.55	X	Ē	0.65		=	316.76	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	x	8	5.75			0.55	X	Ī	0.65		=	628.21	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.9	91	X	10	06.25			0.55	X	Ī	0.65		=	392.48	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	X	10	06.25			0.55	X	Ē	0.65		=	778.39	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.9	91	X	11	19.01			0.55	Х	Ī	0.65		=	439.62	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	х	11	19.01			0.55	x	Ī	0.65		=	871.86	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.9	91	Х	11	18.15			0.55	x	Ī	0.65	$\equiv$	=	436.44	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	x	11	18.15			0.55	X	Ē	0.65		=	865.55	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.9	91	x	11	13.91			0.55	X	Ē	0.65		=	420.77	(79)
Southwest <sub>0.9x</sub>	0.77	х	29.	57	X	11	13.91			0.55	Х		0.65		=	834.49	(79)
Southwest <sub>0.9x</sub>	0.77	х	14.9	91	х	10	04.39			0.55	х		0.65		=	385.61	(79)
Southwest <sub>0.9x</sub>	0.77	Х	29.	57	X	10	04.39			0.55	X		0.65		=	764.75	(79)
Southwest <sub>0.9x</sub>	0.77	х	14.	91	X	9	2.85			0.55	X		0.65		=	342.99	(79)
Southwest <sub>0.9x</sub>	0.77	X	29.	57	X	9	2.85	]		0.55	X		0.65		=	680.22	(79)
Southwest <sub>0.9x</sub>	0.77	х	14.	91	X	6	9.27			0.55	X		0.65		=	255.87	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	X	6	9.27			0.55	×		0.65		=	507.45	(79)
Southwest <sub>0.9x</sub>	0.77	x	14.	91	X	4	4.07			0.55	×		0.65		=	162.79	(79)
Southwest <sub>0.9x</sub>	0.77	х	29.	57	X	4	4.07			0.55	X		0.65		=	322.86	(79)
Southwest <sub>0.9x</sub>	0.77	х	14.	91	X	3	1.49			0.55	X		0.65		=	116.31	(79)
Southwest <sub>0.9x</sub>	0.77	x	29.	57	X	3	1.49			0.55	X		0.65		=	230.68	(79)
Solar gains in v	vatts, ca	lculated	for eacl	n month	<u> </u>			(83)m	ı = Su	m(74)m .	(82)ı	n				•	
(83)m= 482.19		1226.37		1932.67			1874.79	1644	4.26	1366.1	954.	19	582.19	409.	65		(83)
Total gains – in			<u> </u>		<del>-</del>	<del></del>			_							1	45.00
(84)m= 1177.89	1540.23	1897.55	2267.45	2528.14	25	504.86	2392.6	2168	3.85	1910.23	1553	.85	1224.47	1085	.51		(84)
7. Mean intern	al tempe	erature	(heating	seasor	า)												
Temperature of	during he	eating p	eriods ir	the liv	ing	area f	rom Tab	ole 9,	, Th1	(°C)						21	(85)
Utilisation fact					Ť								<del></del>			1	
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	0	ct	Nov	De	ЭС		



(86)m=	1	1	0.99	0.98	0.94	0.87	0.77	0.82	0.94	0.99	1	1		(86)
Mear	interna	l temper	ature in	living are	ea T1 (fc	ollow ste	ps 3 to 7	' in Tabl	e 9c)	•				
(87)m=	18.18	18.42	18.85	19.48	20.05	20.55	20.8	20.75	20.33	19.59	18.83	18.22		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19	19.02	19.03	19.1	19.11	19.17	19.17	19.18	19.15	19.11	19.09	19.06		(88)
Utilis	ation fac	tor for a	ains for	rest of d	wellina. I	n2.m (se	ee Table	9a)		•	•	•		
(89)m=	1	0.99	0.99	0.97	0.91	0.76	0.55	0.62	0.88	0.98	1	1		(89)
Mear	interna	l temper	ature in	the rest	of dwelli	na T2 (fa	ollow ste	ens 3 to	7 in Tabl	le 9c)				
(90)m=	15.43	15.79	16.42	17.36	18.18	18.87	19.11	19.08	18.6	17.54	16.42	15.51		(90)
		<u> </u>	<u> </u>	<u> </u>			<u> </u>	<u> </u>	<u>!</u>	L fLA = Livin	g area ÷ (4	4) =	0.17	(91)
Mear	interna	l temner	ature (fo	or the wh	ole dwel	ling) – fl	ΙΔ <b>ν</b> Τ1	⊥ (1 _ fl	Δ) <b>v</b> T2					
(92)m=	15.9	16.24	16.83	17.72	18.5	19.15	19.39	19.37	18.89	17.89	16.83	15.97		(92)
	∟—— ⁄ adjustn	nent to t	he mear	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate	<u> </u>			
(93)m=	15.75	16.09	16.68	17.57	18.35	19	19.24	19.22	18.74	17.74	16.68	15.82		(93)
8. Sp	ace hea	ting requ	uirement											
						ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the u			,	using Ta				A .	0	0.1	N.	D .		
l Itilie	Jan	Feb tor for g	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	1	0.99	0.98	0.95	0.88	0.75	0.56	0.62	0.86	0.97	0.99	1		(94)
				4)m x (84		00	5.00	0.02	0.00	0.0.	0.00			, ,
	1172.16		1855.2	2150.6	2231.78	1880.53	1337.02	1355.18	1642.19	1502.01	1214.15	1081.55		(95)
Mont	hly aver	age exte	rnal tem	perature	from Ta	able 8						<u>I</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	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]			•	
(97)m=	7262.16	7028.81	6334.62	5152.57	3914.57	2486.55	1492.67	1577.77	2663.93	4204.22	5742.14	7095.58		(97)
-		<del></del>	<del> </del>	r each m								ı	l	
(98)m=	4530.96	3699.05	3332.69	2161.42	1251.99	0	0	0	0		3260.15	l.		<b>—</b>
								Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	24721.15	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								98.53	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
-	e heatir	_	. •		, .							i		<b>—</b>
				econdar		mentary	•						0	(201)
				nain syst	. ,			(202) = 1					1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Effici	ency of ı	main spa	ace heat	ing syste	em 1								91.9	(206)
Effici	ency of	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/y	/ear
Spac	e heatin	g require	ement (c	alculate	d above)								•	
	4530.96	3699.05	3332.69	2161.42	1251.99	0	0	0	0	2010.45	3260.15	4474.44		
(211)n	n = {[(98	)m x (20	4)] } x 1	00 ÷ (20	6)									(211)
	4930.31	4025.08	3626.43	2351.93	1362.34	0	0	0	0		3547.49			
								Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	<u>=</u>	26900.06	(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	ıl (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	F	0	(215)
Water heating						•		_
Output from water heater (calculated above)						1		
	79.22 173	3.06 188.61	187.87	227.56	237.89	254.02		7
Efficiency of water heater							81.8	(216)
(217)m= 91.29 91.24 91.14 90.87 90.26 8	81.8	1.8 81.8	81.8	90.76	91.13	91.29		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m								
` '	19.1 21	1.56 230.58	229.68	250.73	261.03	278.24		
	<u> </u>	Tota	ıl = Sum(2	19a) <sub>112</sub> =			2964.49	(219)
Annual totals				k۱	Nh/year		kWh/year	_
Space heating fuel used, main system 1							26900.06	
Water heating fuel used							2964.49	]
Electricity for pumps, fans and electric keep-hot						·		_
central heating pump:						30		(230c)
Total electricity for the above, kWh/year		sum	of (230a).	( <b>2</b> 30g) =			30	(231)
Electricity for lighting							656.8	(232)
12a. CO2 emissions – Individual heating systems	s includin	g micro-CHF						
	Energ kWh/y			Emiss kg CO2	<b>ion fac</b> 2/kWh	tor	<b>Emissions</b> kg CO2/yea	ır
Space heating (main system 1)		rear			2/kWh	tor =		nr ](261)
Space heating (main system 1) Space heating (secondary)	kWh/y	vear		kg CO2	2/kWh		kg CO2/yea	_
	kWh/y (211) x	vear «		kg CO2	2/kWh 6	=	kg CO2/yea	(261)
Space heating (secondary)	kWh/y (211) x (215) x (219) x	vear «	(264) =	0.21 0.51	2/kWh 6	= =	kg CO2/yea	(261) (263)
Space heating (secondary) Water heating	kWh/y (211) x (215) x (219) x	(262) + (263) + (	(264) =	0.21 0.51	2/kWh 6 19	= =	kg CO2/yea 5810.41 0 640.33	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/y (211) x (215) x (219) x (261) + (	(262) + (263) + (	(264) =	0.21 0.21	2/kWh 6 19	= =	kg CO2/yea 5810.41 0 640.33 6450.74	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/y (211) x (215) x (219) x (261) + ( (231) x	(262) + (263) + (	,	0.21 0.51	2/kWh 6 19 16	= = = = =	kg CO2/yea 5810.41 0 640.33 6450.74 15.57	(261) (263) (264) (265) (267)

El rating (section 14)

(274)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 16 - Existing Be Lean - 3B4P - MF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 270 (1a) x (2a) =885.6 (3a) 3.28 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)270 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =885.6 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)3 30 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.03 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.78 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.73 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjuste	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
[	0.92	0.91	0.89	0.8	0.78	0.69	0.69	0.67	0.73	0.78	0.82	0.85	]	
	ate effec chanica		•	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	3b) = (23a	) × Fmv (6	eguation (I	N5)) . othe	rwise (23b	o) = (23a)			0	(23a)
				iency in %						(===,			0	(23c)
			•	•	ŭ		`		,	2h)m + (:	23h) <b>x</b> [	1 – (23c)		(230)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
L	Dalance	d mecha	L anical ve	entilation	without	heat red	coverv (N	л ЛV) (24b	D)m = (2)	2b)m + (2	 23b)	ļ	J	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If v	whole h	ouse ex	tract ver	itilation c	r positiv	e input v	ventilatio	on from (	outside	<u>!</u>		Į.	ı	
•					-	-				.5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
				ole hous m = (22b						0.5]				
(24d)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86		(24d)
Effec	tive air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in bo	x (25)	•			•	
(25)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86		(25)
3 Hea	at losses	and he	eat loss r	paramete	ir.					_		_		_
ELEM		Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	<b>(</b> )	k-value kJ/m²-l		A X k kJ/K
Windov	vs Type		(111)			22.26	<u> </u>	/[1/( 1.8 )+		37.38	<u> </u>	10/111 -1		(27)
	vs Type					2.47		/[1/( 1.8 )+		4.15	Ħ			(27)
	vs Type					2.47		/[1/( 1.8 )+		4.15	Ħ			(27)
	vs Type					3.861		/[1/( 1.8 )+		6.48	片			(27)
	vs Type					7.356	╡ .			12.35	$\exists$			(27)
	vs Type					10.78	= .			18.1	=			(27)
	vs Type					4.904				8.23				(27)
Walls T		258.	53	54.1	$\neg$	204.4		0.35		71.55	=			(29)
Walls T	•	40.2		0	=	40.28		0.31		12.37			-	(29)
	rea of e					298.8	=	0.01		12.01				(31)
Party w			,			17.06	=	0	=	0	<b>—</b> [			(32)
Party fl						271.8							<b></b>	(32a)
Party c						271.8							<b></b>	(32b)
* for wind	dows and			ffective wil		alue calcul		g formula 1	1/[(1/U-valu	ue)+0.04] a	s given in	paragraph		(020)
			= S (A x		part	<del>-</del>		(26)(30	) + (32) =				174.7	6 (33)
	apacity (		•	•					((28).	(30) + (32	2) + (32a).	(32e) =	36922.	
			,	P = Cm ÷	- TFA) in	kJ/m²K			Indica	ative Value:	Medium		250	(35)
•	•		ere the de tailed calc		constructi	on are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Therma	al bridge	s : S (L	x Y) cal	culated u	using Ap	pendix l	<						44.82	(36)



	of therma	0 0	are not kn	own (36) =	= 0.05 x (3	11)			(33) ±	(36) =			240.50	(37)
	ation hea		alculated	l monthly	<b>V</b>				. ,		25)m x (5)	1	219.58	(37)
VOITHIC	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	271.01	266.16	261.41	239.08	234.9	215.46	215.46	211.86	222.95	234.9	243.35	252.19		(38)
, ,	ransfer o			<u> </u>		<u> </u>			<u> </u>	= (37) + (37)	<u> </u>			, ,
(39)m=	490.59	485.74	480.99	458.66	454.49	435.04	435.04	431.44	442.53	454.49	462.94	471.77		
(55)111=	430.33	400.74	400.00	430.00	404.40	400.04	100.04	401.44	l .		Sum(39) <sub>1</sub>		458.64	(39)
Heat lo	oss para	meter (H	HLP), W	/m²K						$= (39)m \div$		12712-	400.04	(,
(40)m=	1.82	1.8	1.78	1.7	1.68	1.61	1.61	1.6	1.64	1.68	1.71	1.75		
						•	•	•	•	Average =	Sum(40) <sub>1</sub>	12 /12=	1.7	(40)
Numbe	er of day	's in mor	nth (Tab	le 1a)									Ī	
	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 ener	rgy requi	irement:								kWh/ye	ear:	
٨٥٥٠١٣		nanay l	NI.										1	(40)
	ned occu A > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		.09		(42)
	A £ 13.9		6 /	. L. exp	( 0.0000	/	,, ,,,,,	/_/]	(					
								(25 x N)				7.66		(43)
	the annua e that 125	1				_	-	to achieve	a water us	se target o	t			
			_						Con	Oct	Nov	Daa		
Hot wat	Jan er usage ii	Feb	Mar day for ea	Apr	May $Vd m = fa$	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
	118.42	114.12	109.81	105.5	101.2	96.89	96.89	101.2	105.5	109.81	114.12	118.42		
(44)m=	110.42	114.12	109.61	105.5	101.2	90.09	96.69	101.2			m(44) <sub>112</sub> =		1291.89	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,i	m x nm x E	OTm / 3600			· /		1291.09	(++)
(45)m=	175.62	153.6	158.5	138.18	132.59	114.41	106.02	121.66	123.11	143.48	156.62	170.08		
(10)							1	1	l		m(45) <sub>112</sub> =	<u> </u>	1693.87	(45)
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46			( - /			`
(46)m=	26.34	23.04	23.77	20.73	19.89	17.16	15.9	18.25	18.47	21.52	23.49	25.51		(46)
Water	storage	loss:				•								
Storag	je volum	e (litres)	includir	ng any so	olar or W	WHRS	storage	within sa	ame ves	sel		305		(47)
	-	_			_		) litres in	, ,						
			hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
	storage nanufact		odarod I	oss fact	ar ie kna	wn (k\//	o/dov/):						1	(40)
,					JI IS KIIU	יייוו (אייו	i/uay).					.63		(48)
•	erature f							(40) (40)				.6		(49)
	y iost tro		storage	e, KVVN/ye	ear			(48) x (49)	) =		0.	.98		(50)
Energy	nanufact	urar's de	_	-	nee fact	ar is nat	KNOWN:							
b) If m	nanufact ater stora		eclared o	cylinder l								0		(51)
b) If m Hot wa	nanufact ater stora munity h	age loss	eclared of factor fr	cylinder l com Tabl								0		(51)
b) If m Hot wa	ater stora	age loss eating s	eclared of factor from the section of the section o	cylinder l com Tabl								0		(51) (52)
b) If m Hot wa If comi	ater stora munity h	age loss eating s from Tal	eclared of factor fr ee section ble 2a	cylinder l com Tabl on 4.3										, ,
b) If m Hot wa If comi Volum Tempe	ater stora munity h e factor	age loss eating s from Tal actor fro	eclared of factor fr ee section ble 2a m Table	cylinder l rom Tabl on 4.3	e 2 (kW				) x (52) x (	53) =		0		(52)



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 30.32 27.38 30.32 29.34 30.32 29.34 30.32 29.34 30.32 29.34 30.32 29.34 30.32	(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= 30.32 27.38 30.32 29.34 30.32 29.34 30.32 29.34 30.32 29.34 30.32 29.34 30.32	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 54.55 49.27 54.55 52.79 54.55 36.09 37.3 37.3 36.09 54.55 52.79 54.55	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 260.49 230.25 243.37 220.32 217.46 179.85 173.64 189.28 188.55 228.35 238.75 254.95	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 260.49 230.25 243.37 220.32 217.46 179.85 173.64 189.28 188.55 228.35 238.75 254.95	
Output from water heater (annual) <sub>112</sub> 2625.25	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 126.29 112.4 120.6 111.65 111.98 90.39 89.34 94.55 93.28 115.6 117.78 124.45	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 154.65 154.6	(66) (67)
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= 154.65 154.6	` /
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= 154.65 154.6	` /
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= 154.65 154.6	(67)
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= 154.65 154.6	(67)
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= 154.65 154.6	(67) (68)
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	(67) (68)
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	(67) (68) (69)
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= 154.65 154.6	(67) (68) (69)
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= 154.65 154.	(67) (68) (69) (70)
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	(67) (68) (69) (70)
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	(67) (68) (69) (70) (71)
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	(67) (68) (69) (70) (71)

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

6. Solar gains:



Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	X	3.86	x	11.28	x	0.55	x	0.65	] =	10.79	(75)
Northeast 0.9x	0.54	X	7.36	x	11.28	x	0.55	X	0.65	=	14.42	(75)
Northeast 0.9x	0.77	X	10.78	x	11.28	x	0.55	x	0.65	] =	30.14	(75)
Northeast 0.9x	0.54	X	4.9	x	11.28	x	0.55	x	0.65	=	9.61	(75)
Northeast 0.9x	0.77	X	3.86	x	22.97	x	0.55	x	0.65	] =	21.97	(75)
Northeast 0.9x	0.54	X	7.36	х	22.97	x	0.55	X	0.65	=	29.35	(75)
Northeast 0.9x	0.77	X	10.78	x	22.97	x	0.55	X	0.65	=	61.35	(75)
Northeast 0.9x	0.54	X	4.9	x	22.97	x	0.55	x	0.65	=	19.57	(75)
Northeast 0.9x	0.77	X	3.86	x	41.38	x	0.55	X	0.65	=	39.58	(75)
Northeast 0.9x	0.54	X	7.36	x	41.38	x	0.55	x	0.65	=	52.88	(75)
Northeast 0.9x	0.77	X	10.78	x	41.38	x	0.55	x	0.65	=	110.53	(75)
Northeast 0.9x	0.54	X	4.9	x	41.38	x	0.55	x	0.65	=	35.26	(75)
Northeast 0.9x	0.77	X	3.86	x	67.96	x	0.55	X	0.65	=	65	(75)
Northeast 0.9x	0.54	X	7.36	x	67.96	x	0.55	X	0.65	=	86.85	(75)
Northeast 0.9x	0.77	X	10.78	x	67.96	x	0.55	X	0.65	=	181.52	(75)
Northeast 0.9x	0.54	X	4.9	X	67.96	X	0.55	X	0.65	=	57.9	(75)
Northeast 0.9x	0.77	X	3.86	x	91.35	x	0.55	x	0.65	=	87.38	(75)
Northeast <sub>0.9x</sub>	0.54	X	7.36	х	91.35	<b>x</b>	0.55	x	0.65	=	116.75	(75)
Northeast <sub>0.9x</sub>	0.77	X	10.78	x	91.35	x	0,55	x	0.65	=	244	(75)
Northeast <sub>0.9x</sub>	0.54	X	4.9	x	91.35	Х	0.55	x	0.65	=	77.83	(75)
Northeast 0.9x	0.77	X	3.86	x	97.38	x	0.55	x	0.65	=	93.15	(75)
Northeast 0.9x	0.54	X	7.36	х	97.38	x	0.55	x	0.65	] =	124.46	(75)
Northeast 0.9x	0.77	X	10.78	x	97.38	x	0.55	X	0.65	] =	260.13	(75)
Northeast 0.9x	0.54	X	4.9	x	97.38	x	0.55	X	0.65	] =	82.98	(75)
Northeast 0.9x	0.77	X	3.86	x	91.1	x	0.55	X	0.65	=	87.14	(75)
Northeast 0.9x	0.54	X	7.36	x	91.1	x	0.55	X	0.65	=	116.43	(75)
Northeast 0.9x	0.77	X	10.78	x	91.1	x	0.55	X	0.65	=	243.35	(75)
Northeast 0.9x	0.54	X	4.9	X	91.1	x	0.55	X	0.65	=	77.62	(75)
Northeast 0.9x	0.77	X	3.86	x	72.63	x	0.55	X	0.65	=	69.47	(75)
Northeast 0.9x	0.54	X	7.36	x	72.63	x	0.55	X	0.65	=	92.82	(75)
Northeast 0.9x	0.77	X	10.78	x	72.63	x	0.55	X	0.65	=	194	(75)
Northeast 0.9x	0.54	X	4.9	x	72.63	x	0.55	X	0.65	=	61.88	(75)
Northeast 0.9x	0.77	X	3.86	X	50.42	x	0.55	X	0.65	=	48.23	(75)
Northeast 0.9x	0.54	X	7.36	X	50.42	X	0.55	X	0.65	] =	64.44	(75)
Northeast 0.9x	0.77	X	10.78	x	50.42	x	0.55	X	0.65	=	134.68	(75)
Northeast 0.9x	0.54	X	4.9	x	50.42	x	0.55	x	0.65	] =	42.96	(75)
Northeast 0.9x	0.77	X	3.86	x	28.07	x	0.55	x	0.65	=	26.85	(75)
Northeast 0.9x	0.54	X	7.36	x	28.07	x	0.55	X	0.65	=	35.87	(75)
Northeast 0.9x	0.77	X	10.78	x	28.07	x	0.55	x	0.65	=	74.97	(75)



Northeast <sub>0.9x</sub>	0.54	1 .	10	l v	20.07	1 ,	0.55	v	0.05	1 _	22.04	(75)
Northeast 0.9x	0.54	X I v	4.9	X	28.07	l x	0.55	X	0.65	] =   _	23.91	╡
Northeast 0.9x	0.77	X	3.86	X	14.2	X I v	0.55	X	0.65	=   _	13.58	(75) (75)
Northeast 0.9x	0.54	x x	7.36	x x	14.2	x x	0.55	x	0.65	=   =	18.14	」 <sup>(73)</sup>
Northeast 0.9x	0.77	] ]	4.9	^   x	14.2	] ]	0.55		0.65	! 1	37.92	](75)
Northeast 0.9x	0.54	X I v		^   x	14.2	x x	0.55	X	0.65	=   =	12.1	](75)
Northeast 0.9x	0.77	x x	7.36	^   x	9.21	] ^   x	0.55 0.55	X X	0.65	]	8.81 11.78	](75) ](75)
Northeast 0.9x	0.54	] ^ ] <sub>x</sub>	10.78	^   x	9.21	] ^   x	0.55	X	0.65	]	24.61	」(75) 【(75)
Northeast 0.9x	0.77	] ^ ] x	4.9	^   x	9.21	] ^   x	0.55	X	0.65	-   =	7.85	](75)
South 0.9x	0.77	] ^ ] x	2.47	l ^	46.75	] ^   x	0.55	X	0.65	]	28.61	](78)
South 0.9x	0.77	l ^	2.47	x	76.57	l ^ l x	0.55	X	0.65		46.85	](78)
South 0.9x	0.77	)	2.47	x	97.53	^   x	0.55	X	0.65	l   _	59.68	(78)
South 0.9x	0.77	l ^ l x	2.47	l x	110.23	] ^ ] <sub>X</sub>	0.55	X	0.65	!   _	67.46	](78)
South 0.9x	0.77	x	2.47	x	114.87	X	0.55	x	0.65	!   =	70.29	(78)
South 0.9x	0.77	x	2.47	l X	110.55	X	0.55	x	0.65	!   =	67.65	] (78)
South 0.9x	0.77	ı L	2.47	X	108.01	l X	0.55	x	0.65	!   =	66.1	] (78)
South 0.9x	0.77	X	2.47	x	104.89	X	0.55	x	0.65	   =	64.19	] (78)
South 0.9x	0.77	x	2.47	X	101.89	X	0.55	X	0.65	=	62.35	(78)
South 0.9x	0.77	x	2.47	х	82.59	х	0.55	x	0.65	=	50.54	(78)
South <sub>0.9x</sub>	0.77	x	2.47	х	55.42	x	0.55	x	0.65	=	33.91	(78)
South 0.9x	0.77	x	2.47	x	40.4	x	0.55	x	0.65	=	24.72	(78)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	36.79		0.55	x	0.65	=	202.91	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	62.67		0.55	x	0.65	i   =	345.64	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	х	85.75	j	0.55	x	0.65	=	472.91	(79)
Southwest <sub>0.9x</sub>	0.77	×	22.26	x	106.25	j	0.55	x	0.65	j =	585.96	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	119.01	j	0.55	x	0.65	j =	656.33	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	х	118.15	ĺ	0.55	x	0.65	=	651.58	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	х	113.91		0.55	x	0.65	=	628.19	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	104.39		0.55	x	0.65	=	575.7	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	92.85	]	0.55	x	0.65	=	512.07	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	69.27		0.55	X	0.65	=	382	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	44.07		0.55	X	0.65	=	243.04	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	31.49		0.55	X	0.65	=	173.65	(79)
West 0.9x	0.77	x	2.47	x	19.64	X	0.55	X	0.65	=	12.02	(80)
West 0.9x	0.77	x	2.47	x	38.42	X	0.55	X	0.65	=	23.51	(80)
West 0.9x	0.77	x	2.47	x	63.27	x	0.55	X	0.65	=	38.72	(80)
West 0.9x	0.77	x	2.47	x	92.28	x	0.55	X	0.65	=	56.47	(80)
West 0.9x	0.77	x	2.47	x	113.09	x	0.55	X	0.65	=	69.21	(80)
West 0.9x	0.77	x	2.47	x	115.77	x	0.55	X	0.65	=	70.84	(80)
West 0.9x	0.77	x	2.47	x	110.22	X	0.55	X	0.65	=	67.45	(80)
West 0.9x	0.77	X	2.47	X	94.68	X	0.55	X	0.65	=	57.94	(80)



West	0.9x	0.77		X	2.4	17	X	7	73.59	x		0.55	х	0.65	-	45.03	(80)
West	0.9x	0.77		X	2.4	17	X	4	5.59	x		0.55	_ x _	0.65	<del>-</del>	27.9	(80)
West	0.9x	0.77		X	2.4	17	X	2	24.49	х		0.55	x	0.65	_	14.99	(80)
West	0.9x	0.77		X	2.4	17	X	1	6.15	X		0.55	x	0.65	=	9.88	(80)
٦	ains in	watts, ca	alcula	ted	for eac	h month	_			(83)m	ı = Sı	um(74)m .	(82)m		ı	1	
(83)m=	308.51	548.24	809.5			1321.79	_	350.8	1286.29	111	16	909.76	622.04	373.68	261.31		(83)
Ŭ		nternal a		_	,	<u> </u>	· `								1	1	(5.4)
(84)m=	1023.68	1261.01	1499.	.28	1752.78	1932.92	19	905.81	1817.82	1654	1.44	1468.58	1237.76	1033.53	955.98		(84)
7. Me	an inter	nal temp	oeratu	ıre (	(heating	season	)										
Temp	erature	during h	neatin	g pe	eriods ir	n the livi	ng	area	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains f	or li	ving are	ea, h1,m	(s	ee Ta	ble 9a)							,	_
	Jan	Feb	Ma	ar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1		0.99	0.97		0.91	0.81	0.8	36	0.97	1	1	1		(86)
Mean	interna	l temper	ature	in l	iving are	ea T1 (fo	ollo	w ste	ps 3 to 7	' in T	able	e 9c)					
(87)m=	18.78	18.96	19.2	9	19.79	20.25	2	20.67	20.86	20.	82	20.48	19.89	19.3	18.81		(87)
Temp	erature	durina h	neatin	a ne	eriods ir	rest of	d۷.	velling	from Ta	ble 9	——. Э Th	n2 (°C)				•	
(88)m=	19.46	19.47	19.4	<del></del>	19.54	19.55		19.61	19.61	19.		19.58	19.55	19.53	19.51		(88)
l Itilioc	ation for	tor for a	aine f	or r	oct of d	wolling	h2	m (cc	ee Table	02)							
(89)m=	1	1	1	OI I	0.99	0.95	_	0.84	0.65	9a) 0.7	72	0.94	0.99	1	1	1	(89)
							-				$\forall$						()
(90)m=	16.54	16.82	ature 17.3	-	18.08	of dwell	Ť	1 12 (fo 19.34	ollow ste	ps 3	$\overline{}$	19.09	e 9c)	17.35	16.63	1	(90)
(90)11=	10.54	10.02	17.3	'	10.00	10.73		19.54	19.54	19.	JZ			g area ÷ (4		0.16	(91)
														g aroa . (	., –	0.16	(31)
		<del></del>				i	_	<u> </u>	LA × T1	<del>`</del>						1	(00)
(92)m=	16.9	17.16	17.6		18.35	18.99	_	19.55	19.75	19.		19.31	18.5	17.66	16.97		(92)
(93)m=	16.75	17.01	ne me		18.2	18.84	_	19.4	m Table	4 <b>e</b> , 19.		re appro	18.35	17.51	16.82	1	(93)
` '		ting requ			10.2	10.04		19.4	19.0	19.	36	19.10	10.33	17.51	10.02		(50)
		· ·			nperatui	re obtair	ec	d at ste	ep 11 of	Tabl	e 9h	so tha	t Ti m=(	76)m an	d re-calc	culate	
		factor fo						a at ot	op 11 01	· ab.		, 00 1110		, o, a	a ro oare	Jaiato	
	Jan	Feb	Ma	ar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains,	hm:	:	•	_								•	1	
(94)m=	1	1	0.99		0.98	0.94		0.83	0.65	0.7	72	0.92	0.99	1	1		(94)
		hmGm	<del>.</del>		, ,		_								1	1	<b>4</b> 1
` ′		1256.96				1810.36	_	580.37	1178.51	1183	3.27	1352.85	1221.72	1030.8	954.97		(95)
		age exte		<del></del> i					40.0	46	4 1	444	40.0	7.4	4.0	1	(06)
(96)m=	4.3	4.9	6.5		8.9	11.7		14.6	16.6	16		14.1	10.6	7.1	4.2	J	(96)
1		5880.99		_	4266.27		_	1 , VV = 2087	=[(39)m :   <sub>1306 23</sub>	— <u> </u>	_	2239.86	ī —	4817.35	5955.11	1	(97)
` '		L				L	_		th = 0.02						0000.11	J	(=-)
		3107.35		_			_	0	0.02	0	Ó	0	<u> </u>	2726.32	3720.1	]	
` '						<u> </u>	_		l		Tota	per year		r) = Sum(9	<u> </u>	20770.14	(98)
Snace	a heatin	g require	ement	t in	k\/\/h/m²	2/vear						· •	•	•	•	76.93	(99)
Space	o moduli	g roquiit			1 X V V I I/ I I I	, y cai										10.33	(00)



9a. Energy requirements – Individual heating syst	ems <u>includina</u>	micro-CHP)					
Space heating:							
Fraction of space heat from secondary/supplement	entary 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						91.9	(206)
Efficiency of secondary/supplementary heating s	ystem, %					0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug Se	p Oct	Nov	Dec	kWh/y	ear
Space heating requirement (calculated above)				1		1	
3782.57 3107.35 2820.27 1837.17 1066.37	0 0	0 0	1709.98	2726.32	3720.1		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$			1,000.7	0000 00	40.47.00	Ī	(211)
4115.97 3381.23 3068.85 1999.1 1160.36	0 0	0 0 0	1860.7 (year) =Sum(2		4047.99	00000 0	(244)
Charachapting final (accordant) IAN/h/month		Total (KVVII)	year) =3um(2	2 1 7 <sub>15,1012</sub>	F	22600.8	(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/	year) =Sum(2	215) <sub>15,1012</sub>	F	0	(215)
Water heating							
Output from water heater (calculated above)	70.05 470.04	100.00		200 75	054.05		
260.49 230.25 243.37 220.32 217.46 11 Efficiency of water heater	79.85 173.64	189.28 188.5	55 228.35	238.75	254.95	81.8	(216)
	81.8 81.8	81.8 81.8	90.58	91	91.18	01.0	(217)
Fuel for water heating, kWh/month	01.0	01.0	30.30	31	31.10		(=,
$(219)$ m = $(64)$ m x $100 \div (217)$ m					ı		
(219)m= 285.7 252.68 267.42 242.9 241.58 2	19.86 212.27	231.39 230.		262.38	279.62		_
		lotal = Sun	n(219a) <sub>112</sub> =			2978.39	(219)
Annual totals Space heating fuel used, main system 1			K	Wh/year		kWh/yea 22600.8	ar
Water heating fuel used						2978.39	=
ŭ						2910.39	
Electricity for pumps, fans and electric keep-hot						Ī	
central heating pump:					30		(230c)
Total electricity for the above, kWh/year		sum of (230	)a)(230g) =			30	(231)
Electricity for lighting						698.38	(232)
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP					
	Energy		Emiss	ion fac	tor	Emission	S
	kWh/year		kg CO	2/kWh		kg CO2/ye	ear
Space heating (main system 1)	(211) x		0.2	16	=	4881.77	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2		=	643.33	(264)
Space and water heating		+ (263) + (264) =		.~			= ' '
Electricity for pumps, fans and electric keep-hot	(231) + (202)	. (200) 1 (201) -			=	5525.11	(265)
			0.5			15.57	



(232) x Electricity for lighting (268)0.519 362.46 sum of (265)...(271) = Total CO2, kg/year (272) 5903.13 **Dwelling CO2 Emission Rate**  $(272) \div (4) =$ (273) 21.86 El rating (section 14) (274) 75



User Details:	
Assessor Name: Stroma Number:	
Software Name: Stroma FSAP 2012 Software Version: Version	n: 1.0.4.23
Property Address: Flat 24Existing Be Lean - 3B4P -	TF
Address: Branch Hill House, Branch Hill, LONDON, NW3 7LS	
1. Overall dwelling dimensions:	
Area(m²) Av. Height(m)	Volume(m³)
Ground floor	632.04 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 229 (4)	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = $	632.04 (5)
2. Ventilation rate:	
main secondary other total heating heating	m³ per hour
Number of chimneys $0 + 0 = 0 \times 40 =$	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$	0 (6b)
Number of intermittent fans 4 x 10 =	40 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Air obe	anged nor hour
	anges per hour
Infiltration due to chirmneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 40 $\div$ (5) =	0.06 (8)
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after	
deducting areas of openings); if equal user 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	2 (42)
If no draught lobby, enter 0.05, else enter 0	0 (12)
Percentage of windows and doors draught stripped	0 (13)
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	15 (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$	0.81 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	1, 7
Number of sides sheltered	1 (19)
Shelter factor $(20) = 1 - [0.075 \times (19)] =$	0.92 (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	0.75 (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	
(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	



'alaulata offor	0.94 0.9	0.83	0.81	0.71	0.71	0.7	0.75	0.81	0.85	0.88		
	ctive air chan	-	the appli	cable ca	se	<u>!</u>	!	<u>!</u>				
	al ventilation:		201 ) (00	/			. (00)	\ (00 \			0	(2
	eat pump using							)) = (23a)			0	(2
	heat recovery:										0	(2
	d mechanica	1	1	1	<del>- ` `                                 </del>	<del>, ``</del>	ŕ	<del> </del>	<del></del>	<del>````</del>	) ÷ 100] 7	(*
4a)m= 0	0 0		0	0	0	0	0	0	0	0	]	(2
b) if balance	ed mechanica		without	neat red	overy (r	$\frac{\text{MV}}{1}$	$\int_{0}^{\infty} \int_{0}^{\infty} dt = (22)$	2b)m + (2 0	23b) 0	0	1	(1
									0	0		(
•	ouse extract n < 0.5 × (23		•	•				5 × (23h	)			
4c)m= 0	0 0	<del></del>	0	0	0	0	0	0	0	0	1	(
	ventilation or	whole hou	se positi	ve input	L ventilatio	on from I	l					
,	n = 1, then (2)							0.5]				
4d)m= 0.96	0.94 0.9	0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89		(
Effective air	change rate	- enter (24a	a) or (24l	o) or (24	c) or (24	d) in box	x (25)				_	
5)m= 0.96	0.94 0.9	0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89		(
. Heat losse	s and heat lo	ss paramet	er:								_	-
LEMENT	Gross	Openir		Net Ar	ea	U-val	ue	AXU		k-valu	e	ΑΧk
	area (m²)	r	∩ <sup>2</sup>	A ,r		W/m2		(VV/ł	<)	kJ/m²•	K	kJ/K
indows Type	e 1			5.71	<sub>x</sub> 1	/[1/( 1.8 )+	0.04] =	9.59				(
indows Type	2			1.13	x1	/[1/( 1.8 )+	0.04] =	1.9				(
indows Type	9.3			7.2	x1	/[1/( 1.8 )+	0.04] =	12.09				(
indows Type	e 4			3.08	х1	/[1/( 1.8 )+	0.04] =	5.17				(
indows Type	5			3.29	x1	/[1/( 1.8 )+	0.04] =	5.52				(
indows Type	6			2.67	x1	/[1/( 1.8 )+	0.04] =	4.48				(
indows Type	<del>2</del> 7			8.172	<u>x</u> 1	/[1/( 1.8 )+	0.04] =	13.72				(
alls Type1	220.77	31.2	25	189.5	2 x	0.35	=	66.33				(
/alls Type2	31.6	0		31.6	X	0.31	=	9.7				(
	222.14	0		222.1	4 X	0.16	<u> </u>	35.54			$\neg$	(
oof	1											
oof otal area of e	lements, m²			474.5	1							(
	lements, m <sup>2</sup>			474.5 14.63	=	0	=	0	<b>—</b>			(
otal area of e	lements, m²				x	0	=	0				
otal area of e arty wall arty floor or windows and	lements, m <sup>2</sup> roof windows, us on both sides			14.63 222.1	3 ×				s given ir	n paragrapi	h 3.2	
otal area of e arty wall arty floor or windows and include the area	roof windows, u	of internal wa		14.63 222.1	3 ×				s given ir	n paragrapi	h 3.2	
otal area of e arty wall arty floor or windows and include the area abric heat los	roof windows, ι as on both sides	of internal wa A x U)		14.63 222.1	3 ×	g formula 1	/[(1/U-valu ) + (32) =					05 (



		0 0	are not kn	own (36) =	= 0.05 x (3	1)								_
	abric he								, ,	(36) =			235.23	(37)
Ventila			alculated		, 	Ι.	Ι	Γ.	· ,	= 0.33 × (	1	<u> </u>	1	
(00)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(38)
(38)m=	200.23	196.51	192.85	175.7	172.49	157.55	157.55	154.79	163.31	172.49	178.98	185.77		(36)
Heat tr	ansfer o		_							= (37) + (37)	38)m	1	1	
(39)m=	435.46	431.73	428.08	410.93	407.72	392.78	392.78	390.01	398.54	407.72	414.21	421		_
Heat lo	oss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	` '	12 /12=	410.91	(39)
(40)m=	1.9	1.89	1.87	1.79	1.78	1.72	1.72	1.7	1.74	1.78	1.81	1.84		
		_					•	•		Average =	Sum(40) <sub>1</sub>	12 /12=	1.79	(40)
Numbe			nth (Tab	le 1a)	<b>-</b>		1	<u> </u>				1	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ļ	(44)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ener	rgy requi	irement:								kWh/y	ear:	
Assum	ned occu	pancy. I	N								3	.04	1	(42)
if TF	A > 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.		.01	J	(/
	A £ 13.9							(05. 11)	00				1	
								(25 x N) to achieve		se target o		6.39		(43)
		1	person per			_	-							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	117.03	112.77	108.52	104.26	100.01	95.75	95.75	100.01	104.26	108.52	112.77	117.03		
Energy	content of	hot water	used - cal	culated m	onthly = $4$ .	190 x Vd.i	m x nm x E	OTm / 3600		Total = Su oth (see Ta	` '		1276.69	(44)
(45)m=	173.55	151.79	156.63	136.56	131.03	113.07	104.77	120.23	121.67	141.79	154.78	168.08	1	
(10)			.00.00			1.10.07	1	1 .20.20		Total = Su		l	1673.95	(45)
If instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46			( - /			
(46)m=	26.03	22.77	23.5	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21	]	(46)
	storage						!	•				!	•	
Ū		` ,					Ū	within sa	ame ves	sel		305		(47)
	•	_	ind no ta		_			, ,	\+	(O! : /	47\			
	vise if no storage		not wate	er (this ir	iciudes i	nstantar	neous co	ombi boil	ers) ente	er o in (	47)			
	_		eclared l	oss facto	or is kno	wn (kWł	n/dav):				1.	.63	1	(48)
,			m Table			•	,,					1.6	]	(49)
•			storage		ear			(48) x (49)	) =			.98	] ]	(50)
٠.			eclared o	-		or is not	known:	. , ( -,					J	(50)
		_	factor fr		e 2 (kW	h/litre/da	ay)					0		(51)
	-	_	ee secti	on 4.3									1	/ <b>-</b> ->
	e factor		ble 2a m Table	2h								0		(52)
					oor			(A7\ \ /F4	۱ × (۵۵) ··· (	E2)		0	] 1	(53)
٠.	/ iost fro (50) or (		storage	, KVVN/Y6	zai			(47) x (51)	) X (5∠) X (	53) =		0	-	(54) (55)
LIILEI	(30) 01 (	54) III (C	)))								0.	.98	J	(55)



Water storage loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
(56)m= 30.32 27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(56)
If cylinder contains dedicated	d solar sto	rage, (57)r	n = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 30.32 27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32		(57)
Primary circuit loss (an	nual) fro	m Table	3							0		(58)
Primary circuit loss cal	culated f	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by factor fr	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 54.55 49.27	54.55	52.79	54.55	36.09	37.3	37.3	36.09	54.55	52.79	54.55		(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	0		(61)
Total heat required for	water he	eating ca	alculated	for each	n month	(62)m =	0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 258.42 228.45	241.51	218.69	215.9	178.5	172.39	187.85	187.1	226.66	236.91	252.95		(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 V	VWHRS	applies	, see Ap	pendix (	3)	_	_	_		
(63)m = 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water hea	ter											
(64)m= 258.42 228.45	241.51	218.69	215.9	178.5	172.39	187.85	187.1	226.66	236.91	252.95		_
						Outp	out from wa	ater heate	r (annual) <sub>1</sub>	12	2605.33	(64)
Heat gains from water	heating,	kWh/mo	onth 0.25	[0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m	]	
(65)m= 125.6 111.8	119.98	111.11	111.46	89.94	88.93	94.07	92.8	115.04	117.17	123.78		(65)
in <mark>clude</mark> (57)m in cald	culation of	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	<mark>mu</mark> nity h	eating	
include (57)m in calc 5. Internal gains (see				ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gains (see	Table 5	and 5a)		ylinder is	s in the d	dwelling	or hot w	ater is fr	om com	munity h	eating	
	Table 5	and 5a)		ylinder is Jun	s in the d	dwelling Aug	or hot w	ater is fr	om com	munity h	eating	
5. Internal gains (see Metabolic gains (Table	Table 5	and 5a)	:								eating	(66)
5. Internal gains (see Metabolic gains (Table Jan Feb	Table 5 5), Wat Mar 151.98	and 5a) ts Apr 151.98	May 151.98	Jun 151.98	Jul 151.98	Aug 151.98	Sep 151.98	Oct	Nov	Dec	eating	(66)
5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 151.98 151.98	Table 5 5), Wat Mar 151.98	and 5a) ts Apr 151.98	May 151.98	Jun 151.98	Jul 151.98	Aug 151.98	Sep 151.98	Oct	Nov	Dec	eating	(66)
5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11	Table 5 5), Wat Mar 151.98 ted in Ap	ts Apr 151.98 ppendix l 21.62	May 151.98 _, equati	Jun 151.98 on L9 or 13.64	Jul 151.98 r L9a), a 14.74	Aug 151.98 Iso see	Sep 151.98 Table 5 25.72	Oct 151.98	Nov 151.98	Dec 151.98	eating	, ,
5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular	Table 5 5), Wat Mar 151.98 ted in Ap	ts Apr 151.98 ppendix l 21.62	May 151.98 _, equati	Jun 151.98 on L9 or 13.64	Jul 151.98 r L9a), a 14.74	Aug 151.98 Iso see	Sep 151.98 Table 5 25.72	Oct 151.98	Nov 151.98	Dec 151.98	eating	, ,
5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96	Table 5 5), Wat Mar 151.98 ted in Ap 28.55 ulated in 391.56	Apr 151.98 ppendix 1 21.62 Append 369.41	May 151.98 -, equati 16.16 dix L, equ	Jun 151.98 fon L9 or 13.64 uation L	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63	Aug 151.98 Iso see 19.16 3a), also	Sep 151.98 Table 5 25.72 see Ta 303.9	Oct 151.98 32.66 ble 5 326.05	Nov 151.98	Dec 151.98	eating	(67)
5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calculated)  (67)m= 39.53 35.11  Appliances gains (calculated)	Table 5 5), Wat Mar 151.98 ted in Ap 28.55 ulated in 391.56	Apr 151.98 ppendix 1 21.62 Append 369.41	May 151.98 -, equati 16.16 dix L, equ	Jun 151.98 fon L9 or 13.64 uation L	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63	Aug 151.98 Iso see 19.16 3a), also	Sep 151.98 Table 5 25.72 see Ta 303.9	Oct 151.98 32.66 ble 5 326.05	Nov 151.98	Dec 151.98	eating	(67)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2	Mar 151.98 ted in Ap 28.55 ulated in 391.56 tted in Ap 38.2	Apr 151.98 opendix 1 21.62 Appendix 369.41 opendix 38.2	May 151.98 _, equati 16.16 dix L, equ 341.46 L, equat	Jun 151.98 on L9 or 13.64 uation L 315.18 ion L15	Jul 151.98 r L9a), a 14.74 13 or L1 297.63 or L15a)	Aug 151.98 Iso see 19.16 3a), also 293.5	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table	Oct 151.98 32.66 ble 5 326.05 5	Nov 151.98 38.11	Dec 151.98 40.63	eating	(67) (68)
5. Internal gains (see  Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular  (67)m= 39.53 35.11  Appliances gains (calcular  (68)m= 397.84 401.96  Cooking gains (calcular	Mar 151.98 ted in Ap 28.55 ulated in 391.56 tted in Ap 38.2	Apr 151.98 opendix 1 21.62 Appendix 369.41 opendix 38.2	May 151.98 _, equati 16.16 dix L, equ 341.46 L, equat	Jun 151.98 on L9 or 13.64 uation L 315.18 ion L15	Jul 151.98 r L9a), a 14.74 13 or L1 297.63 or L15a)	Aug 151.98 Iso see 19.16 3a), also 293.5	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table	Oct 151.98 32.66 ble 5 326.05 5	Nov 151.98 38.11	Dec 151.98 40.63	eating	(67) (68)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains (70)m= 3 3	Table 5 Mar 151.98 ted in Ap 28.55 ulated in 391.56 ted in Ap 38.2 (Table 5	Apr 151.98 ppendix I 21.62 Appendix 369.41 ppendix 38.2 5a)	May 151.98 -, equati 16.16 dix L, equ 341.46 L, equat 38.2	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2	Aug 151.98 Iso see 19.16 3a), also 293.5 ), also se 38.2	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2	Oct 151.98 32.66 ble 5 326.05 5 38.2	Nov 151.98 38.11 354.01	Dec 151.98 40.63 380.28	eating	(67) (68) (69)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains	Table 5 Mar 151.98 ted in Ap 28.55 ulated in Ap 391.56 ted in Ap 38.2 (Table 5	Apr 151.98 opendix I 21.62 Appendix I 369.41 opendix 38.2 5a) 3	May 151.98 -, equati 16.16 dix L, equ 341.46 L, equat 38.2	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2	Aug 151.98 Iso see 19.16 3a), also 293.5 ), also se 38.2	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2	Oct 151.98 32.66 ble 5 326.05 5 38.2	Nov 151.98 38.11 354.01	Dec 151.98 40.63 380.28 38.2	eating	(67) (68) (69)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation (71)m= -121.59 -121.59	Table 5 Mar 151.98 ted in Ap 28.55 ulated in 391.56 tted in Ap 38.2 (Table 5	Apr 151.98 opendix I 21.62 Appendix I 369.41 opendix 38.2 5a) 3	May 151.98 -, equati 16.16 dix L, equ 341.46 L, equat 38.2	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2	Aug 151.98 Iso see 19.16 3a), also 293.5 , also se 38.2	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2	Oct 151.98 32.66 ble 5 326.05 5 38.2	Nov 151.98 38.11 354.01 38.2	Dec 151.98 40.63 380.28 38.2	eating	(67) (68) (69) (70)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation (71)m= -121.59 -121.59  Water heating gains (T	Table 5 Mar 151.98 ted in Ap 28.55 ulated in 391.56 tted in Ap 38.2 (Table 5	Apr 151.98 opendix I 21.62 Appendix I 369.41 opendix 38.2 5a) 3	May 151.98 -, equati 16.16 dix L, equ 341.46 L, equat 38.2	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2	Aug 151.98 Iso see 19.16 3a), also 293.5 , also se 38.2	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2	Oct 151.98 32.66 ble 5 326.05 5 38.2	Nov 151.98 38.11 354.01 38.2	Dec 151.98 40.63 380.28 38.2	eating	(67) (68) (69) (70)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation (71)m= -121.59 -121.59  Water heating gains (T (72)m= 168.82 166.36	Table 5  151.98 ted in Ap 28.55 ulated in Ap 391.56 ted in Ap 38.2 (Table 5 3 on (negated of the context) 161.26	Apr 151.98 opendix I 21.62 Appendix 369.41 opendix 38.2 5a) 3 tive value	May 151.98 -, equati 16.16 dix L, equat 341.46 L, equat 38.2 3 es) (Tab	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2 3 le 5) -121.59	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2	Aug 151.98 Iso see 19.16 3a), also 293.5 , also se 38.2 3	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2 3	Oct 151.98  32.66 ble 5 326.05 5 38.2  -121.59	Nov 151.98 38.11 354.01 38.2 3	Dec 151.98 40.63 380.28 38.2 166.37	eating	(67) (68) (69) (70) (71)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation (71)m= -121.59 -121.59  Water heating gains (T (72)m= 168.82 166.36  Total internal gains =	Table 5  5), Wat Mar  151.98  ted in Ap  28.55  ulated in 391.56  ited in Ap  38.2  (Table 5  3  on (negate of the companion	Apr 151.98 opendix l 21.62 Appendix 369.41 opendix 38.2 5a) 3 tive value -121.59	May 151.98 -, equati 16.16 dix L, equ 341.46 L, equat 38.2 3 es) (Tab -121.59	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2 3 le 5) -121.59	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2 3 -121.59	Aug 151.98 Iso see 19.16 3a), also 293.5 ), also se 38.2 3	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2 3 -121.59	Oct 151.98 32.66 ble 5 326.05 5 38.2 3 -121.59 154.63 (70)m + (7	Nov 151.98 38.11 354.01 38.2 3 -121.59 162.74 1)m + (72)	Dec 151.98 40.63 380.28 38.2 166.37	eating	(67) (68) (69) (70) (71)
Metabolic gains (Table  Jan Feb  (66)m= 151.98 151.98  Lighting gains (calcular (67)m= 39.53 35.11  Appliances gains (calcular (68)m= 397.84 401.96  Cooking gains (calcular (69)m= 38.2 38.2  Pumps and fans gains (70)m= 3 3  Losses e.g. evaporation (71)m= -121.59 -121.59  Water heating gains (T (72)m= 168.82 166.36	Table 5  151.98 ted in Ap 28.55 ulated in Ap 391.56 ted in Ap 38.2 (Table 5 3 on (negated of the context) 161.26	Apr 151.98 opendix I 21.62 Appendix 369.41 opendix 38.2 5a) 3 tive value	May 151.98 -, equati 16.16 dix L, equat 341.46 L, equat 38.2 3 es) (Tab	Jun 151.98 fon L9 or 13.64 uation L 315.18 ion L15 38.2 3 le 5) -121.59	Jul 151.98 r L9a), a 14.74 13 or L1: 297.63 or L15a) 38.2	Aug 151.98 Iso see 19.16 3a), also 293.5 , also se 38.2 3	Sep 151.98 Table 5 25.72 see Ta 303.9 ee Table 38.2 3	Oct 151.98  32.66 ble 5 326.05 5 38.2  -121.59	Nov 151.98 38.11 354.01 38.2 3	Dec 151.98 40.63 380.28 38.2 166.37	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)	
Northeast 0.9x	0.77	X	3.08	x	11.28	x	0.55	x	0.65	] =	8.61	(75)
Northeast 0.9x	0.54	X	3.29	x	11.28	x	0.55	X	0.65	=	6.45	(75)
Northeast 0.9x	0.77	X	2.67	x	11.28	x	0.55	x	0.65	] =	7.46	(75)
Northeast 0.9x	0.54	X	8.17	x	11.28	x	0.55	x	0.65	] =	16.02	(75)
Northeast 0.9x	0.77	X	3.08	x	22.97	x	0.55	x	0.65	] =	17.53	(75)
Northeast 0.9x	0.54	X	3.29	х	22.97	x	0.55	X	0.65	=	13.13	(75)
Northeast 0.9x	0.77	X	2.67	х	22.97	x	0.55	X	0.65	=	15.19	(75)
Northeast 0.9x	0.54	X	8.17	x	22.97	x	0.55	X	0.65	=	32.61	(75)
Northeast 0.9x	0.77	X	3.08	х	41.38	x	0.55	X	0.65	=	31.57	(75)
Northeast 0.9x	0.54	X	3.29	x	41.38	x	0.55	X	0.65	=	23.65	(75)
Northeast 0.9x	0.77	X	2.67	x	41.38	x	0.55	x	0.65	=	27.37	(75)
Northeast 0.9x	0.54	X	8.17	x	41.38	x	0.55	x	0.65	=	58.75	(75)
Northeast 0.9x	0.77	X	3.08	x	67.96	x	0.55	X	0.65	=	51.85	(75)
Northeast 0.9x	0.54	X	3.29	x	67.96	x	0.55	x	0.65	=	38.84	(75)
Northeast 0.9x	0.77	X	2.67	x	67.96	x	0.55	X	0.65	=	44.95	(75)
Northeast 0.9x	0.54	X	8.17	X	67.96	X	0.55	X	0.65	=	96.49	(75)
Northeast 0.9x	0.77	X	3.08	x	91.35	x	0.55	x	0.65	=	69.7	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.29	х	91.35	<b>x</b>	0.55	x	0.65	=	52.22	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	x	91.35	x	0.55	x	0.65	=	60.42	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	x	91.35	Х	0.55	x	0.65	=	129.7	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	x	97.38	x	0.55	x	0.65	=	74.31	(75)
Northeast 0.9x	0.54	X	3.29	х	97.38	x	0.55	x	0.65	=	55.67	(75)
Northeast 0.9x	0.77	X	2.67	x	97.38	x	0.55	X	0.65	=	64.42	(75)
Northeast 0.9x	0.54	X	8.17	x	97.38	x	0.55	X	0.65	] =	138.27	(75)
Northeast 0.9x	0.77	X	3.08	X	91.1	x	0.55	X	0.65	=	69.52	(75)
Northeast 0.9x	0.54	X	3.29	x	91.1	x	0.55	X	0.65	=	52.08	(75)
Northeast 0.9x	0.77	X	2.67	x	91.1	x	0.55	X	0.65	=	60.26	(75)
Northeast 0.9x	0.54	X	8.17	X	91.1	x	0.55	X	0.65	=	129.35	(75)
Northeast 0.9x	0.77	X	3.08	X	72.63	x	0.55	X	0.65	=	55.42	(75)
Northeast 0.9x	0.54	X	3.29	X	72.63	x	0.55	X	0.65	=	41.52	(75)
Northeast 0.9x	0.77	X	2.67	x	72.63	x	0.55	X	0.65	=	48.04	(75)
Northeast 0.9x	0.54	X	8.17	x	72.63	x	0.55	X	0.65	=	103.12	(75)
Northeast 0.9x	0.77	X	3.08	X	50.42	x	0.55	X	0.65	=	38.47	(75)
Northeast 0.9x	0.54	X	3.29	X	50.42	X	0.55	X	0.65	=	28.82	(75)
Northeast 0.9x	0.77	X	2.67	x	50.42	x	0.55	X	0.65	=	33.35	(75)
Northeast 0.9x	0.54	X	8.17	x	50.42	x	0.55	x	0.65	=	71.59	(75)
Northeast 0.9x	0.77	X	3.08	x	28.07	x	0.55	x	0.65	=	21.42	(75)
Northeast 0.9x	0.54	X	3.29	x	28.07	x	0.55	X	0.65	=	16.04	(75)
Northeast 0.9x	0.77	X	2.67	x	28.07	x	0.55	x	0.65	] =	18.57	(75)



Northeast <sub>0.9x</sub>	0.54	X	8.17	X	28.07	X	0.55	X	0.65	=	39.85	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	x	14.2	x	0.55	x	0.65	] =	10.83	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.29	X	14.2	X	0.55	X	0.65	=	8.12	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	x	14.2	x	0.55	x	0.65	=	9.39	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	x	14.2	x	0.55	x	0.65	] =	20.16	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	X	9.21	x	0.55	x	0.65	] =	7.03	(75)
Northeast 0.9x	0.54	x	3.29	X	9.21	X	0.55	x	0.65	=	5.27	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	x	9.21	X	0.55	x	0.65	] =	6.1	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	X	9.21	X	0.55	X	0.65	=	13.08	(75)
Southwest <sub>0.9x</sub>	0.77	X	5.71	x	36.79		0.55	X	0.65	=	52.05	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	X	36.79		0.55	x	0.65	=	10.3	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	36.79		0.55	X	0.65	=	65.63	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	X	62.67		0.55	x	0.65	=	88.66	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	62.67		0.55	X	0.65	=	17.55	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	62.67		0.55	X	0.65	=	111.8	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	X	85.75		0.55	x	0.65	=	121.31	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	85.75		0.55	X	0.65	=	24.01	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	X	85.75		0.55	X	0.65	=	152.96	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	х	106.25		0.55	x	0.65	=	150.31	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	х	106.25		0.55	x	0.65	=	29.75	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	X	106.25		0.55	x	0.65	=	189.53	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	119.01		0.55	x	0.65	=	168.36	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	119.01		0.55	x	0.65	=	33.32	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	х	119.01		0.55	x	0.65	=	212.29	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	118.15		0.55	X	0.65	=	167.14	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	118.15		0.55	x	0.65	=	33.08	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	118.15		0.55	X	0.65	=	210.75	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	113.91		0.55	X	0.65	=	161.14	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	113.91		0.55	x	0.65	=	31.89	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	113.91		0.55	X	0.65	=	203.19	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	104.39		0.55	X	0.65	=	147.67	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	104.39		0.55	X	0.65	=	29.22	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	104.39		0.55	X	0.65	] =	186.21	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	92.85		0.55	X	0.65	=	131.35	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	92.85		0.55	X	0.65	=	25.99	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	92.85		0.55	x	0.65	=	165.63	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	69.27		0.55	x	0.65	=	97.99	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	69.27		0.55	x	0.65	=	19.39	(79)
Southwest <sub>0.9x</sub>	0.77	x	7.2	x	69.27		0.55	x	0.65	] =	123.56	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	44.07		0.55	x	0.65	] =	62.34	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	44.07		0.55	x	0.65	=	12.34	(79)



Southwest <sub>0.9x</sub> 0.77	X	7.:	2	X Z	14.07		0.55	х	0.65	=	78.61	(79)
Southwest <sub>0.9x</sub> 0.77	x	5.7	<u>'</u> 1	x (	31.49		0.55	_ x _	0.65	=	44.54	(79)
Southwest <sub>0.9x</sub> 0.77	x	1.1	3	x (	31.49		0.55	_ x _	0.65	=	8.82	(79)
Southwest <sub>0.9x</sub> 0.77	x	7.:	2	x (	31.49		0.55	x	0.65	=	56.17	(79)
Solar gains in watts, ca	lculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m= 166.53 296.46	439.63	601.72	726	743.64	707.42	611.2	495.21	336.82	201.79	141		(83)
Total gains – internal a	nd solar	(84)m =	= (73)m -	+ (83)m	, watts						•	
(84)m= 844.31 971.49	1092.6	1218.67	1305.03	1268.98	1210.92	1121.9	1025.32	921.74	828.24	799.88		(84)
7. Mean internal temp	erature	(heating	season	)								
Temperature during h		`		,	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisation factor for ga	ains for I	iving are	ea, h1,m	(see Ta	able 9a)		,					
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 1 1	1	1	0.99	0.96	0.9	0.93	0.98	1	1	1		(86)
Mean internal tempera	atura in l	living ar	22 T1 (fc	llow sta	ne 3 to 7	in Tabl	o 9c)					
(87)m= 18.68 18.84	19.14	19.62	20.08	20.52	20.76	20.72	20.35	19.78	19.19	18.71		(87)
` '					<u> </u>	<u> </u>						, ,
Temperature during h							<u> </u>	40.40	10.10	40.44		(88)
(88)m= 19.4 19.41	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(00)
Utilisation factor for ga	ains for r			h2,m (se		9a)						
(89)m= 1 1	1	0.99	0.98	0.92	0.77	0.82	0.96	0.99	1	1		(89)
Me <mark>an int</mark> ernal temp <mark>era</mark>	ature in t	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m= 16.37 16.61	17.06	17.79	18.46	19.11	19.41	19.37	18.88	18.03	17.16	16.44		(90)
							f	LA = Livin	g area ÷ (4	4) =	0.15	(91)
Mean internal tempera	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2					
(92)m= 16.72 16.94	17.37	18.06	18.7	19.32	19.61	19.57	19.1	18.29	17.46	16.78		(92)
Apply adjustment to the	ne mean	interna	temper	ature fro	m Table	4e, whe	ere appro	priate		Į.		
(93)m= 16.57 16.79	17.22	17.91	18.55	19.17	19.46	19.42	18.95	18.14	17.31	16.63		(93)
8. Space heating requ	iirement											
Set Ti to the mean into				ed at st	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation factor fo	<del></del>		ı						·		I	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for ga	0.99	0.99	0.96	0.9	0.76	0.81	0.95	0.99	1	1		(94)
Useful gains, hmGm,				0.9	0.76	0.61	0.93	0.99	_ '	'		(04)
		<u> </u>	1258.73	1140.67	916.48	905.71	975.4	913.26	826.23	798.97		(95)
Monthly average exte					1 0.00		0.0	0.0.20	020.20			()
(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			l		l	l			<u> </u>	I.	1	• •
(97)m= 5341.39 5132.91					1123.72	<del></del>	1932.44	3073.2	4230.91	5234.41		(97)
Space heating require	ment fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m	I	1	
· — —	2606.64		1141.8	0	0	0	0	1607	2451.37	3299.97		
<u> </u>					•	Tota	l per year	(kWh/yea	r) = Sum(9	8) <sub>15,912</sub> =	19051.59	(98)
Space heating require	ement in	kWh/m²	2/vear								83.19	(99)
		,	. ,								55.10	( = 3)



On Engray requirements, Individual heating quet	ome including	micro CHD)				
9a. Energy requirements – Individual heating systems Space heating:	<del>ems including</del>	micro-CHP)				
Fraction of space heat from secondary/supplement	entary 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					91.9	(206)
Efficiency of secondary/supplementary heating s	ystem, %				0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct	Nov Dec	kWh/y	 /ear
Space heating requirement (calculated above)		· · · · · ·			- -	
3346.77 2798.16 2606.64 1799.88 1141.8	0 0	0 0	1607 24	51.37 3299.97	7	
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$					7	(211)
3641.75 3044.79 2836.39 1958.52 1242.44	0 0	0 0		67.43 3590.82	_	(O44)
Constant to the second		rotai (kwii/ye	ear) =Sum(211)	15,1012	20730.78	(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	7	
		Total (kWh/ye	ear) =Sum(215)	15,1012	0	(215)
Water heating						
Output from water heater (calculated above)	70.5 470.00	407.05		20.04	_	
258.42   228.45   241.51   218.69   215.9   1 Efficiency of water heater	78.5 172.39	187.85 187.1	226.66 23	36.91 252.95	81.8	(216)
	81.8 81.8	81.8 81.8	90.52 9	0.91 91.1	01.0	(217)
Fuel for water heating, kWh/month					_	, ,
$(219)$ m = $(64)$ m × $100 \div (217)$ m			_	<u> </u>	_	
(219)m= 283.69 250.9 265.54 241.15 239.54 2	18.22 210.75	229.64 228.73 Total = Sum(		60.6 277.66		
Annual totals		rotal = Sum(	····-	/year	2956.83 kWh/ye	(219)
Space heating fuel used, main system 1			KVVII	/yeai	20730.78	
Water heating fuel used					2956.83	=
Electricity for pumps, fans and electric keep-hot						
central heating pump:				30	٦	(2300
		eum of (220a	) (220a) –	30		
Total electricity for the above, kWh/year		sum of (230a	)(∠30g) =		30	(231)
Electricity for lighting					698.14	(232)
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP				
	<b>Energy</b> kWh/year		Emission kg CO2/k		Emissior kg CO2/y	
Space heating (main system 1)	(211) x		0.216	=	4477.85	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216		638.68	(264)
Space and water heating		+ (263) + (264) =	0.210		5116.52	(265)
	(231) x	(, - ( <del></del> ), -	2-1-			=
Electricity for pumps, fans and electric keep-hot	( <del>2</del> 01)		0.519		15.57	(267)



Electricity for lighting (232) x (268)0.519 362.33 sum of (265)...(271) = Total CO2, kg/year (272) 5494.43 **Dwelling CO2 Emission Rate**  $(272) \div (4) =$ (273) 23.99 El rating (section 14) (274) 73



# **APPENDIX VIII – BE-GREEN DER WORKSHEETS (REFURB)**



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 1 - Existing Be-Green - 3B6P - GF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x (2a) =516.2 (3a) 178 2.9 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)178 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =516.2 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)3 30 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.06 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.81 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.75 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



· —		e (allowi				<u> </u>	<del>`</del>	<u> </u>	1			1	
0.95 Calculate effe	0.93 Ctive air	0.92 Change i	0.82 rate for t	0.8 <b>he appli</b>	0.71 <b>cable ca</b>	0.71 S <b>e</b>	0.69	0.75	0.8	0.84	0.88	J	
If mechanica		•										0	(2
If exhaust air h	eat pump (	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	wise (23b	) = (23a)			0	(2
If balanced with	n heat reco	overy: effici	iency in %	allowing f	or in-use fa	actor (from	n Table 4h	) =				0	(
a) If balance	ed mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	)m = (22	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
4a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
b) If balance	ed mech	anical ve	ntilation	without	heat rec	overy (N	ЛV) (24b	)m = (22	2b)m + (2	23b)		1	
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(
c) If whole h if (22b)n			ntilation on the control of the cont	•	•				5 × (23b	<b>)</b> )			
c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	
d) If natural if (22b)n			ole hous m = (22k		•				0.5]				
d)m= 0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89	]	(
Effective air	change	rate - er	nter (24a	) or (24k	o) or (24	c) or (24	d) in box	(25)			•	•	
5)m= 0.95	0.94	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.89		(
. Heat losse	s and he	eat loss r	naramet	er.					_				
EMENT	Gros area	SS	Openin	gs	Net Ar A ,n		U-valı W/m2		A X U (W/I		k-value		A X k kJ/K
ndows Type		(111-)	"		10.69		/[1/( 1.8 )+		17.96	(X)	KJ/1111		NJ/IN
ndows Type					3.14		/[1/( 1.8 )+	, L	5.27	Ħ			
indows Type					3.61		/[1/( 1.8 )+	, i	6.06	Ħ			(
oor	, 0				178.5			= [		<u></u>			(
alls	134.	20	17.45		116.9	_	0.25		44.6275	<u>'</u>		╡	<del></del>
oof	51.4		0	<u></u>	51.42	=			8.23	북 ¦		╡	(
ital area of e						_	0.16	[	0.23				`` `
rty wall	,iciticitis	, 111			364.3	=				— r			
rty wall					54.81	_	0	= [	0			╡	(
or windows and	roof wind	ows, use e	effective wi	ndow U-va	127.0		ı formula 1	/[(1/U-valu	ıe)+0.04] a	] as given in	paragraph		
nclude the area	as on both	sides of in	nternal wall	ls and par	titions								
bric heat los		•	U)				(26)(30)	+ (32) =				123.08	(
eat capacity	^	` ,						((28)	.(30) + (32	2) + (32a).	(32e) =	34562.19	(
ermal mass	•	`		,					tive Value			250	(
r design assess n be used inste				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
ermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix k	<						54.65	
etails of therma		are not kn	own (36) =	= 0.05 x (3	1)								
tal fabric he								` '	(36) =			177.73	(
entilation hea	r	l 1	r i			_			= 0.33 × (		1	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3)m= 162.54	159.54	156.59	142.76	140.17	128.12	128.12	125.89	132.76	140.17	145.41	150.88	]	(
eat transfer of 340.27	337.26	nt, VV/K 334.32	320.49	317.9	305.85	305.85	303.62	(39)m 310.49	= (37) + (3	38)m 323.13	328.61	1	



Heat loss para	meter (l	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.91	1.89	1.88	1.8	1.79	1.72	1.72	1.71	1.74	1.79	1.82	1.85		
				<u> </u>	<u> </u>	<u> </u>	<u> </u>		L Average =	Sum(40) <sub>1</sub> .	12 /12=	1.8	(40)
Number of day	s in mo	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 heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		97		(42)
Annual averag											4.81		(43)
Reduce the annua not more that 125	_				-	-	to achieve	a water us	se target o	of Total			
						·	l .			·			
Jan Hot water usage ii	Feb	Mar	Apr	May	Jun	Jul Toble 10 Y	Aug	Sep	Oct	Nov	Dec		
					1		· <i>′</i>	1					
(44)m= 115.29	111.1	106.91	102.72	98.52	94.33	94.33	98.52	102.72	106.91	111.1	115.29		
Energy content of	hot water	used - cal	culated mo	onth $lv = 4$ .	190 x Vd.r	m x nm x D	7m / 3600			m(44) <sub>112</sub> = ables 1b. 1		1257.76	(44)
(45)m= 170.98	149.54	154.31	134.53	129.09	111.39	103.22	118.45	119.86	139.69	152.48	165.58		
(43)11= 170.98	149.54	134.31	154.55	129.09	111.39	103.22	110.43			m(45) <sub>112</sub> =		1649.12	(45)
If ins <mark>tantane</mark> ous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		Total = Su	111(43)112 =		1049.12	(40)
(46)m= 25.65	22.43	23.15	20.18	19.36	16.71	15.48	17.77	17.98	20.95	22.87	24.84		(46)
Water storage	loss:												
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		305		(47)
If community h	eating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage				!	(1.\ \ / /	- /-l · · ·							(40)
a) If manufact				or is kno	wn (kvvr	n/day):				1.	63		(48)
Temperature fa										0.	54		(49)
Energy lost fro b) If manufact		_	-		or ic not		(48) x (49)	) =		0.	88		(50)
Hot water stora			-								0		(51)
If community h	-			`		,					<u> </u>		( )
Volume factor	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m watei	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (	(54) in (5	55)								0.	88		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
(56)m= 27.29	24.65	27.29	26.41	27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(56)
If cylinder contains	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= 27.29	24.65	27.29	26.41	27.29	26.41	27.29	27.29	26.41	27.29	26.41	27.29		(57)
Primary circuit	•	•									0		(58)
Primary circuit				,	•	. ,	, ,						
(modified by				i	ı —		<del></del>	<u> </u>		<del>-                                    </del>			(50)
(59)m= 37.3	33.69	37.3	36.09	37.3	36.09	37.3	37.3	36.09	37.3	36.09	37.3		(59)



Combi loss calculated	d for each	month (	(61)m –	(60) ± 3(	65 v (41)	١m						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0	0	01)111 =	00) + 3	05 × (41)	0	0	0	T 0	0	1	(61)
Total heat required for				-							(50)m + (61)m	(- )
(62)m= 235.56 207.87		197.03	193.67	173.89	167.8	183.0		204.27	<del> </del>	230.17	(59)111 + (61)111	(62)
Solar DHW input calculate								ļ			I	(/
(add additional lines i								ii ooniinoe	mon to wat	or ricating)		
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from water he	 ater	Į				<u> </u>	<u> </u>		<u> </u>		ı	
(64)m= 235.56 207.87		197.03	193.67	173.89	167.8	183.0	3 182.36	204.27	214.98	230.17		
· · · <b>L</b>		l	l			C	utput from w	ater heat	_ <b>I</b> er (annual)₁	l12	2409.54	(64)
Heat gains from water	r heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61	)m] + 0.8 )	x [(46)m	n + (57)m	+ (59)m	. 1	•
(65)m= 108.52 96.39	102.98	94.73	94.59	87.04	85.99	91.0	<del></del>	98.11	100.7	106.72	ĺ	(65)
include (57)m in ca	Iculation	of (65)m	only if c	vlinder i	s in the o	dwellir	ng or hot w	ater is	from com	munity h	ı neating	
5. Internal gains (se				•			<u> </u>			,		
Metabolic gains (Tab			,									
Jan Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(66)m= 148.66 148.66	148.66	148.66	148.66	148.66	148.66	148.6	6 148.66	148.66	148.66	148.66		(66)
Lighting gains (calcul	ated in A	pendix	L, equati	on L9 o	r L9a), <mark>a</mark>	lso se	e Table 5					
(67)m= 36.99 32.86	26.72	20.23	15.12	12.77	13.79	17.93	24.07	30.56	35.67	38.02		(67)
Appliances gains (ca	culated ir	Append	dix L, eq	uation L	13 or L1	3a), a	so see Ta	ble 5				
(68)m= 349.62 353.25	344.11	324.65	300.08	276.99	261.56	257.9	3 267.07	286.54	311.11	334.2		(68)
Cooking gains (calcu	ated in A	ppendix	L, equat	ion L15	or L15a)	), also	see Table	5		•		
(69)m= $37.87$ $37.87$	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87	37.87		(69)
Pumps and fans gain	s (Table !	5a)					•		•			
(70)m= 0 0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g. evaporat	on (nega	tive valu	es) (Tab	le 5)	•		•	•	•			
(71)m= -118.93 -118.93	-118.93	-118.93	-118.93	-118.93	-118.93	-118.9	3 -118.93	-118.93	-118.93	-118.93		(71)
Water heating gains	Table 5)						•	•	•			
(72)m= 145.86 143.44	138.41	131.57	127.14	120.89	115.58	122.3	8 124.8	131.87	139.86	143.45		(72)
Total internal gains	=			(66)	)m + (67)m	ı + (68)	m + (69)m +	(70)m + (	71)m + (72)	)m	•	
(73)m= 600.07 597.14	576.84	544.05	509.93	478.24	458.53	465.8	4 483.54	516.57	554.23	583.26		(73)
6. Solar gains:		•			•	•						
Solar gains are calculated	alos gnisu t	r flux from	Table 6a	and assoc	iated equa	itions to	convert to th	ne applica	ble orienta	tion.		
Orientation: Access		Area		Flu			g_ T-1-101-	_	FF		Gains	
Table 6	a 	m²		1a	ble 6a		Table 6b		Table 6c		(W)	_
Northeast 0.9x 0.7	7 ×	3.1	14	X 1	11.28	x	0.55	X	0.65	=	8.78	(75)
Northeast 0.9x 0.5	4 ×	3.6	61	X	11.28	x	0.55	×	0.65	=	7.08	(75)
Northeast 0.9x 0.7	7 ×	3.1	14	x 2	22.97	×	0.55	×	0.65	=	17.87	(75)
Northeast 0.9x 0.5	4 ×	3.6	S1	x 2	22.97	] x [	0.55	x [	0.65	=	14.41	(75)
Northeast <sub>0.9x</sub> 0.7	7 ×	3.1	14	X Z	11.38	x [	0.55	x	0.65	=	32.19	(75)

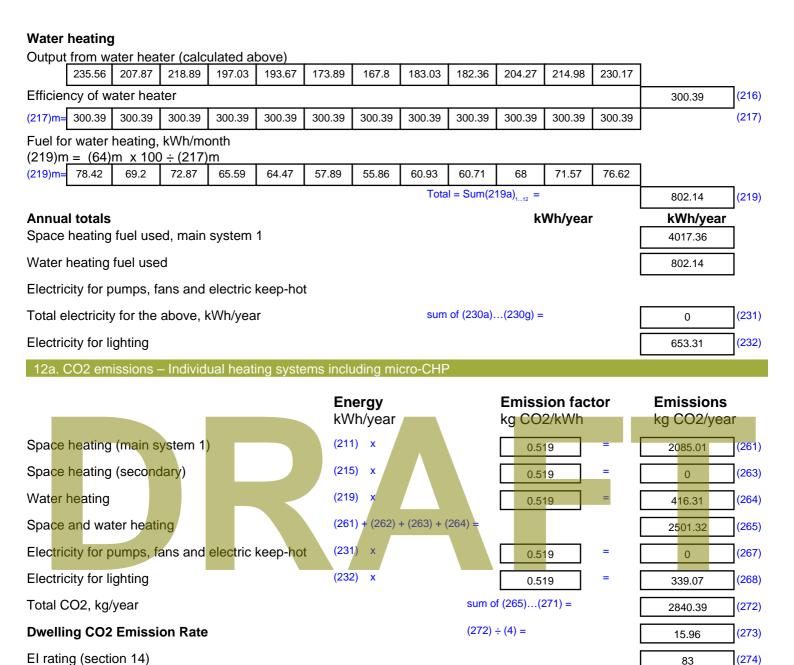


Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	4	1.38	x		0.55	X		0.65		=	25.95	(75)
Northeast 0.9x	0.77	X	3.1	4	x	6	7.96	x		0.55	X		0.65		=	52.86	(75)
Northeast 0.9x	0.54	X	3.6	51	x	6	7.96	x		0.55	X		0.65		=	42.62	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	9	1.35	x		0.55	X		0.65		=	71.06	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	9	1.35	x		0.55	X		0.65		=	57.29	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	9	7.38	x		0.55	X		0.65		=	75.76	(75)
Northeast 0.9x	0.54	X	3.6	51	x	9	7.38	х		0.55	X		0.65		=	61.08	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	(	91.1	х		0.55	X		0.65		=	70.87	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	Ç	91.1	x		0.55	X		0.65		=	57.14	(75)
Northeast 0.9x	0.77	X	3.1	4	x	7	2.63	х		0.55	X		0.65		=	56.5	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	7	2.63	х		0.55	X		0.65		=	45.55	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	5	0.42	х		0.55	X		0.65		=	39.22	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	5	0.42	x		0.55	X		0.65		=	31.62	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.1	4	x	2	8.07	x		0.55	X		0.65		=	21.83	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	2	8.07	x		0.55	X		0.65		=	17.6	(75)
Northeast <sub>0.9x</sub>	0.77	x	3.1	4	x	,	14.2	x		0.55	X		0.65		=	11.04	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.6	51	x	,	14.2	х		0.55	X		0.65		=	8.9	(75)
Northeast 0.9x	0.77	X	3.1	4	×	(	9.21	Х		0.55	X		0.65		=	7.17	(75)
Northeast 0.9x	0.54	X	3.6	1	х	ę	9.21	x		0.55	X		0.65		=	5.78	(75)
Southwest <sub>0.9x</sub>	0.77	x	10.	.7	х	3	6.79			0.55	X		0.65		=	97.52	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	6	2.67			0.55	X		0.65		=	166.11	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.	.7	x [	8	5.7 <mark>5</mark>			0.55	X		0.65		=	227.28	(79)
Southwest <sub>0.9x</sub>	0.77	x	10.	.7	x	10	06.25			0.55	X		0.65		=	281.61	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	х	1	19.01			0.55	X		0.65		=	315.43	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	1	18.15			0.55	X		0.65		=	313.15	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	1	13.91			0.55	X		0.65		=	301.91	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	1(	04.39			0.55	X		0.65		=	276.68	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	9	2.85			0.55	X		0.65		=	246.1	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	6	9.27			0.55	X		0.65		=	183.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	4	4.07			0.55	X		0.65		=	116.8	(79)
Southwest <sub>0.9x</sub>	0.77	X	10.	.7	x	3	1.49			0.55	X		0.65		=	83.46	(79)
Solar gains in	1				$\overline{}$			<del>`                                    </del>	_	m(74)m .	<u> </u>	_				l	
(83)m= 113.37	198.38	285.42	377.1	443.78		19.98	429.92	378	.73	316.94	223.	03	136.75	96.4	4		(83)
Total gains – ir			<u> </u>		·											l	(0.4)
(84)m= 713.44	795.52	862.26	921.14	953.71	92	28.22	888.44	844	.57	800.48	739.	59	690.98	679.	66		(84)
7. Mean inter	nal temp	erature	(heating	seasor	า)												-
Temperature	during h	eating p	eriods ir	the liv	ing a	area f	rom Tab	ole 9,	, Th1	(°C)						21	(85)
Utilisation fac					Ť					ı						ı	
Jan	Feb	Mar	Apr	May	+	Jun	Jul		ug	Sep	Od	ot	Nov	De	С		(00)
(86)m= 1	1	1	1	0.99	1 0	).97	0.91	0.9	93	0.98	1		1	1			(86)
Mean internal				` `	_					9c)						ı	
(87)m= 18.74	18.85	19.15	19.59	20.05	2	20.5	20.75	20.	71	20.35	19.7	'9	19.19	18.7	<b>'</b> 4		(87)
					-												



Temperatu		<del>, , , , , , , , , , , , , , , , , , , </del>	i	i		1	1	<u> </u>	i	ı			4
(88)m= 19.39	19.4	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(88)
Utilisation f	actor for g	gains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m= 1	1	1	0.99	0.98	0.93	0.79	0.83	0.96	0.99	1	1		(89)
Mean interr	nal tempe	rature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m= 16.39	16.62	17.06	17.76	18.41	19.08	19.39	19.36	18.88	18.03	17.18	16.47		(90)
	•			•	•	•	•	f	LA = Livin	g area ÷ (4	1) =	0.28	(91)
Mean interr	nal tempe	rature (fo	r the wh	ole dwe	llina) = f	Ι Δ <b>χ</b> Τ1	+ (1 – fl	A) x T2			•		
(92)m= 17.05		17.64	18.27	18.87	19.47	19.77	19.74	19.29	18.53	17.75	17.11		(92)
Apply adjus		ļ	ı interna		ature fro	ı——— ım Table	4e, whe	ere appro	L opriate	<u> </u>			
(93)m= 17.05	1	17.64	18.27	18.87	19.47	19.77	19.74	19.29	18.53	17.75	17.11		(93)
8. Space he	eating req	uirement			1		1						
Set Ti to the	e mean in	ternal tei	mperatu	re obtair	ned at st	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the utilisation	on factor f	or gains	using Ta	able 9a									
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation f	actor for g	gains, hm	i e										
(94)m= 1	1	1	0.99	0.97	0.93	0.82	0.85	0.96	0.99	1	1		(94)
Useful gain			<u> </u>										(0.5)
(95)m= 712.2		858.09	911.73	929.04	860.02	728.7	720.72	767.98	733.18	689.13	678.74		(95)
Monthly ave			İ				V is						(00)
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	ate for me	_	_		_		x [(93)m 1014.15		2519.87	3440.51	4241.28		(97)
` '							<u> </u>				4241.28		(97)
Space heat (98)m= 2698.		2133.33	1506.83			$\frac{\ln = 0.02}{0}$	24 X [(97	)m – (95   0	1329.3	1980.99	2650.53		
(30)111= 2030.	2204.2	2133.33	1300.03	1003.47					<u> </u>			15568.79	(98)
				_,			1018	ıl per year	(KVVII/yeai	) = Sum(9	0)15,912 =		=
Space heat	ing requir	ement in	kWh/m²	²/year								87.47	(99)
9a. Energy r	equireme	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space hea	•										r		_
Fraction of	space he	at from s	econdar	y/supple	ementary	system					ļ	0	(201)
Fraction of	space he	at from m	nain syst	tem(s)			(202) = 1	- (201) =				1	(202)
Fraction of	total heat	ing from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of	of main sp	ace heat	ing syste	em 1							Ī	387.54	(206)
Efficiency of	f seconda	ary/suppl	ementar	y heatin	g systen	า, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	 ear
Space heat		<u> </u>	<u> </u>		L		1 7.09	Гоор			200		<i>.</i>
2698.	<del></del>	<del>- `</del>		1005.47	<del>`</del>	0	0	0	1329.3	1980.99	2650.53		
(211)m = {[(9	98)m x (2)	1 14)1	00 ÷ (20	)6)	1	<u>!</u>	1		<u>I</u>				(211)
696.2	<del>i `</del>	550.48	388.82	259.45	0	0	0	0	343.01	511.17	683.94		(=:-)
	_!	<u> </u>	<u> </u>			<u> </u>	Tota	l al (kWh/yea	ar) =Sum(2	211) <sub>151012</sub>	=	4017.36	(211)
Space heat	ing fuel (s	secondar	v) k\//h/	month				•	,		Ĺ		<b></b> ` ′
$= \{[(98) \text{m x } ($	•		• / ·										
(215)m = 0	0	0	0	0	0	0	0	0	0	0	0		
		•	•	•	•	•	Tota	ıl (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
											L		







		l	Jser D	etails:						
Assessor Name: Software Name:	Stroma FSAP 20			Stroma Softwa	are Vei	rsion:			n: 1.0.4.23	
Address	Dropob Hill House		·				Be-Gre	en - 4B8	8P - GF	
Address: 1. Overall dwelling dime	Branch Hill House,	Branch Hill	I, LON	DON, IN	VV3 /LS					
1. Overall awailing aims	11010110.		Area	n(m²)		Av. Hei	ight(m)		Volume(m³	)
Ground floor				<u>`                                    </u>	(1a) x		2.9	(2a) =	660.04	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1	e)+(1n)	22	27.6	(4)					_
Dwelling volume					(3a)+(3b	)+(3c)+(3d	)+(3e)+	.(3n) =	660.04	(5)
2. Ventilation rate:										
		econdary heating	(	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 fa	ns					5	x '	10 =	50	(7a)
Number of passive vents					Ī	0	<b>x</b> '	10 =	0	(7b)
Number of flueless gas fi	res				Ī	0	X 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney						50		÷ (5) =	0.08	(8)
If a pressurisation test has be Number of storeys in the		lea, proceed to	0 (17), 0	urierwise c	onunue ir	om (9) 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	masonr	y constr	uction			0	(11)
if both types of wall are prededucting areas of openir	resent, use the value corre	sponding to th	ne greate	er wall area	a (after					
If suspended wooden f	· ,	aled) or 0.1	(seale	d), else	enter 0				0	(12)
If no draught lobby, ent	,	,	`	,,					0	(13)
Percentage of windows	s and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	• • •		•	•	•	etre of e	nvelope	area	15	(17)
If based on air permeabil	•								0.83	(18)
Air permeability value applie.  Number of sides sheltere		is been done (	or a deg	ıree air pei	rmeability	is being us	sed	ĺ		7(40)
Shelter factor	eu .			(20) = 1 - [	[0.075 x (1	9)] =			0.85	(19) (20)
Infiltration rate incorporat	ing shelter factor			(21) = (18)	) x (20) =				0.7	(21)
Infiltration rate modified for		d							• • • • • • • • • • • • • • • • • • • •	` ′
	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22										
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
					<u> </u>		<u> </u>		l	



Adjusted	l infiltra	tion rate	e (allowii	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
	0.89	0.88	0.86	0.77	0.75	0.67	0.67	0.65	0.7	0.75	0.79	0.82		
Calculate	<i>e effect</i> hanical		_	ate for t	he appli	cable ca	se			•				(22-)
			using Appe	ndix N (2	3h) <i>– (</i> 23a	a) × Fmv (e	equation (	N5)) othe	rwise (23h	n) = (23a)		[	0	(23a)
			overy: effici		, ,	,	•	,,	•	) = (23a)		l I	0	(23b) (23c)
			•		Ū		,		,	2h)m + (	23h) <b>√</b> ['	l 1 – (23c)	0 1001	(230)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	- 100]	(24a)
· · ·	alancec		anical ve		without	heat red	covery (	<u> </u>	<u> </u>	L	23h)			, ,
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,			tract ven (23b), tl		•	•				.5 × (23b	) )			
(24c)m=	0	0	0	0	0	0	0	0	0	O	0	0		(24c)
ـــ d) If na	atural v	entilatio	on or who	ole hous	e positiv	/e input	ventilati	on from	loft		l .			
if (	(22b)m	= 1, the	en (24d)ı	m = (22k)	o)m othe	· `	24d)m =	<del>- `</del>	22b)m² x	0.5]				
(24d)m=	0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(24d)
			rate - en		, ,	<del>´`</del>	c) or (24	<del>,                                    </del>	x (25)					
(25)m=	0.9	0.88	0.87	8.0	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(25)
3. Heat	osses	and he	eat loss p	aramete	er:									
ELEME	NT	Gros area		Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I		k-value kJ/m²-k		A X k kJ/K
Windows	s Type	1				3.77	x <sup>'</sup>	/[1/( 1.8 )+	- 0.04] =	6.33				(27)
Windows	S Type :	2				3.77	X.	/[1/( 1.8 )+	- 0.04] =	6.33				(27)
Windows	s Type	3				3.77	X'	/[1/( 1.8 )+	- 0.04] =	6.33				(27)
Windows	s Type	4				4.94	x′	/[1/( 1.8 )+	- 0.04] =	8.29				(27)
Floor						227.5	5 x	0.25	=	56.875				(28)
Walls Ty	rpe1	94.6	8	16.2	5	78.43	3 X	0.35	=	27.45				(29)
Walls Ty	pe2	53.4	8	0		53.48	3 X	0.31	=	16.42				(29)
Roof		104.	54	0		104.5	4 x	0.16	=	16.73				(30)
Total are	ea of ele	ements	, m²			480.2	2							(31)
Party wa	all					83.58	3 x	0	=	0				(32)
Party cei	iling					122.9	6							(32b)
			ows, use e sides of in				lated usin	g formula 1	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	3.2	
Fabric he	eat loss	s, W/K =	= S (A x	U)				(26)(30	) + (32) =			[	144.70	6 (33)
Heat cap	oacity C	m = S(	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	42649.4	(34)
Thermal	mass p	oarame	ter (TMP	? = Cm ÷	- TFA) ir	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
For design can be use					constructi	ion are no	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal	bridges	s : S (L	x Y) cald	culated u	using Ap	pendix I	K						72.03	(36)
if details of			are not kno	own (36) =	= 0.05 x (3	1)			(33) +	- (36) =		آ	216.79	9 (37)



entilation hea	at loss ca	alculated	l monthly	<b>V</b>				(38)m	= 0.33 × (	(25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m= 196.13	192.74	189.42	173.83	170.91	157.33	157.33	154.81	162.56	170.91	176.81	182.98		(38)
leat transfer o	coefficier	nt, W/K				•	•	(39)m	= (37) + (37)	38)m	!		
39)m= 412.91	409.53	406.21	390.61	387.7	374.12	374.12	371.6	379.35	387.7	393.6	399.77		
									•	Sum(39) <sub>1</sub>	12 /12=	390.6	(39)
leat loss para		<del> </del>						· ` ′	= (39)m ÷	<u>`                                    </u>	1		
1.81	1.8	1.78	1.72	1.7	1.64	1.64	1.63	1.67	1.7	1.73	1.76	1.72	(40)
lumber of day	s in moi	nth (Tab	le 1a)					,	average =	Sum(40) <sub>1</sub>	12 / 12=	1.72	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
11)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
ssumed occu											.04		(42)
if TFA > 13.9 if TFA £ 13.9	-	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.	.9)			
nnual averag	,	ater usac	ae in litre	s per da	av Vd.av	erage =	(25 x N)	+ 36		100	6.35		(43
Reduce the annua	al average	hot water	usage by	5% if the o	lwelling is	designed t			se target o		0.00		(
ot more that 125	litres per l	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
lot w <mark>ater u</mark> sage ii				Vd,m ≠ fa									
14)m= 116.98	112.73	108.47	104.22	99.97	95.71	95.71	99.97	104.22	108.47	112.73	116.98		<b>–</b>
inergy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1276.18	(44
15)m= 173.48	151.73	156.57	136.5	130.98	113.02	104.73	120.18	121.62	141.73	154.71	168.01		
									Γotal = Su	m(45) <sub>112</sub> =	=	1673.27	(45
instantaneous w		ng at point	of use (no	hot water				) to (61)					
Vater storage	22.76	23.49	20.48	19.65	16.95	15.71	18.03	18.24	21.26	23.21	25.2		(46
storage volum		includin	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		305		(47
community h	` ,		•			•					500		(
Otherwise if no	_			-			, ,	ers) ente	er '0' in (	47)			
Vater storage													
a) If manufact				or is kno	wn (kWh	n/day):				1.	.63		(48
emperature fa	actor fro	m Table	2b							0.	.54		(49
inergy lost fro		-	-				(48) x (49)	) =		0.	.88		(50
<ul><li>o) If manufact lot water stora</li></ul>			-								0		(51
community h	-			<b>-</b> ()	,	.,,					<u> </u>		(0)
olume factor	from Tal	ble 2a									0		(52
emperature fa	actor fro	m Table	2b								0		(53
nergy lost fro		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54
Enter (50) or (										0.	.88		(55
Votor otorogo	loce cal	culated f	for each	month			((56)m - (	55) × (41)	m				
Vater storage	1033 Cal		———	111011111			((30))) = (		<u></u>				



If cylinder contains dedicated solar storage, $(57)$ m = $(56)$ m x $[(50) - (H11)] \div (50)$ , else $(57)$ m = $(56)$ m where $(H11)$ is from Appendix H										
(57)m= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 (5	57)									
Primary circuit loss (annual) from Table 3	58)									
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m										
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)										
(59)m= 37.3 33.69 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3 (5	59)									
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m										
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0	61)									
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$										
(62)m= 238.07 210.06 221.15 199 195.56 175.52 169.32 184.77 184.12 206.32 217.21 232.59	62)									
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)										
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)										
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (6	63)									
Output from water heater										
(64)m= 238.07 210.06 221.15 199 195.56 175.52 169.32 184.77 184.12 206.32 217.21 232.59										
Output from water heater (annual) <sub>112</sub> 2433.69 (6	64)									
Heat gains from water heating, kWh/month $0.25 (0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$										
(65)m= 109.35 97.12 103.73 95.39 95.22 87.58 86.49 91.63 90.44 98.79 101.44 107.53	65)									
in <mark>clude</mark> (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										
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)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	36)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 151.89 151	66) 67)									
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         151.89         161.89										
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5										
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	67)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	67)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	67) 68)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 (69)m= 38.19	67) 68)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 (69)m= 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19 38.19	67) 68)									
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	67) 68)									
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	67) 68) 69)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19	67) 68) 69)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 151.89 (66)m= 45.54 40.45 32.9 24.9 18.62 15.72 16.98 22.07 29.63 37.62 43.91 46.81 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 396.58 400.69 390.32 368.24 340.38 314.18 296.69 292.57 302.94 325.02 352.89 379.08 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.19	668) 669) 770)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m	668) 669) 770)									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (66)m	668) 669) 770)									

Flux

Table 6a

Area

m²

Orientation: Access Factor

Table 6d

Gains

(W)

FF

Table 6c

Table 6b



Northeast 0.9x			,				1						_
Northeast 0.8	Northeast <sub>0.9x</sub>	0.54	X	4.94	X	11.28	X	0.55	X	0.65	=	9.68	(75)
Northeast 0.8	<u>L</u>	0.54	X	4.94	X	22.97	X	0.55	X	0.65	=	19.71	(75)
Northeast 0.8% 0.54	· · · <u>L</u>	0.54	X	4.94	X	41.38	X	0.55	X	0.65	<u> </u>	35.52	(75)
Northeast 0,8x	<u>L</u>	0.54	X	4.94	X	67.96	X	0.55	X	0.65	] =	58.33	(75)
Northeast 0.9x	<u>L</u>	0.54	X	4.94	x	91.35	X	0.55	X	0.65	=	78.4	(75)
Northeast 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.94	x	97.38	X	0.55	X	0.65	=	83.59	(75)
Northeast 0.9x	<u>L</u>	0.54	X	4.94	X	91.1	X	0.55	X	0.65	=	78.19	(75)
Northeast 0.9%	Northeast <sub>0.9x</sub>	0.54	X	4.94	X	72.63	X	0.55	X	0.65	=	62.34	(75)
Northeast 0.9x	<u>L</u>	0.54	X	4.94	X	50.42	X	0.55	X	0.65	=	43.28	(75)
Northeast 0.9x	Northeast 0.9x	0.54	X	4.94	X	28.07	X	0.55	X	0.65	=	24.09	(75)
South 0.9x	<u>L</u>	0.54	X	4.94	X	14.2	X	0.55	X	0.65	=	12.19	(75)
South 0.9x	Northeast <sub>0.9x</sub>	0.54	X	4.94	X	9.21	X	0.55	X	0.65	=	7.91	(75)
South 0.9x	South 0.9x	0.54	X	3.77	x	46.75	X	0.55	X	0.65	=	30.62	(78)
South 0.9x 0.54	South 0.9x	0.54	X	3.77	x	76.57	X	0.55	X	0.65	=	50.15	(78)
South 0.9x 0.54	South 0.9x	0.54	X	3.77	X	97.53	X	0.55	X	0.65	=	63.89	(78)
South 0.9× 0.54	South 0.9x	0.54	X	3.77	x	110.23	X	0.55	X	0.65	=	72.21	(78)
South 0.9x 0.54 x 3.77 x 108.01 x 0.55 x 0.65 = 70.75 (78) South 0.9x 0.54 x 3.77 x 104.89 x 0.55 x 0.65 = 66.71 (78) South 0.9x 0.54 x 3.77 x 101.89 x 0.55 x 0.65 = 66.71 (78) South 0.9x 0.54 x 3.77 x 8.25.9 x 0.55 x 0.65 = 66.74 (78) South 0.9x 0.54 x 3.77 x 55.42 x 0.55 x 0.65 = 54.1 (78) South 0.9x 0.54 x 3.77 x 36.79 x 0.55 x 0.65 = 26.46 (78) Southwest0.9x 0.54 x 3.77 x 8.57 x 0.55 x 0.65 = 24.1 (79) Southwest0.9x 0.54 x 3.77 x 8.5.75 x 0.65 = 24.1 (79) Southwest0.9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 56.17 (79) Southwest0.9x 0.54 x 3.77 x 119.01 x 0.55 x 0.65 = 69.6 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 113.91 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 144.07 x 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.54 x 3.77 x 19.64 x 0.55 x 0.65 = 25.17 (80) West 0.9x 0.54 x 3.77 x 38.42 x 0.55 x 0.65 = 25.17 (80)	South 0.9x	0.54	X	3.77	X	114.87	x	0.55	X	0.65	=	75.24	(78)
South 0.9x 0.54	South 0.9x	0.54	X	3.77	X	110.55	Х	0.55	X	0.65	-	72.41	(78)
South 0.9x 0.5d x 3.77 x 101.89 x 0.55 x 0.65 = 66.74 (78) South 0.9x 0.5d x 3.77 x 40.4 x 0.55 x 0.65 = 54.1 (78) South 0.9x 0.5d x 3.77 x 40.4 x 0.55 x 0.65 = 36.3 (78) South 0.9x 0.5d x 3.77 x 40.4 x 0.55 x 0.65 = 26.46 (78) South 0.9x 0.5d x 3.77 x 40.4 x 0.55 x 0.65 = 26.46 (78) Southwest0.9x 0.5d x 3.77 x 62.67 0.55 x 0.65 = 24.1 (79) Southwest0.9x 0.5d x 3.77 x 62.67 0.55 x 0.65 = 41.05 (79) Southwest0.9x 0.5d x 3.77 x 106.25 0.55 x 0.65 = 69.6 (79) Southwest0.9x 0.5d x 3.77 x 119.01 0.55 x 0.65 = 77.95 (79) Southwest0.9x 0.5d x 3.77 x 118.15 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.5d x 3.77 x 113.91 0.55 x 0.65 = 77.39 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 68.38 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79) Southwest0.9x 0.5d x 3.77 x 104.39 0.55 x 0.65 = 28.87 (79)	South 0.9x	0.54	X	3.77	х	108.01	X	0.55	x	0.65	=	70.75	(78)
South         0.9x         0.54         x         3.77         x         82.59         x         0.55         x         0.65         =         54.1         (78)           South         0.9x         0.54         x         3.77         x         55.42         x         0.55         x         0.65         =         54.1         (78)           South         0.9x         0.54         x         3.77         x         40.4         x         0.55         x         0.65         =         26.46         (78)           Southwesto,9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         24.1         (79)           Southwesto,9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         56.17         (79)           Southwesto,9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         56.17         (79)           Southwesto,9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.95	South 0.9x	0.54	X	3.77	х	104.89	x	0.55	x	0.65	=	68.71	(78)
South         0.9x         0.54         x         3.77         x         55/42         x         0.55         x         0.65         =         36.3         (78)           South         0.9x         0.54         x         3.77         x         40.4         x         0.55         x         0.65         =         26.46         (78)           Southwesto, 9x         0.54         x         3.77         x         36.79         0.55         x         0.65         =         24.1         (79)           Southwesto, 9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         24.1         (79)           Southwesto, 9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwesto, 9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwesto, 9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         74.61         (79)	South 0.9x	0.54	X	3.77	X	101.89	X	0.55	x	0.65	=	66.74	(78)
South         0.9x         0.54         x         3.77         x         40.4         x         0.55         x         0.65         =         26.46         (78)           Southwesto.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         24.1         (79)           Southwesto.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwesto.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x <td>South 0.9x</td> <td>0.54</td> <td>x</td> <td>3.77</td> <td>x</td> <td>82.59</td> <td>Х</td> <td>0.55</td> <td>x</td> <td>0.65</td> <td>=</td> <td>54.1</td> <td>(78)</td>	South 0.9x	0.54	x	3.77	x	82.59	Х	0.55	x	0.65	=	54.1	(78)
Southwest0.9x         0.54         x         3.77         x         36.79         0.55         x         0.65         =         24.1         (79)           Southwest0.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwest0.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         56.17         (79)           Southwest0.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwest0.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.95         (79)           Southwest0.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.39         (79)           Southwest0.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwest0.9x         0.54	South 0.9x	0.54	X	3.77	х	55.42	X	0.55	x	0.65	=	36.3	(78)
Southwesto.9x         0.54         x         3.77         x         62.67         0.55         x         0.65         =         41.05         (79)           Southwesto.9x         0.54         x         3.77         x         85.75         0.55         x         0.65         =         56.17         (79)           Southwesto.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54	South 0.9x	0.54	X	3.77	х	40.4	X	0.55	x	0.65	=	26.46	(78)
Southwest0.9x         0.54         x         3.77         x         85.75         0.55         x         0.65         =         56.17         (79)           Southwest0.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwest0.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         69.6         (79)           Southwest0.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.95         (79)           Southwest0.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwest0.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwest0.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         45.37         (79)           Southwest0.9x         0.54	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	36.79		0.55	X	0.65	=	24.1	(79)
Southwesto.9x         0.54         x         3.77         x         106.25         0.55         x         0.65         =         69.6         (79)           Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         45.37         (79)           Southwesto.9x         0.54	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	62.67		0.55	X	0.65	=	41.05	(79)
Southwesto.9x         0.54         x         3.77         x         119.01         0.55         x         0.65         =         77.95         (79)           Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         104.39         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         60.82         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           West         0.9x         0	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	85.75		0.55	x	0.65	=	56.17	(79)
Southwesto.9x         0.54         x         3.77         x         118.15         0.55         x         0.65         =         77.39         (79)           Southwesto.9x         0.54         x         3.77         x         113.91         0.55         x         0.65         =         74.61         (79)           Southwesto.9x         0.54         x         3.77         x         92.85         0.55         x         0.65         =         68.38         (79)           Southwesto.9x         0.54         x         3.77         x         69.27         0.55         x         0.65         =         60.82         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         45.37         (79)           Southwesto.9x         0.54         x         3.77         x         44.07         0.55         x         0.65         =         28.87         (79)           West         0.9x         0.54         x         3.77         x         19.64         x         0.55         x         0.65         =         20.63         (79)           West	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	106.25		0.55	X	0.65	=	69.6	(79)
Southwest0.9x       0.54       x       3.77       x       113.91       0.55       x       0.65       =       74.61       (79)         Southwest0.9x       0.54       x       3.77       x       104.39       0.55       x       0.65       =       68.38       (79)         Southwest0.9x       0.54       x       3.77       x       69.27       0.55       x       0.65       =       60.82       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       45.37       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       28.87       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x <td< td=""><td>Southwest<sub>0.9x</sub></td><td>0.54</td><td>X</td><td>3.77</td><td>x</td><td>119.01</td><td></td><td>0.55</td><td>X</td><td>0.65</td><td>=</td><td>77.95</td><td>(79)</td></td<>	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	119.01		0.55	X	0.65	=	77.95	(79)
Southwest0.9x       0.54       x       3.77       x       104.39       0.55       x       0.65       =       68.38       (79)         Southwest0.9x       0.54       x       3.77       x       92.85       0.55       x       0.65       =       60.82       (79)         Southwest0.9x       0.54       x       3.77       x       69.27       0.55       x       0.65       =       45.37       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	118.15		0.55	x	0.65	=	77.39	(79)
Southwest0.9x       0.54       x       3.77       x       92.85       0.55       x       0.65       =       60.82       (79)         Southwest0.9x       0.54       x       3.77       x       69.27       0.55       x       0.65       =       45.37       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       25.17       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	113.91		0.55	x	0.65	=	74.61	(79)
Southwest0.9x       0.54       x       3.77       x       69.27       0.55       x       0.65       =       45.37       (79)         Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       25.17       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	104.39		0.55	X	0.65	=	68.38	(79)
Southwest0.9x       0.54       x       3.77       x       44.07       0.55       x       0.65       =       28.87       (79)         Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	92.85		0.55	X	0.65	=	60.82	(79)
Southwest0.9x       0.54       x       3.77       x       31.49       0.55       x       0.65       =       20.63       (79)         West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	69.27		0.55	x	0.65	=	45.37	(79)
West       0.9x       0.54       x       3.77       x       19.64       x       0.55       x       0.65       =       12.86       (80)         West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	X	44.07		0.55	x	0.65	=	28.87	(79)
West       0.9x       0.54       x       3.77       x       38.42       x       0.55       x       0.65       =       25.17       (80)         West       0.9x       0.54       x       3.77       x       63.27       x       0.55       x       0.65       =       41.45       (80)	Southwest <sub>0.9x</sub>	0.54	X	3.77	x	31.49		0.55	x	0.65	=	20.63	(79)
West 0.9x 0.54 x 3.77 x 63.27 x 0.55 x 0.65 = 41.45 (80)	West 0.9x	0.54	X	3.77	x	19.64	X	0.55	x	0.65	] =	12.86	(80)
	West 0.9x	0.54	X	3.77	x	38.42	X	0.55	x	0.65	=	25.17	(80)
	West 0.9x	0.54	X	3.77	x	63.27	x	0.55	x	0.65	] =	41.45	(80)
0.01	L	0.54	X	3.77	x	92.28	X	0.55	x	0.65	] =	60.45	(80)
West $0.9x$ 0.54 $\times$ 3.77 $\times$ 113.09 $\times$ 0.55 $\times$ 0.65 = 74.08 (80)	West 0.9x	0.54	X	3.77	X	113.09	X	0.55	X	0.65	] =	74.08	(80)



West	0.9x	0.54	x	3.7	7	x	1	15.77	x [	0.55	x	0.65	=	75.83	(80)
West	0.9x	0.54	х	3.7	7	x	1	10.22	x	0.55	x	0.65	=	72.2	(80)
West	0.9x	0.54	x	3.7	7	x	9	4.68	x	0.55	x	0.65	=	62.01	(80)
West	0.9x	0.54	x	3.7	7	x	7	3.59	x	0.55	x	0.65	=	48.2	(80)
West	0.9x	0.54	x	3.7	7	x	4	5.59	x	0.55	x	0.65	=	29.86	(80)
West	0.9x	0.54	x	3.7	7	x	2	4.49	x	0.55	x	0.65	=	16.04	(80)
West	0.9x	0.54	x	3.7	7	x	1	6.15	x [	0.55	x	0.65	=	10.58	(80)
•	gains in wat					1			<del>`</del>	Sum(74)m .	<del>`</del>	1	ı	I	
(83)m=			7.02	260.57	305.68	Ь_	09.22	295.75	261.4	4 219.04	153.42	93.39	65.57		(83)
_	gains – inter			<del>` ´ </del>	, ,	·			707.0	745 70	747.44	C00.05	704.50	1	(04)
(84)m=	734.93 79	0.31   828	3.22	854.77	861.22	82	29.33	794.24	767.8	745.78	717.41	699.65	704.56		(84)
	ean internal														_
•	erature dur	Ū	٠.			•			ole 9,	Γh1 (°C)				21	(85)
Utilisa	ation factor	<del></del>				È				1 -			_	Ī	
	-		/lar	Apr	May	$\vdash$	Jun	Jul	Aug	<del></del>	Oct	Nov	Dec		(00)
(86)m=	1	1	1	1	1	_ C	).99	0.97	0.97	0.99	1	1	1		(86)
Mean	internal ter		T					ps 3 to 7		<u> </u>					
(87)m=	19.17	3.86 19	.13	19.54	19.97	2	0.41	20.67	20.64	20.29	19.76	19.2	18.77		(87)
Temp	erature dur	ing heati	ing pe	eriods ir	rest of	dw	elling	from Ta	able 9,	Th2 (°C)					
(88)m=	19.46 19	9.47 19	.48	19.53	19.54	1:	9.58	19.58	19.5	19.56	19.54	19.52	19.5		(88)
Utilisa	ation factor	for gains	for r	est of d	welling,	h2,	m (se	e Table	9a)						
(89)m=	1	1	1	1	0.99	C	).97	0.9	0.92	0.99	1	1	1		(89)
Mean	internal ter	nperatur	e in t	he rest	of dwell	ing	T2 (f	ollow ste	eps 3 t	o 7 in Tab	le 9c)				
(90)m=	16.48	6.67 17	.07	17.72	18.34		19	19.36	19.33	18.83	18.03	17.23	16.55		(90)
	-			-					-	1	fLA = Livir	ig area ÷ (	4) =	0.22	(91)
Mean	internal ter	mperatur	e (foi	the wh	ole dwe	lling	g) = fl	_A × T1	+ (1 –	fLA) × T2					
(92)m=			.53	18.13	18.7	_	9.31	19.65	19.62		18.42	17.67	17.05		(92)
Apply	adjustmen	t to the n	nean	internal	temper	atu	re fro	m Table	4e, w	here appro	opriate				
(93)m=	17.08 17	7.16 17	.53	18.13	18.7	1	9.31	19.65	19.62	19.15	18.42	17.67	17.05		(93)
	ace heating														
	ï to the mea tilisation fac			•		ned	at ste	ep 11 of	Table	9b, so tha	ıt Ti,m=(	76)m an	d re-calc	culate	
			/lar	Apr	May	Γ,	Jun	Jul	Aug	g Sep	Oct	Nov	Dec		
Utilisa	ation factor					<u> </u>			<u> </u>	9					
(94)m=	1	1	1	1	0.99	C	).97	0.91	0.93	0.98	1	1	1		(94)
Usefu	ıl gains, hm	Gm , W	= (94	)m x (84	1)m							-		•	
(95)m=	734.36 78	9.41 826	6.65	851.58	852.96	80	)3.95	721.03	710.9	732.75	714.82	698.82	704.11		(95)
	hly average	1		i							·	i	i	ı	
(96)m=			.5	8.9	11.7	<u> </u>	14.6	16.6	16.4		10.6	7.1	4.2		(96)
	loss rate for					_		=[(39)m : 1142.09		<del></del>		4160.05	E107.00	1	(97)
(97)m=	5278.24 502 e heating re									1916.64 17)m – (95		<u> </u>	5137.26		(31)
(98)m=	3380.65 28 <sup>4</sup>					V V I I/	0 0	n = 0.02	24 X [(\$	0	<del>i                                    </del>	2492.52	3298.26		
(00)111–	2000.00 20	.5.55	0.00	1002.12	1000.01	<u> </u>					1722.00	2-52.52	3200.20		



Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	19825.3	(98)
Space heating requirement in kWh/m²/year	87.11	(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	383.02	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	kWh/ye	ar
Space heating requirement (calculated above)  3380.65 2843.86 2719.33 1982.12 1385.91 0 0 0 1722.65 2492.52 3298.26		
		(5.4.4)
$ (211)m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ 882.64 742.49 709.98 517.5 361.84 0 0 0 0 449.76 650.76 861.13 $		(211)
Total (kWh/year) =Sum(211) <sub>151012</sub> =	5176.11	(211)
Space heating fuel (secondary), kWh/month		<b>`</b> ′
$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0		
Total (kWh/year) =Sum(215) <sub>15,1012</sub> =	0	(215)
Water heating		
Output from water heater (calculated above)  238.07 210.06 221.15 199 195.56 175.52 169.32 184.77 184.12 206.32 217.21 232.59		
Efficiency of water heater	300.39	(216)
(217)m= 300.39 300.39 300.39 300.39 300.39 300.39 300.39 300.39 300.39 300.39 300.39		(217)
Fuel for water heating, kWh/month		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		
Total = Sum(219a) <sub>112</sub> =	810.18	(219)
Annual totals kWh/year	kWh/yea	 r
Space heating fuel used, main system 1	5176.11	
Water heating fuel used	810.18	
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)(230g) =	0	(231)
Electricity for lighting	804.3	(232)
12a. CO2 emissions – Individual heating systems including micro-CHP		
Energy Emission factor kWh/year kg CO2/kWh	Emissions kg CO2/ye	
Space heating (main system 1) (211) x 0.519 =	2686.4	(261)
Space heating (secondary) (215) x 0.519 =	0	(263)



Space and water heating	(261) + (262) + (263) + (2	64) =	3106.88	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	0	(267)
Electricity for lighting	(232) x	0.519	417.43	(268)
Total CO2, kg/year		sum of (265)(271) =	3524.32	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	15.48	(273)
El rating (section 14)			83	(274)





User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 7 - Existing Be-Green - 3B6P - MF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 250.9 (1a) x (2a) =(3a) 4.4 1103.96 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)250.9 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =1103.96 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.04 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.79 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.73 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjusted infiltration rate (allowing for shelter and wind speed) = $(2$	21a) x (22a)m
0.93 0.91 0.89 0.8 0.78 0.69 0.69	0.67 0.73 0.78 0.82 0.85
Calculate effective air change rate for the applicable case If mechanical ventilation:	(220)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)	0   (23a) )) otherwise (23b) = (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from T	
	(=55)
a) If balanced mechanical ventilation with heat recovery (MVHF	$(24a) = (22b) + (23b) \times [1 - (23c) \div 100]$ $0  0  0  0  0  (24a)$
b) If balanced mechanical ventilation without heat recovery (MV	
(24b)m= 0 0 0 0 0 0 0 0	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
c) If whole house extract ventilation or positive input ventilation	
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c)$	
(24c)m= 0 0 0 0 0 0 0	0 0 0 0 0 (24c)
d) If natural ventilation or whole house positive input ventilation	from loft
if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.8$	
(24d)m= 0.93 0.91 0.9 0.82 0.81 0.74 0.74	0.73 0.76 0.81 0.83 0.87 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d)	in box (25)
(25)m= 0.93 0.91 0.9 0.82 0.81 0.74 0.74	0.73 0.76 0.81 0.83 0.87 (25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross area (m²) Openings Net Area A ,m²	U-value A X U k-value A X k W/m2K (W/K) kJ/m²-K kJ/K
	$/(1.8) + 0.04] = 25.04 \tag{27}$
	/(1.8) + 0.04] = 49.65  (27)
	40.00
(0.000	/(1.8) + 0.04] = 18.19 (27)
Windows Type 4 4.81 x1/[1.	/(1.8) + 0.04] =
Windows Type 5 7.72 x1/[1.	/(1.8) + 0.04] = 8.08   (27)
Windows Type 5 7.72 x1/[1.	/(1.8) + 0.04] = 8.08 $/(1.8) + 0.04] = 12.96 $ (27)
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]	/(1.8) + 0.04] = 8.08 $/(1.8) + 0.04] = 12.96$ $/(1.8) + 0.04] = 12.29$ (27)
Windows Type 5       7.72       x1/[1/2]         Windows Type 6       7.32       x1/[1/2]         Walls Type 1       337.79       75.17       262.62       x	/(1.8) + 0.04] = 8.08 $ /(1.8) + 0.04] = 12.96 $ $ /(1.8) + 0.04] = 12.29 $ $ 0.35 = 91.92 $ $ (27) $ $ (29)$
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type 1       337.79       75.17       262.62       x         Walls Type 2       58.52       0       58.52       x	
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type 1       337.79       75.17       262.62       x         Walls Type 2       58.52       0       58.52       x         Total area of elements, m²       396.31	
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type 1       337.79       75.17       262.62       x         Walls Type 2       58.52       0       58.52       x         Total area of elements, m²       396.31         Party wall       11.35       x	
Windows Type 5       7.72       x1/[1]         Windows Type 6       7.32       x1/[1]         Walls Type1       337.79       75.17       262.62       x         Walls Type2       58.52       0       58.52       x         Total area of elements, m²       396.31         Party wall       11.35       x         Party floor       251.47	
Windows Type 5  Windows Type 6  T.72  X1/[1]  Windows Type 6  Walls Type 1  337.79  75.17  262.62  X  Walls Type 2  58.52  Total area of elements, m <sup>2</sup> Party wall  Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for ** include the areas on both sides of internal walls and partitions	
Windows Type 5  Windows Type 6  T.72  X1/[1, Windows Type 6  Walls Type 1  337.79  75.17  262.62  X  Walls Type 2  58.52  Total area of elements, m <sup>2</sup> Party wall  Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for ** include the areas on both sides of internal walls and partitions	
Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  S8.52  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for ** include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)   7.72  x1/[1]  x1/[	J(1.8) + 0.04] = 8.08 (27) J(1.8) + 0.04] = 12.96 (27) J(1.8) + 0.04] = 12.29 (27) J(1.8) + 0.04] = 12.29 (29) J(1.8) + 0.04] = 12.29 (31) J(1.8) + 0.04] = 12.29 (32) J(1.8) + 0.04] = 12.29 (33)
Windows Type 5  Windows Type 6  Walls Type 1  Walls Type 2  58.52  Total area of elements, m <sup>2</sup> Party wall  Party floor  Party ceiling  * for windows and roof windows, use effective window U-value calculated using for the include the areas on both sides of internal walls and partitions  Fabric heat loss, W/K = S (A x U)  Heat capacity Cm = S(A x k)	J(1.8) + 0.04] = 8.08 (27) J(1.8) + 0.04] = 12.96 (27) J(1.8) + 0.04] = 12.29 (27) J(1.8) + 0.04] = 12.29 (29) J(1.8) + 0.04] = 12.29 (31) J(1.8) + 0.04] = 12.29 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (34) J(1.8) + 0.04 (35) J(1.8) + 0.04 (36) J(1.8) + 0.04 (37) J(1.8) + 0.04 (38) J(1.8) + 0.04 (39) J(1.8) + 0.04 (30) J(1.8) + 0.04 (31) J(1.8) + 0.04 (32)
Windows Type 5	J(1.8) + 0.04] = 8.08 (27) J(1.8) + 0.04] = 12.96 (27) J(1.8) + 0.04] = 12.29 (27) J(1.8) + 0.04] = 12.29 (29) J(1.8) + 0.04] = 12.29 (31) J(1.8) + 0.04] = 12.29 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (34) J(1.8) + 0.04 (35) J(1.8) + 0.04 (36) J(1.8) + 0.04 (37) J(1.8) + 0.04 (38) J(1.8) + 0.04 (38) J(1.8) + 0.04 (39) J(1.8) + 0.04 (30) J(1.8) + 0.04 (31) J(1.8) + 0.04 (32) J(1.8) + 0.04 (32) J(1.8) + 0.04 (33) J(1.8) + 0.04 (34) J(1.8) + 0.04 (35)



Total fabria boot loss	(22) + (26)			7(07)
Total fabric heat loss  Ventilation heat loss calculated monthly	(33) + (36) = $(38)m = 0.33 \times$	(25)m v (5)	295.54	(37)
Jan Feb Mar Apr May Jun Jul	Aug Sep Oct	Nov Dec	1	
(38)m= 338.77 332.69 326.73 298.73 293.49 269.1 269.1	264.59 278.5 293.49	304.09 315.17	1	(38)
Heat transfer coefficient, W/K	(39)m = $(37)$ + $(39)$ m		J	
(39)m= 634.31 628.23 622.27 594.27 589.03 564.65 564.65	560.13 574.04 589.03	599.63 610.71	1	
	Average =	: Sum(39) <sub>112</sub> /12=	594.25	(39)
Heat loss parameter (HLP), W/m²K	(40)m = $(39)$ m -	- (4)		
(40)m= 2.53 2.5 2.48 2.37 2.35 2.25 2.25	2.23 2.29 2.35	2.39 2.43		<b>-</b>
Number of days in month (Table 1a)	Average =	: Sum(40) <sub>112</sub> /12=	2.37	(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:	
Assumed occupancy, N		3.07	1	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9	9)2)] + 0.0013 x (TFA -13		]	(42)
if TFA £ 13.9, $N = 1$	(25 × N) + 20		1	(10)
Annual average hot water usage in litres per day Vd,average = Reduce the annual average hot water usage by 5% if the dwelling is designed		107.07	]	(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= 117.77 113.49 109.21 104.93 100.64 96.36 96.36	100.64 104.93 109.21	113.49 117.77		<b>-</b>
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x l		m(44) <sub>112</sub> = ables 1b, 1c, 1d)	1284.81	(44)
(45)m= 174.66 152.75 157.63 137.43 131.86 113.79 105.44	120.99 122.44 142.69	155.76 169.14	]	
		ım(45) <sub>112</sub> =	1684.59	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in	· · · · ·		1	(15)
(46)m= 26.2 22.91 23.64 20.61 19.78 17.07 15.82 Water storage loss:	18.15 18.37 21.4	23.36 25.37	]	(46)
Storage volume (litres) including any solar or WWHRS storage	within same vessel	305	1	(47)
If community heating and no tank in dwelling, enter 110 litres in	n (47)		_	
Otherwise if no stored hot water (this includes instantaneous co	ombi boilers) enter '0' in	(47)		
Water storage loss:			٦	
a) If manufacturer's declared loss factor is known (kWh/day):		1.63	]	(48)
Temperature factor from Table 2b	(40) (40)	0.54	]	(49)
Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor is not known:	$(48) \times (49) =$	0.88	J	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	]	(51)
If community heating see section 4.3			<u>-</u>	
Volume factor from Table 2a		0	1	(52)
Temperature factor from Table 2b			1	(53)
	(47) (54) (50)	0	] 7	
Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53) =	0 0.88		(54) (55)



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29	(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= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 37.3 33.69 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3	(59)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total 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= 239.24 211.09 222.21 199.93 196.45 176.29 170.02 185.58 184.94 207.28 218.26 233.73	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 239.24 211.09 222.21 199.93 196.45 176.29 170.02 185.58 184.94 207.28 218.26 233.73	
Output from water heater (annual) <sub>112</sub> 2445.01	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 109.74 97.46 104.08 95.69 95.51 87.83 86.73 91.9 90.71 99.11 101.79 107.91	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 153.4 15	(66) (67)
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= 153.4 15	, ,
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= 153.4 15	, ,
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= 153.4 1	(67)
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= 153.4 15	(67)
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= 153.4 15	(67) (68)
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= 153.4 15	(67) (68)
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= 153.4 15	(67) (68) (69)
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= 153.4 15	(67) (68) (69)
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= 153.4 15	(67) (68) (69) (70)
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	(67) (68) (69) (70)
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	(67) (68) (69) (70) (71)
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	(67) (68) (69) (70) (71)

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

6. Solar gains:



Orientation: Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast <sub>0.9x</sub> 0.54	x	10.84	x	11.28	x	0.55	x	0.65	=	21.24	(75)
Northeast 0.9x 0.77	x	4.81	x	11.28	x	0.55	X	0.65	=	13.45	(75)
Northeast 0.9x 0.77	x	7.72	x	11.28	x	0.55	X	0.65	=	21.58	(75)
Northeast 0.9x 0.77	x	7.32	х	11.28	x	0.55	x	0.65	=	20.46	(75)
Northeast 0.9x 0.54	X	10.84	x	22.97	x	0.55	x	0.65	=	43.24	(75)
Northeast 0.9x 0.77	X	4.81	x	22.97	x	0.55	x	0.65	=	27.37	(75)
Northeast 0.9x 0.77	X	7.72	x	22.97	x	0.55	x	0.65	=	43.93	(75)
Northeast 0.9x 0.77	x	7.32	x	22.97	x	0.55	X	0.65	=	41.65	(75)
Northeast 0.9x 0.54	x	10.84	x	41.38	x	0.55	x	0.65	=	77.9	(75)
Northeast 0.9x 0.77	x	4.81	x	41.38	x	0.55	X	0.65	=	49.31	(75)
Northeast 0.9x 0.77	x	7.72	x	41.38	x	0.55	X	0.65	=	79.14	(75)
Northeast 0.9x 0.77	x	7.32	х	41.38	x	0.55	X	0.65	=	75.04	(75)
Northeast 0.9x 0.54	x	10.84	х	67.96	x	0.55	x	0.65	=	127.94	(75)
Northeast 0.9x 0.77	x	4.81	x	67.96	x	0.55	X	0.65	=	80.98	(75)
Northeast 0.9x 0.77	x	7.72	х	67.96	x	0.55	x	0.65	=	129.97	(75)
Northeast 0.9x 0.77	X	7.32	X	67.96	Х	0.55	X	0.65		123.24	(75)
Northeast 0.9x 0.54	X	10.84	х	91.35	х	0.55	x	0.65		171.98	(75)
Northeast 0.9x 0.77	x	4.81	х	91.35	×	0.55	x	0.65	=	108.85	(75)
Northeast 0.9x 0.77	x	7.72	x	91.35	x	0.55	x	0.65	=	174.71	(75)
Northeast 0.9x 0.77	x	7.32	x	91.35	Х	0.55	x	0.65	=	165.66	(75)
Northeast <sub>0.9x</sub> 0.54	X	10.84	x	97.38	х	0.55	x	0.65	j =	183.35	(75)
Northeast 0.9x 0.77	x	4.81	х	97.38	x	0.55	x	0.65	=	116.05	(75)
Northeast 0.9x 0.77	x	7.72	х	97.38	x	0.55	x	0.65	=	186.26	(75)
Northeast 0.9x 0.77	x	7.32	x	97.38	x	0.55	x	0.65	=	176.61	(75)
Northeast 0.9x 0.54	x	10.84	x	91.1	x	0.55	x	0.65	=	171.52	(75)
Northeast 0.9x 0.77	x	4.81	x	91.1	x	0.55	x	0.65	=	108.56	(75)
Northeast 0.9x 0.77	x	7.72	х	91.1	x	0.55	x	0.65	=	174.24	(75)
Northeast 0.9x 0.77	x	7.32	х	91.1	x	0.55	X	0.65	=	165.21	(75)
Northeast 0.9x 0.54	X	10.84	х	72.63	x	0.55	X	0.65	=	136.73	(75)
Northeast 0.9x 0.77	x	4.81	x	72.63	х	0.55	x	0.65	=	86.55	(75)
Northeast 0.9x 0.77	x	7.72	x	72.63	х	0.55	x	0.65	=	138.91	(75)
Northeast 0.9x 0.77	x	7.32	x	72.63	x	0.55	x	0.65	=	131.71	(75)
Northeast 0.9x 0.54	x	10.84	x	50.42	x	0.55	x	0.65	=	94.93	(75)
Northeast 0.9x 0.77	x	4.81	x	50.42	x	0.55	x	0.65	j =	60.08	(75)
Northeast 0.9x 0.77	x	7.72	x	50.42	x	0.55	x	0.65	j =	96.44	(75)
Northeast 0.9x 0.77	x	7.32	x	50.42	x	0.55	x	0.65	j =	91.44	(75)
Northeast <sub>0.9x</sub> 0.54	x	10.84	x	28.07	x	0.55	x	0.65	j =	52.84	(75)
Northeast 0.9x 0.77	x	4.81	x	28.07	x	0.55	x	0.65	j =	33.45	(75)
Northeast <sub>0.9x</sub> 0.77	X	7.72	х	28.07	х	0.55	X	0.65	=	53.68	(75)



Northeast 0.96												
Northeast 0.5%	Northeast 0.9x 0.77	X	7.32	x	28.07	X	0.55	x	0.65	=	50.9	(75)
Northeast 0.9,	Northeast 0.9x 0.54	X	10.84	x	14.2	x	0.55	x	0.65	=	26.73	(75)
Northeast 0.9x	Northeast 0.9x 0.77	X	4.81	x	14.2	x	0.55	x	0.65	=	16.92	(75)
Northeast 0.9x	Northeast 0.9x 0.77	X	7.72	x	14.2	x	0.55	x	0.65	=	27.15	(75)
Northeast 0.9x	Northeast 0.9x 0.77	X	7.32	x	14.2	x	0.55	x	0.65	=	25.75	(75)
Northeast 0.0x	Northeast 0.9x 0.54	X	10.84	x	9.21	x	0.55	x	0.65	=	17.35	(75)
Northeast 0.0x	Northeast 0.9x 0.77	X	4.81	x	9.21	X	0.55	x	0.65	=	10.98	(75)
Southwesto, 9x	Northeast 0.9x 0.77	X	7.72	x	9.21	X	0.55	x	0.65	=	17.62	(75)
Southwesto, 9x	Northeast 0.9x 0.77	X	7.32	x	9.21	X	0.55	x	0.65	=	16.71	(75)
Southwesto, 9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	36.79	]	0.55	x	0.65	=	135.91	(79)
Southwesto.sk 0.77 x 29.57 x 62.67 0.55 x 0.66 = 456.14 (79)  Southwesto.sk 0.77 x 14.91 x 85.75 0.55 x 0.65 = 316.76 (79)  Southwesto.sk 0.77 x 14.91 x 106.25 0.55 x 0.65 = 322.48 (79)  Southwesto.sk 0.77 x 14.91 x 106.25 0.55 x 0.65 = 322.86 (79)  Southwesto.sk 0.77 x 14.91 x 106.25 0.55 x 0.65 = 322.86 (79)  Southwesto.sk 0.77 x 14.91 x 119.01 0.55 x 0.65 = 438.42 (79)  Southwesto.sk 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79)  Southwesto.sk 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79)  Southwesto.sk 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79)  Southwesto.sk 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79)  Southwesto.sk 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79)  Southwesto.sk 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79)  Southwesto.sk 0.77 x 14.91 x 113.91 0.55 x 0.65 = 420.77 (79)  Southwesto.sk 0.77 x 14.91 x 113.91 0.55 x 0.65 = 420.77 (79)  Southwesto.sk 0.77 x 29.57 x 113.91 0.55 x 0.65 = 420.77 (79)  Southwesto.sk 0.77 x 29.57 x 14.91 x 13.91 0.55 x 0.65 = 420.77 (79)  Southwesto.sk 0.77 x 29.57 x 14.91 x 13.91 0.55 x 0.65 = 420.77 (79)  Southwesto.sk 0.77 x 29.57 x 14.91 x 13.91 0.55 x 0.65 = 336.51 (79)  Southwesto.sk 0.77 x 29.57 x 14.91 x 13.91 0.55 x 0.65 = 336.51 (79)  Southwesto.sk 0.77 x 29.57 x 14.91 x 13.91 0.55 x 0.65 = 336.51 (79)  Southwesto.sk 0.77 x 29.57 x 14.91 x 13.91 0.55 x 0.65 = 336.51 (79)  Southwesto.sk 0.77 x 14.91 x 69.27 0.55 x 0.65 = 336.61 (79)  Southwesto.sk 0.77 x 14.91 x 44.07 0.55 x 0.66 = 32.286 (79)  Southwesto.sk 0.77 x 14.91 x 31.49 0.55 x 0.65 = 255.87 (79)  Southwesto.sk 0.77 x 14.91 x 31.49 0.55 x 0.66 = 320.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 320.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 320.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 230.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 320.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 320.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 230.68 (79)  Southwesto.sk 0.77 x 29.57 x 31.49 0.55 x 0.66 = 230.68 (79)	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	36.79	]	0.55	x	0.65	=	269.55	(79)
Southwesto,9x 0.77 x 14.91 x 85.75 0.55 x 0.65 = 316.76 (79)  Southwesto,9x 0.77 x 29.57 x 85.75 0.55 x 0.65 = 628.21 (79)  Southwesto,9x 0.77 x 14.91 x 106.25 0.55 x 0.65 = 322.48 (79)  Southwesto,9x 0.77 x 14.91 x 119.01 0.55 x 0.65 = 322.48 (79)  Southwesto,9x 0.77 x 14.91 x 119.01 0.55 x 0.65 = 438.62 (79)  Southwesto,9x 0.77 x 14.91 x 119.01 0.55 x 0.65 = 871.88 (79)  Southwesto,9x 0.77 x 14.91 x 119.01 0.55 x 0.65 = 438.62 (79)  Southwesto,9x 0.77 x 14.91 x 118.15 0.55 x 0.65 = 438.44 (79)  Southwesto,9x 0.77 x 29.57 x 116.15 0.55 x 0.65 = 438.44 (79)  Southwesto,9x 0.77 x 14.91 x 113.91 0.55 x 0.65 = 420.77 (79)  Southwesto,9x 0.77 x 29.57 x 113.91 0.55 x 0.65 = 420.77 (79)  Southwesto,9x 0.77 x 29.57 x 114.91 x 118.45 0.55 x 0.65 = 420.77 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 14.91 x 164.39 0.55 x 0.65 = 420.77 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 14.91 x 164.39 0.55 x 0.65 = 385.61 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 19.25 x 0.65 = 342.99 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 19.25 x 0.65 = 342.99 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 19.25 x 0.65 = 342.99 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 19.25 x 0.65 = 342.99 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 19.25 x 0.55 x 0.65 = 342.99 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 19.25 x 0.55 x 0.65 = 325.67 (79)  Southwesto,9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 325.67 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 232.86 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 323.68 (79)  Southwe	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	62.67	]	0.55	x	0.65	=	231.51	(79)
Southwesto,9x 0.77 x 29.57 x 14.91 x 119.01 0.55 x 0.65 = 392.48 (79)  Southwesto,9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 778.39 (79)  Southwesto,9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 871.86 (79)  Southwesto,9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 871.86 (79)  Southwesto,9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 871.86 (79)  Southwesto,9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 871.86 (79)  Southwesto,9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 871.86 (79)  Southwesto,9x 0.77 x 29.57 x 113.91 0.55 x 0.65 = 420.77 (79)  Southwesto,9x 0.77 x 14.91 x 118.15 0.55 x 0.65 = 883.49 (79)  Southwesto,9x 0.77 x 14.91 x 113.91 0.55 x 0.65 = 883.49 (79)  Southwesto,9x 0.77 x 29.57 x 114.91 x 104.39 0.55 x 0.65 = 883.49 (79)  Southwesto,9x 0.77 x 29.57 x 104.39 0.55 x 0.65 = 883.49 (79)  Southwesto,9x 0.77 x 29.57 x 104.39 0.55 x 0.65 = 883.49 (79)  Southwesto,9x 0.77 x 29.57 x 14.91 x 16.439 0.55 x 0.65 = 385.61 (79)  Southwesto,9x 0.77 x 14.91 x 92.85 0.55 x 0.65 = 342.99 (79)  Southwesto,9x 0.77 x 14.91 x 69.27 0.55 x 0.65 = 680.22 (79)  Southwesto,9x 0.77 x 14.91 x 44.07 0.55 x 0.65 = 500.74.5 (79)  Southwesto,9x 0.77 x 14.91 x 44.07 0.55 x 0.65 = 500.74.5 (79)  Southwesto,9x 0.77 x 14.91 x 44.07 0.55 x 0.65 = 500.74.5 (79)  Southwesto,9x 0.77 x 29.57 x 44.07 0.55 x 0.65 = 500.74.5 (79)  Southwesto,9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 322.86 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 29.57 x 44.07 0.55 x 0.65 = 500.82 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 200.68 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 162.79 (79)  Southwesto,9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 200.68 (79)	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	62.67	]	0.55	x	0.65	=	459.14	(79)
Southwesto,9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	85.75	]	0.55	x	0.65	=	316.76	(79)
Southwesto.9x	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	85.75	]	0.55	x	0.65	=	628.21	(79)
Southwest0.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	106.25	]	0.55	x	0.65	=	392.48	(79)
Southwest0.9x 0.77 x 29.57 x 119.01 0.55 x 0.65 = 871.86 (79) Southwest0.9x 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79) Southwest0.9x 0.77 x 14.91 x 113.91 0.55 x 0.65 = 886.55 (79) Southwest0.9x 0.77 x 14.91 x 113.91 0.55 x 0.65 = 834.49 (79) Southwest0.9x 0.77 x 14.91 x 194.39 0.55 x 0.65 = 834.49 (79) Southwest0.9x 0.77 x 14.91 x 194.39 0.55 x 0.65 = 386.61 (79) Southwest0.9x 0.77 x 14.91 x 92.85 0.55 x 0.65 = 764.75 (79) Southwest0.9x 0.77 x 14.91 x 92.85 0.55 x 0.65 = 342.99 (79) Southwest0.9x 0.77 x 14.91 x 69.27 0.55 x 0.65 = 680.22 (79) Southwest0.9x 0.77 x 14.91 x 69.27 0.55 x 0.65 = 557.45 (79) Southwest0.9x 0.77 x 14.91 x 44.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.40 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.91 x 14.07 0.55 x 0.65 = 162.79 (79) Southwest0.9x 0.77 x 14.91 x 14.91 x 14.07 0.55 x	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	106.25	]	0.55	x	0.65	=	778.39	(79)
Southwesto, 9x 0.77 x 14.91 x 118.15 0.55 x 0.65 = 436.44 (79) Southwesto, 9x 0.77 x 14.91 x 113.91 0.55 x 0.65 = 420.77 (79) Southwesto, 9x 0.77 x 14.91 x 113.91 0.55 x 0.65 = 834.49 (79) Southwesto, 9x 0.77 x 14.91 x 104.39 0.55 x 0.65 = 834.49 (79) Southwesto, 9x 0.77 x 14.91 x 92.85 0.55 x 0.65 = 385.61 (79) Southwesto, 9x 0.77 x 14.91 x 92.85 0.55 x 0.65 = 764.75 (79) Southwesto, 9x 0.77 x 14.91 x 92.85 0.55 x 0.65 = 342.99 (79) Southwesto, 9x 0.77 x 14.91 x 69.27 0.55 x 0.65 = 680.22 (79) Southwesto, 9x 0.77 x 14.91 x 69.27 0.55 x 0.65 = 255.87 (79) Southwesto, 9x 0.77 x 14.91 x 69.27 0.55 x 0.65 = 507.45 (79) Southwesto, 9x 0.77 x 14.91 x 44.07 0.55 x 0.65 = 162.79 (79) Southwesto, 9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 162.79 (79) Southwesto, 9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 232.86 (79) Southwesto, 9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 322.86 (79) Southwesto, 9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 14.91 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79) Southwesto, 9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79)	Southwest <sub>0.9x</sub> 0.77	X	14.91	X	119.01		0.55	X	0.65	=	439.62	(79)
Southwesto, 9x 0.77	Southwest <sub>0.9x</sub> 0.77	X	29.57	х	119.01		0.55	x	0.65		871.86	(79)
Southwesto.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	х	118.15		0.55	x	0.65	=	436.44	(79)
Southwest0.9x	Southwest <sub>0.9x</sub> 0.77	x	29.57	x	118.15		0.55	x	0.65	=	865.55	(79)
Southwest0.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	113.91		0.55	х	0.65	=	420.77	(79)
Southwesto,9x	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	113.91		0.55	х	0.65	=	834.49	(79)
Southwest0.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	104.39	]	0.55	Х	0.65	=	385.61	(79)
Southwest0,9x	Southwest <sub>0.9x</sub> 0.77	X	29.57	X	104.39	]	0.55	x	0.65	=	764.75	(79)
Southwest0.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	X	92.85		0.55	x	0.65	=	342.99	(79)
Southwesto.9x	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	92.85		0.55	x	0.65	=	680.22	(79)
Southwesto.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	X	69.27	]	0.55	x	0.65	=	255.87	(79)
Southwesto.9x	Southwest <sub>0.9x</sub> 0.77	X	29.57	x	69.27		0.55	x	0.65	=	507.45	(79)
Southwesto.9x	Southwest <sub>0.9x</sub> 0.77	X	14.91	X	44.07	]	0.55	x	0.65	=	162.79	(79)
Southwesto.9x 0.77 x 29.57 x 31.49 0.55 x 0.65 = 230.68 (79)  Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m  (83)m = 482.19 846.84 1226.37 1633.01 1932.67 1964.25 1874.79 1644.26 1366.1 954.19 582.19 409.65  Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)m = 1153.07 1515.41 1872.74 2242.64 2503.32 2498.6 2386.34 2162.59 1903.97 1529.04 1199.66 1060.7 (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)  Utilisation factor for gains for living area, h1,m (see Table 9a)		X	29.57	X	44.07		0.55	x	0.65	=	322.86	(79)
Solar gains in watts, calculated for each month  (83)m = Sum(74)m(82)m  (83)m = 482.19  846.84  1226.37  1633.01  1932.67  1964.25  1874.79  1644.26  1366.1  954.19  582.19  409.65  (83)  Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)m = 1153.07  1515.41  1872.74  2242.64  2503.32  2498.6  2386.34  2162.59  1903.97  1529.04  1199.66  1060.7  (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)	Southwest <sub>0.9x</sub> 0.77	X	14.91	x	31.49		0.55	x	0.65	=	116.31	(79)
(83)m= 482.19 846.84 1226.37 1633.01 1932.67 1964.25 1874.79 1644.26 1366.1 954.19 582.19 409.65  Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)m= 1153.07 1515.41 1872.74 2242.64 2503.32 2498.6 2386.34 2162.59 1903.97 1529.04 1199.66 1060.7  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)  Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest <sub>0.9x</sub> 0.77	X	29.57	X	31.49	]	0.55	X	0.65	=	230.68	(79)
(83)m= 482.19 846.84 1226.37 1633.01 1932.67 1964.25 1874.79 1644.26 1366.1 954.19 582.19 409.65  Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)m= 1153.07 1515.41 1872.74 2242.64 2503.32 2498.6 2386.34 2162.59 1903.97 1529.04 1199.66 1060.7  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)  Utilisation factor for gains for living area, h1,m (see Table 9a)												
Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)m= 1153.07 1515.41 1872.74 2242.64 2503.32 2498.6 2386.34 2162.59 1903.97 1529.04 1199.66 1060.7 (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)  Utilisation factor for gains for living area, h1,m (see Table 9a)	1 1		T T	$\neg$		Ė			T T		Ī	(00)
(84)m= 1153.07 1515.41 1872.74 2242.64 2503.32 2498.6 2386.34 2162.59 1903.97 1529.04 1199.66 1060.7 (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)  Utilisation factor for gains for living area, h1,m (see Table 9a)	` '					1644	1.26 1366.1	954.19	582.19	409.65		(83)
7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)  Utilisation factor for gains for living area, h1,m (see Table 9a)	<u> </u>		<del>`                                    </del>	<del>- `</del>	<del></del>	2160	50 1002 07	1520.04	1100 66	1060.7		(84)
Temperature during heating periods in the living area from Table 9, Th1 (°C)  21 (85)  Utilisation factor for gains for living area, h1,m (see Table 9a)			l		2300.34	12102	9 1803.97	1329.02	1133.00	1000.7		(04)
Utilisation factor for gains for living area, h1,m (see Table 9a)	•				,		TI 4 (0.0)					7,
		•		_		ole 9	Ih1 (°C)				21	(85)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec				Ť	<u> </u>			<b>2</b> - 1	N <sub>1</sub> , 1			
	Jan   Feb   M	viar	Apr   May	/	Jun   Jul	LA	ug   Sep	<u> Oct</u>	I NOV	Dec		



(86)m= 1 1 0.99 0.98 0.94 0.87 0.77 0.82 0.94 0.99 1 1		(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)		
(87)m= 20.65 19.33 18.85 19.45 20.05 20.56 20.8 20.75 20.32 19.58 18.8 19.2		(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)		
(88)m= 19 19.02 19.03 19.1 19.11 19.17 19.17 19.18 19.15 19.11 19.09 19.06		(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)		
(89)m= 1 0.99 0.99 0.97 0.91 0.77 0.55 0.62 0.88 0.98 1 1		(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)		
(90)m= 18.31 15.78 16.41 17.35 18.17 18.87 19.11 19.08 18.59 17.53 16.41 15.5		(90)
fLA = Living area ÷ (4) =	0.17	(91)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$		
(92)m= 18.71 16.38 16.82 17.71 18.49 19.15 19.39 19.37 18.89 17.88 16.81 16.13		(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate		
(93)m= 18.71 16.38 16.82 17.71 18.49 19.15 19.39 19.37 18.89 17.88 16.81 16.13		(93)
8. Space heating requirement		
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate utilisation factor for gains using Table 9a	ate	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Utilisation factor for gains, hm:		
(94)m= 1 0.99 0.98 0.95 0.89 0.76 0.58 0.65 0.87 0.97 0.99 1		(94)
Useful gains, hmGm , W = (94)m x (84)m		
(95)m= 1150.2 1501.33 1833.64 2134.09 2227.7 1909.34 1391.86 1401.39 1654.1 1482.32 1190.44 1057.31		(95)
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)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]		, ,
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ] (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18	ı	(96) (97)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]	ı	, ,
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04		, ,
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98) <sub>15912</sub> =	26801.39	(97)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98) <sub>159.12</sub> =  Space heating requirement in kWh/m²/year	26801.39	(97)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m— (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m — (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98) <sub>15912</sub> =  Space heating requirement in kWh/m²/year	26801.39	(97)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98) <sub>159.12</sub> =  Space heating requirement in kWh/m²/year	26801.39	(97)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98) <sub>15912</sub> =  Space heating requirement in kWh/m²/year  9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating:	26801.39 106.82	(97) (98) (99)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98)15912 =  Space heating requirements - Individual heating systems including micro-CHP)  Space heating: Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s)	26801.39	(97) (98) (99) (201)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98)t_s_s_12 =  Space heating requirements - Individual heating systems including micro-CHP)  Space heating:  Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s) (202) = 1 - (201) =  Fraction of total heating from main system 1 (204) = (202) x [1 - (203)] =	26801.39 106.82 0 1	(97) (98) (99) (201) (202) (204)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m ]  (97)m = 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m  (98)m = 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98)15912 =  Space heating requirement in kWh/m²/year  9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating:  Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s) (202) = 1 – (201) =  Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =  Efficiency of main space heating system 1	26801.39 106.82 0 1 1 350.65	(97) (98) (99) (201) (202) (204) (206)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m - (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98)15912 =  Space heating requirement in kWh/m²/year  9a. Energy requirements - Individual heating systems including micro-CHP)  Space heating:  Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s) (202) = 1 - (201) =  Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] =  Efficiency of secondary/supplementary heating system, %	26801.39 106.82 0 1 1 350.65	(97) (98) (99) (201) (202) (204) (206) (208)
Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]  (97)m = 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m  (98)m = 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98) <sub>1.59.12</sub> = Space heating requirement in kWh/m²/year  9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating: Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s)  [202] = 1 – (201) = Fraction of total heating from main system 1  [204] = (202) x [1 – (203)] = Efficiency of secondary/supplementary heating system, %  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	26801.39 106.82 0 1 1 350.65	(97) (98) (99) (201) (202) (204) (206) (208)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m - (96)m ]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98)15912 =  Space heating requirement in kWh/m²/year  9a. Energy requirements - Individual heating systems including micro-CHP)  Space heating:  Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s) (202) = 1 - (201) =  Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] =  Efficiency of secondary/supplementary heating system, %	26801.39 106.82 0 1 1 350.65	(97) (98) (99) (201) (202) (204) (206) (208)
Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]  (97)m= 9138.86 7214.12 6422.32 5234.71 3998.63 2570.9 1577.17 1661.5 2748.4 4287.12 5823.79 7283.18  Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m  (98)m= 5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 0 2086.77 3336.01 4632.04  Total per year (kWh/year) = Sum(98)48.12 = Space heating requirement in kWh/m²/year  9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating: Fraction of space heat from secondary/supplementary system  Fraction of total heating from main system 1 (202) = 1 – (201) = 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 Space heating requirement (calculated above)  5943.57 3838.99 3413.98 2232.45 1317.58 0 0 0 0 0 2086.77 3336.01 4632.04	26801.39 106.82 0 1 1 350.65 0 kWh/year	(97) (98) (99) (201) (202) (204) (206) (208)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m - (96)m]   (97)m = 9138.86   7214.12   6422.32   5234.71   3998.63   2570.9   1577.17   1661.5   2748.4   4287.12   5823.79   7283.18   Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m   (98)m = 5943.57   3838.99   3413.98   2232.45   1317.58   0   0   0   0   2086.77   3336.01   4632.04   Total per year (kWh/year) = Sum(98) <sub>1.58.12</sub> = Space heating requirement in kWh/m²/year   9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating: Fraction of space heat from secondary/supplementary system   (202) = 1 - (201) =   Fraction of total heating from main system 1   (204) = (202) x [1 - (203)] =   Efficiency of main space heating system 1   Efficiency of secondary/supplementary heating system, %	26801.39 106.82 0 1 1 350.65 0 kWh/year	(97) (98) (99) (201) (202) (204) (206) (208)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m - (96)m]   (97)m=   9138.86   7214.12   6422.32   5234.71   3998.63   2570.9   1577.17   1661.5   2748.4   4287.12   5823.79   7283.18   Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m   (98)m=   5943.57   3838.99   3413.98   2232.45   1317.58   0   0   0   0   2086.77   3336.01   4632.04   Total per year (kWh/year) = Sum(98)s	26801.39 106.82 0 1 1 350.65 0 kWh/year	(97) (98) (99) (201) (202) (204) (206) (208)



Space heating fuel (secondary), kWh/month									
$= \{[(98)m \times (201)]\} \times 100 \div (208)$ $(215)m =                                   $	0	0	0	0	0	0	0		
		<u> </u>	Tota	l (kWh/yea	ar) =Sum(2	1 215) <sub>15,1012</sub>	<b></b>	0	(215)
Water heating									_
Output from water heater (calculated above)								l	
239.24 211.09 222.21 199.93 196.45	176.29	170.02	185.58	184.94	207.28	218.26	233.73		<b>–</b>
Efficiency of water heater				_	1			300.39	(216)
(217)m= 300.39 300.39 300.39 300.39 300.39	300.39	300.39	300.39	300.39	300.39	300.39	300.39		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m									
(219)m= 79.64 70.27 73.98 66.56 65.4	58.69	56.6	61.78	61.57	69	72.66	77.81		
			Tota	I = Sum(2	19a) <sub>112</sub> =			813.95	(219)
Annual totals					k\	Wh/year	· '	kWh/yea	<u></u>
Space heating fuel used, main system 1								7643.37	
Water heating fuel used								813.95	
Electricity for pumps, fans and electric keep-hot									
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			0	(231)
Electricity for lighting								656.8	(232)
12a. CO2 emissions – Individual heating syste	ms inclu	uding mi	cro-CHF						
	<b>E</b> n kW	ergy /h/year	cro+CHF		kg CO			Emissions kg CO2/ye	ar
Space heating (main system 1)	<b>En</b> kW (21	ergy /h/year	cro <sub>*</sub> CHF			2/kWh	tor		
	<b>En</b> kW (21	ergy /h/year	cro-CHF		kg CO	2/kWh		kg CO2/ye	ar
Space heating (main system 1)	<b>En</b> kW (21	ergy /h/year 1) x	cro-CHF		kg CO:	2/kWh 19	= [	kg CO2/ye	ear (261)
Space heating (main system 1) Space heating (secondary)	En kW (21) (21)	ergy /h/year 1) x			0.5°	2/kWh 19	= [	kg CO2/ye	(261) (263)
Space heating (main system 1) Space heating (secondary) Water heating	En kW (21) (21) (21) (26)	hergy /h/year			0.5°	2/kWh 19 19	= [	3966.91 0 422.44	(261) (263) (264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	(215) (216) (216) (217) (217) (26) (23)	nergy /h/year 1) x 5) x 9) x			0.5 0.5 0.5	2/kWh 19 19 19	=	3966.91 0 422.44 4389.35	(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	(215) (216) (216) (217) (217) (26) (23)	nergy /h/year 1) x 5) x 9) x 1) + (262) -		(264) =	0.5 0.5 0.5 0.5	2/kWh 19 19 19	=	3966.91 0 422.44 4389.35	(261) (263) (264) (265) (267)

El rating (section 14)

(274)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 16 - Existing Be-Green - 3B4P - MF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Av. Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 270 (1a) x (2a) =885.6 (3a) 3.28 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)270 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =885.6 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a)3 30 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =0.03 (8)If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.78 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.73 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



Adjuste	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
[	0.92	0.91	0.89	0.8	0.78	0.69	0.69	0.67	0.73	0.78	0.82	0.85	]	
	ate effec chanica		•	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	3b) = (23a	) × Fmv (6	eguation (I	N5)) . othe	rwise (23b	o) = (23a)			0	(23a)
				iency in %						(===,			0	(23c)
			•	•	ŭ		`		,	2h)m + (:	23h) <b>x</b> [	1 – (23c)		(230)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
L	Dalance	d mecha	L anical ve	entilation	without	heat red	coverv (N	л ЛV) (24b	D)m = (2)	2b)m + (2	 23b)	ļ	J	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If v	whole h	ouse ex	tract ver	itilation c	r positiv	e input v	ventilatio	on from (	outside	<u>!</u>		Į.	J	
•					-	-				.5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
				ole hous m = (22b						0.5]				
(24d)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86	]	(24d)
Effec	tive air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in bo	x (25)	•			•	
(25)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86		(25)
3 Hea	at losses	and he	eat loss r	paramete	ir.					_				_
ELEM		Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	<)	k-value kJ/m²-l		A X k kJ/K
Windov	vs Type		(111)			22.26	<u> </u>	/[1/( 1.8 )+		37.38	<u> </u>	10/111 -1		(27)
	vs Type					2.47		/[1/( 1.8 )+		4.15	Ħ			(27)
	vs Type					2.47		/[1/( 1.8 )+		4.15	Ħ			(27)
	vs Type					3.861		/[1/( 1.8 )+		6.48	片			(27)
	vs Type					7.356	╡ .			12.35	$\exists$			(27)
	vs Type					10.78	= .			18.1	=			(27)
	vs Type					4.904				8.23				(27)
Walls T		258.	53	54.1	$\neg$	204.4		0.35		71.55	=			(29)
Walls T	•	40.2		0	=	40.28		0.31		12.37			-	(29)
	rea of e					298.8	=	0.01		12.01				(31)
Party w			,			17.06	=	0	=	0	<b>—</b> [			(32)
Party fl						271.8							<b></b>	(32a)
Party c						271.8							<b></b>	(32b)
* for wind	dows and			ffective wil		alue calcul		g formula 1	1/[(1/U-valu	ue)+0.04] a	s given in	paragraph		(020)
			= S (A x			<del>-</del>		(26)(30	) + (32) =				174.7	6 (33)
	apacity (		•	•					((28).	(30) + (32	2) + (32a).	(32e) =	36922.	
			,	P = Cm ÷	- TFA) in	kJ/m²K			Indica	ntive Value:	Medium		250	(35)
•	•		ere the de tailed calc		constructi	on are no	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Therma	al bridge	s : S (L	x Y) cal	culated u	using Ap	pendix l	<						44.82	(36)



if details of therm	al bridging	are not kn	own (36) =	= 0.05 x (3	11)								_
Total fabric he								• •	(36) =			219.58	(37)
Ventilation hea	1		l monthly	у 1	ī	ī	ī	· · ·	= 0.33 × (	25)m x (5)	ı	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(0.0)
(38)m= 271.01	266.16	261.41	239.08	234.9	215.46	215.46	211.86	222.95	234.9	243.35	252.19		(38)
Heat transfer	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		•	
(39)m= 490.59	485.74	480.99	458.66	454.49	435.04	435.04	431.44	442.53	454.49	462.94	471.77		_
Heat loss para	ameter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> . · (4)	12 /12=	458.64	(39)
(40)m= 1.82	1.8	1.78	1.7	1.68	1.61	1.61	1.6	1.64	1.68	1.71	1.75		
<u> </u>		•		•	•	•	•		Average =	Sum(40) <sub>1</sub>	12 /12=	1.7	(40)
Number of day	ys in moi	· ` ·	le 1a)	ı			1	i	i	ı	i	I	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occi	unancy	N									00	1	(42)
if TFA > 13.			[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		.09		(42)
if TFA £ 13.													
Annual average Reduce the annual									se target o	10	7.66		(43)
not more that 125	\_				_	-	lo domeve	a water ac	sc larger o	,			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage				_	l .			ООР	00.	1101	<b></b>		
(44)m= 118.42	114.12	109.81	105.5	101,2	96.89	96.89	101.2	105.5	109.81	114.12	118.42		
							<u> </u>	-	L Total = Su	m(44) <sub>112</sub> =	 =	1291.89	(44)
Energy content of	f hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,i	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 175.62	153.6	158.5	138.18	132.59	114.41	106.02	121.66	123.11	143.48	156.62	170.08		
		•			•	•	•		Total = Su	m(45) <sub>112</sub> =	=	1693.87	(45)
If instantaneous v	vater heati	ng at point •	of use (no	hot water	r storage),	enter 0 in	boxes (46	) to (61)				•	
(46)m= 26.34	23.04	23.77	20.73	19.89	17.16	15.9	18.25	18.47	21.52	23.49	25.51		(46)
Water storage Storage volum		\ includir	na anv co	olar or M	/\\/LDC	etoraga	within co	ama vac	col		005	1	(47)
If community h	` '		•			_		airie ves	9 <u>C</u> I		305		(47)
Otherwise if n	•			•			. ,	ers) ente	er 'O' in <i>(</i>	47)			
Water storage		not mate	, (u.i.o ii	.0.0000	riotaritar	10000		010, 0111	». • (	•••			
a) If manufac	turer's de	eclared I	oss facto	or is kno	wn (kWl	n/day):				1.	63		(48)
Temperature f	factor fro	m Table	2b							0.	54		(49)
Energy lost fro	om water	storage	, kWh/ye	ear			(48) x (49)	) =		0.	.88		(50)
b) If manufac			-									•	
Hot water stor	_			le 2 (kW	h/litre/da	ay)					0		(51)
If community he Volume factor	•		on 4.3								0	1	(EO)
Temperature f			2b								0		(52) (53)
Energy lost from				≏ar			(47) x (51)	) x (52) v (	53) -				` '
Enter (50) or		_	, 1. VVII/ y	Jui			(TI) X (UI)	, ^ (UZ) ^ (	-		0 88		(54) (55)
(00) 01	(5 1) 111 (6	, ,									.00		(00)



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 (6.41 27.29 26.41 27.29 26.41 27.29 (6.41 27.29 26.41 27.29 26.41 27.29 (6.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 (6.41 27.29 26.41	(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= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 37.3 33.69 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 240.2 211.93 223.08 200.68 197.17 176.91 170.61 186.25 185.62 208.06 219.12 234.66	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 240.2 211.93 223.08 200.68 197.17 176.91 170.61 186.25 185.62 208.06 219.12 234.66	
Output from water heater (annual) <sub>112</sub> 2454.29	(64)
Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 110.06 97.74 104.37 95.95 95.75 88.04 86.92 92.12 90.94 99.37 102.08 108.22	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):	
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 154.65 154.6	(66) (67)
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= 154.65 154.6	` ,
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= 154.65 154.6	` ,
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= 154.65 154.6	(67)
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= 154.65 154.6	(67)
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	(67) (68)
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= 154.65 154.	(67) (68)
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= 154.65 154.6	(67) (68) (69)
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= 154.65 154.6	(67) (68) (69)
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= 154.65 154.6	(67) (68) (69) (70)
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	(67) (68) (69) (70)
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	(67) (68) (69) (70) (71)
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Warts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70) (71)

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

6. Solar gains:



Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	X	3.86	x	11.28	x	0.55	x	0.65	] =	10.79	(75)
Northeast 0.9x	0.54	X	7.36	x	11.28	x	0.55	X	0.65	=	14.42	(75)
Northeast 0.9x	0.77	X	10.78	x	11.28	x	0.55	x	0.65	] =	30.14	(75)
Northeast 0.9x	0.54	X	4.9	x	11.28	x	0.55	x	0.65	=	9.61	(75)
Northeast 0.9x	0.77	X	3.86	x	22.97	x	0.55	x	0.65	] =	21.97	(75)
Northeast 0.9x	0.54	X	7.36	х	22.97	x	0.55	X	0.65	=	29.35	(75)
Northeast 0.9x	0.77	X	10.78	x	22.97	x	0.55	X	0.65	=	61.35	(75)
Northeast 0.9x	0.54	X	4.9	x	22.97	x	0.55	x	0.65	=	19.57	(75)
Northeast 0.9x	0.77	X	3.86	x	41.38	x	0.55	X	0.65	=	39.58	(75)
Northeast 0.9x	0.54	X	7.36	x	41.38	x	0.55	x	0.65	=	52.88	(75)
Northeast 0.9x	0.77	X	10.78	x	41.38	x	0.55	x	0.65	=	110.53	(75)
Northeast 0.9x	0.54	X	4.9	x	41.38	x	0.55	x	0.65	=	35.26	(75)
Northeast 0.9x	0.77	X	3.86	x	67.96	x	0.55	X	0.65	=	65	(75)
Northeast 0.9x	0.54	X	7.36	x	67.96	x	0.55	X	0.65	=	86.85	(75)
Northeast 0.9x	0.77	X	10.78	x	67.96	x	0.55	X	0.65	=	181.52	(75)
Northeast 0.9x	0.54	X	4.9	X	67.96	X	0.55	X	0.65	=	57.9	(75)
Northeast 0.9x	0.77	X	3.86	x	91.35	x	0.55	x	0.65	=	87.38	(75)
Northeast <sub>0.9x</sub>	0.54	X	7.36	х	91.35	<b>x</b>	0.55	x	0.65	=	116.75	(75)
Northeast <sub>0.9x</sub>	0.77	X	10.78	x	91.35	x	0,55	x	0.65	=	244	(75)
Northeast <sub>0.9x</sub>	0.54	X	4.9	x	91.35	Х	0.55	x	0.65	=	77.83	(75)
Northeast 0.9x	0.77	X	3.86	x	97.38	x	0.55	x	0.65	=	93.15	(75)
Northeast 0.9x	0.54	X	7.36	х	97.38	x	0.55	x	0.65	] =	124.46	(75)
Northeast 0.9x	0.77	X	10.78	x	97.38	x	0.55	X	0.65	] =	260.13	(75)
Northeast 0.9x	0.54	X	4.9	x	97.38	x	0.55	X	0.65	] =	82.98	(75)
Northeast 0.9x	0.77	X	3.86	x	91.1	X	0.55	X	0.65	=	87.14	(75)
Northeast 0.9x	0.54	X	7.36	x	91.1	x	0.55	X	0.65	=	116.43	(75)
Northeast 0.9x	0.77	X	10.78	x	91.1	x	0.55	X	0.65	=	243.35	(75)
Northeast 0.9x	0.54	X	4.9	X	91.1	x	0.55	X	0.65	=	77.62	(75)
Northeast 0.9x	0.77	X	3.86	x	72.63	x	0.55	X	0.65	=	69.47	(75)
Northeast 0.9x	0.54	X	7.36	x	72.63	x	0.55	X	0.65	=	92.82	(75)
Northeast 0.9x	0.77	X	10.78	x	72.63	x	0.55	X	0.65	=	194	(75)
Northeast 0.9x	0.54	X	4.9	x	72.63	x	0.55	X	0.65	=	61.88	(75)
Northeast 0.9x	0.77	X	3.86	X	50.42	x	0.55	X	0.65	=	48.23	(75)
Northeast 0.9x	0.54	X	7.36	X	50.42	X	0.55	X	0.65	] =	64.44	(75)
Northeast 0.9x	0.77	X	10.78	x	50.42	x	0.55	X	0.65	=	134.68	(75)
Northeast 0.9x	0.54	X	4.9	x	50.42	x	0.55	x	0.65	] =	42.96	(75)
Northeast 0.9x	0.77	X	3.86	x	28.07	x	0.55	x	0.65	=	26.85	(75)
Northeast 0.9x	0.54	X	7.36	x	28.07	x	0.55	X	0.65	=	35.87	(75)
Northeast 0.9x	0.77	X	10.78	x	28.07	x	0.55	x	0.65	=	74.97	(75)



Northeast <sub>0.9x</sub>	0.54	1 .	10	l v	20.07	1 ,	0.55	v	0.05	1 _	22.04	(75)
Northeast 0.9x	0.54	X I v	4.9	X	28.07	l x	0.55	X	0.65	] =   _	23.91	╡
Northeast 0.9x	0.77	X	3.86	X	14.2	l x	0.55	X	0.65	=   _	13.58	(75) (75)
Northeast 0.9x	0.54	x x	7.36	x x	14.2	x x	0.55	x	0.65	=   =	18.14	」 <sup>(73)</sup>
Northeast 0.9x	0.77	] ]	4.9	^   x	14.2	] ]	0.55		0.65	! 1	37.92	](75)
Northeast 0.9x	0.54	X I v		^   x	14.2	x x	0.55	X	0.65	=   =	12.1	](75)
Northeast 0.9x	0.77	x x	7.36	^   x	9.21	] ^   x	0.55 0.55	X X	0.65	]	8.81 11.78	](75) ](75)
Northeast 0.9x	0.54	] ^ ] <sub>x</sub>	10.78	^   x	9.21	] ^   x	0.55	X	0.65	]	24.61	」(75) 【(75)
Northeast 0.9x	0.77	] ^ ] x	4.9	^   x	9.21	] ^   x	0.55	X	0.65	-   =	7.85	](75)
South 0.9x	0.77	] ^ ] x	2.47	l ^	46.75	] ^   x	0.55	X	0.65	]	28.61	](78)
South 0.9x	0.77	l ^	2.47	x	76.57	l ^ l x	0.55	X	0.65		46.85	](78)
South 0.9x	0.77	)	2.47	x	97.53	^   x	0.55	X	0.65	!   _	59.68	(78)
South 0.9x	0.77	l ^ l x	2.47	l x	110.23	] ^ ] <sub>X</sub>	0.55	X	0.65	!   _	67.46	](78)
South 0.9x	0.77	x	2.47	x	114.87	X	0.55	x	0.65	!   =	70.29	(78)
South 0.9x	0.77	x	2.47	l X	110.55	X	0.55	x	0.65	!   =	67.65	] (78)
South 0.9x	0.77	ı L	2.47	X	108.01	l X	0.55	x	0.65	!   =	66.1	] (78)
South 0.9x	0.77	X	2.47	x	104.89	X	0.55	x	0.65	   =	64.19	] (78)
South 0.9x	0.77	x	2.47	X	101.89	X	0.55	X	0.65	=	62.35	(78)
South 0.9x	0.77	x	2.47	х	82.59	х	0.55	x	0.65	=	50.54	(78)
South <sub>0.9x</sub>	0.77	x	2.47	х	55.42	x	0.55	x	0.65	=	33.91	(78)
South 0.9x	0.77	x	2.47	x	40.4	x	0.55	x	0.65	=	24.72	(78)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	36.79		0.55	x	0.65	=	202.91	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	62.67		0.55	x	0.65	i   =	345.64	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	х	85.75	j	0.55	x	0.65	=	472.91	(79)
Southwest <sub>0.9x</sub>	0.77	×	22.26	×	106.25	j	0.55	x	0.65	j =	585.96	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	119.01	j	0.55	x	0.65	j =	656.33	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	х	118.15	ĺ	0.55	x	0.65	=	651.58	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	х	113.91		0.55	x	0.65	=	628.19	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	104.39		0.55	x	0.65	=	575.7	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	92.85	]	0.55	x	0.65	=	512.07	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	69.27		0.55	X	0.65	=	382	(79)
Southwest <sub>0.9x</sub>	0.77	X	22.26	x	44.07		0.55	X	0.65	=	243.04	(79)
Southwest <sub>0.9x</sub>	0.77	x	22.26	x	31.49		0.55	X	0.65	=	173.65	(79)
West 0.9x	0.77	x	2.47	x	19.64	X	0.55	X	0.65	=	12.02	(80)
West 0.9x	0.77	x	2.47	x	38.42	X	0.55	X	0.65	=	23.51	(80)
West 0.9x	0.77	x	2.47	x	63.27	x	0.55	X	0.65	=	38.72	(80)
West 0.9x	0.77	x	2.47	x	92.28	x	0.55	X	0.65	=	56.47	(80)
West 0.9x	0.77	x	2.47	x	113.09	x	0.55	X	0.65	=	69.21	(80)
West 0.9x	0.77	x	2.47	x	115.77	x	0.55	X	0.65	=	70.84	(80)
West 0.9x	0.77	x	2.47	x	110.22	X	0.55	X	0.65	=	67.45	(80)
West 0.9x	0.77	X	2.47	X	94.68	X	0.55	X	0.65	=	57.94	(80)



West         0.9x         0.77         x         2.47         x         73.59         x         0.55         x         0.65         =         45.03         (80)           West         0.9x         0.77         x         2.47         x         45.59         x         0.55         x         0.65         =         27.9         (80)           West         0.9x         0.77         x         2.47         x         24.49         x         0.55         x         0.65         =         14.99         (80)           West         0.9x         0.77         x         2.47         x         16.15         x         0.55         x         0.65         =         14.99         (80)           West         0.9x         0.77         x         2.47         x         16.15         x         0.55         x         0.65         =         9.88         (80)           Solar gains for watts, calculated for each month         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)         (80)
Vest   0.9x   0.77   x   2.47   x   2.43   x   0.55   x   0.65   =   11.99   (80)
Solar gains in watts, calculated for each month
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 308.51 548.24 809.57 1101.17 1321.79 1350.8 1286.29 1116 909.76 622.04 373.68 261.31 (83)
(83)me 308.51 548.24 809.57 1101.17 1321.79 1350.8 1286.29 1116 909.76 622.04 373.68 261.31 (83)  Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)me 998.87 1236.19 1474.46 1727.97 1908.11 1899.55 1811.56 1648.18 1462.32 1212.94 1008.71 931.17 (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)  Utilisation factor for gains for living area, h1,m (see Table 9a)  Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)  (87)me 19.74 18.95 19.29 19.78 20.25 20.67 20.86 20.82 20.47 19.89 19.27 18.95 (87)  Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)  (88)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)me 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)me 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 0.66 0.99  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (89)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 0.66 0.99  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (89)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 0.66 0.66 0.99  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90)me 16.91 16.81 77.3 18.07 18.74 19.34 19.54 19.55 19.62 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = ft.A x T1 + (1 - ft.A) x T2  (92)me 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)me 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  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
(83)me 308.51 548.24 809.57 1101.17 1321.79 1350.8 1286.29 1116 909.76 622.04 373.68 261.31 (83)  Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)me 998.87 1236.19 1474.46 1727.97 1908.11 1899.55 1811.56 1648.18 1462.32 1212.94 1008.71 931.17 (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)  Utilisation factor for gains for living area, h1,m (see Table 9a)  Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)  (87)me 19.74 18.95 19.29 19.78 20.25 20.67 20.86 20.82 20.47 19.89 19.27 18.95 (87)  Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)  (88)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)me 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)me 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 0.66 0.99  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (89)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 0.66 0.99  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (89)me 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 0.66 0.66 0.99  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90)me 16.91 16.81 77.3 18.07 18.74 19.34 19.54 19.55 19.62 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = ft.A x T1 + (1 - ft.A) x T2  (92)me 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)me 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  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
Total gains – internal and solar (84)m = (73)m + (83)m , watts  (84)m= 998.87 1236.19 1474.46 1727.97 1908.11 1899.55 1811.56 1648.18 1462.32 1212.94 1008.71 931.17 (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)
(84)m= 998.87   1236.19   1474.46   1727.97   1908.11   1899.55   1811.56   1648.18   1462.32   1212.94   1008.71   931.17   (84)  7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)
7. Mean internal temperature (heating season)  Temperature during heating periods in the living area from Table 9, Th1 (°C)  Utilisation factor for gains for living area, h1,m (see Table 9a)  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 1 1 1 0.99 0.97 0.91 0.82 0.86 0.97 1 1 1 1 1 (86)  Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)  (87)m= 19.74 18.95 19.29 19.78 20.25 20.67 20.86 20.82 20.47 19.89 19.27 18.95 (87)  Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)  (88)mi= 19.46 19.47 19.48 19.54 19.55 19.61 19.61 19.61 19.61 19.63 19.55 19.53 19.51 (88)  Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)  (89)m= 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 (89)  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90)m= 16.91 16.81 17.3 18.07 18.74 19.34 19.54 19.52 19.09 18.22 17.34 16.62 (90)  Real internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2  (92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
Temperature during heating periods in the living area from Table 9, Th1 (°C)
Utilisation factor for gains for living area, h1,m (see Table 9a)    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
(86)m=       1       1       1       0.99       0.97       0.91       0.82       0.86       0.97       1       9.95       0.95       0.94       1       0.99       1       1       1       0.99       0.95       0.85       0.65       0.72       0.94       0.99       1       1       1       0.99       0.95       0.85       0.65       0.72       0.94       0.99       1       1       1       0.99       0.95       0.85       0.65       0.72       0.94       0.99       1       1       0.62       0.90       0.90       0.90       0.90       0.90       0.90
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)  (87)m=
(87)m= 19.74 18.95 19.29 19.78 20.25 20.67 20.86 20.82 20.47 19.89 19.27 18.95 (87)  Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)  (88)m= 19.46 19.47 19.48 19.54 19.55 19.61 19.61 19.61 19.61 19.58 19.55 19.53 19.51 (88)  Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)  (89)m= 1 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 1  (89)  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90)m= 16.91 16.81 17.3 18.07 18.74 19.34 19.54 19.52 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)  (88)m=
(88) m= 19.46 19.47 19.48 19.54 19.55 19.61 19.61 19.61 19.58 19.55 19.53 19.51 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)  (89) m= 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 (89)  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90) m= 16.91 16.81 17.3 18.07 18.74 19.34 19.54 19.52 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2  (92) m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93) m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
(88) m= 19.46 19.47 19.48 19.54 19.55 19.61 19.61 19.61 19.58 19.55 19.53 19.51 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)  (89) m= 1 1 1 0.99 0.95 0.85 0.65 0.72 0.94 0.99 1 1 (89)  Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90) m= 16.91 16.81 17.3 18.07 18.74 19.34 19.54 19.52 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2  (92) m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93) m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
(89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - f
(89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2  (92) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - f
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)  (90)m= 16.91 16.81 17.3 18.07 18.74 19.34 19.54 19.52 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
(90)m= 16.91 16.81 17.3 18.07 18.74 19.34 19.54 19.52 19.09 18.22 17.34 16.62 (90)  Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2  (92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate  (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate  (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
(92)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (92)  Apply adjustment to the mean internal temperature from Table 4e, where appropriate  (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
Apply adjustment to the mean internal temperature from Table 4e, where appropriate  (93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
(93)m= 17.36 17.15 17.61 18.34 18.98 19.55 19.75 19.73 19.31 18.49 17.64 16.98 (93)  8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate
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
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:
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Useful gains, hmGm, $W = (94)m \times (84)m$ (95)m = 997.71   1232.62   1464.07   1693.62   1797.44   1597.85   1218.61   1215.52   1356.77   1199.06   1006.37   930.31   (95)
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)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m–(96)m ]
(97)m= 6406.03 5948.67 5345.71 4329.52 3307.85 2151.78 1371.25 1435.33 2304.94 3583.62 4880.6 6031.58 (97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m
(98)m= 4023.79 3169.19 2887.94 1897.85 1123.75 0 0 0 1774.12 2789.45 3795.35
Total per year (kWh/year) = $Sum(98)_{15,912}$ = 21461.42 (98)
Space heating requirement in kWh/m²/year 79.49 (99)



9a. Energy requirements – Individual heating syst	tems including r	micro-CHP)				
Space heating:	Ţ.					_
Fraction of space heat from secondary/supplement	• •				0	(201)
Fraction of space heat from main system(s)	•	202) = 1 - (201) =			1	(202)
Fraction of total heating from main system 1	(2	$(204) = (202) \times [1 - (202)]$	(203)] =		1	(204)
Efficiency of main space heating system 1					379.78	(206)
Efficiency of secondary/supplementary heating s	system, %				0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)			40 0-00 45	0705.05		
4023.79 3169.19 2887.94 1897.85 1123.75	0 0	0 0	1774.12 2789.45	3795.35		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		0 0	407.44 704.40	000.00		(211)
1059.51 834.48 760.43 499.72 295.89	0 0	0 0 Total (k\\/\b/\/es	467.14 734.49 ar) =Sum(211) <sub>15.1012</sub>	999.36	5054.00	7(211)
Charachaeting final (accomplant) 1/Mb/manth		Total (KWIII/yea	ar) =3um(211) <sub>15,1012</sub>		5651.03	(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/yea	ar) =Sum(215) <sub>15,1012</sub>		0	(215)
Water heating						
Output from water heater (calculated above)						
	76.91 170.61	186.25 185.62	208.06 219.12	234.66	202.02	7(246)
Efficiency of water heater (217)m= 300.39 300.39 300.39 300.39 3	300.39 300.39	300.39 300.39	300.39 300.39	300.39	300.39	(216)
Fuel for water heating, kWh/month	300.39	300.39   300.39	300.39 300.39	300.39		(211)
$(219)$ m = $(64)$ m × $100 \div (217)$ m						
(219)m= 79.96 70.55 74.26 66.81 65.64	58.9 56.79	62 61.79	6 <mark>9.26 72.94</mark>	78.12		_
		Total = Sum(2°			817.04	(219)
Annual totals Space heating fuel used, main system 1			kWh/year	,	<b>kWh/yea</b> 5651.03	r ¬
						$\exists$
Water heating fuel used					817.04	
Electricity for pumps, fans and electric keep-hot						_
Total electricity for the above, kWh/year		sum of (230a).	(230g) =		0	(231)
Electricity for lighting					698.38	(232)
12a. CO2 emissions – Individual heating system	s including micr	ro-CHP				
	Energy		Emission fac	tor	Emissions	:
	kWh/year		kg CO2/kWh		kg CO2/ye	
Space heating (main system 1)	(211) x		0.519	=	2932.89	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	424.04	(264)
Space and water heating	(261) + (262) +	(263) + (264) =			3356.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.540	=		=
			0.519		0	(267)
Electricity for lighting	(232) x		0.519	=	362.46	(268)



Total CO2, kg/year

**Dwelling CO2 Emission Rate** 

El rating (section 14)

sum of (265)...(271) =

 $(272) \div (4) =$ 

3719.38 (272)

13.78 (273)

84 (274)



User Details: **Assessor Name:** Stroma Number: **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.23 Property Address: Flat 24 Existing Be-Green - 3B4P - TF Branch Hill House, Branch Hill, LONDON, NW3 7LS Address: 1. Overall dwelling dimensions Volume(m³) Area(m<sup>2</sup>) Av. Height(m) Ground floor 229 (1a) x (2a) =632.04 (3a) 2.76 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)229 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =632.04 (5) total main secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 0 (6b) Number of intermittent fans x 10 =(7a) 4 40 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires 0 (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =(8)0.06 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)0 Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =(16)0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)15 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)0.81 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)1  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.92  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.75 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 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor  $(22a)m = (22)m \div 4$ 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 (22a)m 1.1 1.18



'alaulata atta	0.94 0.	92 0.83	0.81	0.71	0.71	0.7	0.75	0.81	0.85	0.88		
	ctive air chai	•	the appli	icable ca	se	<u>!</u>	!	<u>!</u>				
If mechanica			001) (00	<b>.</b>			. (00)	\ (00 \			0	(2
If exhaust air he								)) = (23a)			0	(2
If balanced with											0	(2
a) If balance		<u> </u>	1	1	<u> </u>	<del>, ``</del>	ŕ	<del> </del>	<del></del>	<del>````</del>	) ÷ 100] 7	(*
4a)m= 0		0 0	0	0	0	0	0	0	0	0		(2
b) If balance		ai ventilatioi	n without	neat red	overy (r	$\frac{\text{MV}}{1}$	$\int_{0}^{\infty} \int_{0}^{\infty} dt = (22)$	2b)m + (2 0	23b) 0	0	1	(
									0	0		(-
c) If whole h	ouse extract n < 0.5 × (23		•	-				5 × (23h	)			
4c)m= 0	<u></u>	0 0	0	0	0	0	0	0	0	0	1	(
d) If natural	ventilation o	r whole hou	se positi	ve input	ventilatio	on from I	l					
,	n = 1, then (2)			•				0.5]				
4d)m= 0.96	0.94 0.	92 0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89		(
Effective air	change rate	- enter (24	a) or (24l	b) or (24	c) or (24	d) in box	x (25)				_	
5)m= 0.96	0.94 0.	92 0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89		(
. Heat losse	s and heat lo	oss parame	ter:								_	-
LEMENT	Gross	Openii		Net Ar	ea	U-val	ue	AXU		k-valu	e	ΑΧk
	area (m²	r	n²	A ,r		W/m2		(VV/ł	<)	kJ/m²•	K	kJ/K
indows Type	÷ 1			5.71	х1	/[1/( 1.8 )+	0.04] =	9.59				(
indows Type	2			1.13	x1	/[1/( 1.8 )+	0.04] =	1.9				(
indows Type	3			7.2	x1	/[1/( 1.8 )+	0.04] =	12.09				(
indows Type	4			3.08	х1	/[1/( 1.8 )+	0.04] =	5.17				(
indows Type	5			3.29	x1	/[1/( 1.8 )+	0.04] =	5.52				(
indows Type	6			2.67	х1	/[1/( 1.8 )+	0.04] =	4.48				(
indows Type	e 7			8.172	<u>x</u> 1	/[1/( 1.8 )+	0.04] =	13.72				(
alls Type1	220.77	31.2	25	189.5	2 x	0.35	=	66.33				(
/alls Type2	31.6	0		31.6	X	0.31	=	9.7				(
	222.14	0		222.1	4 ×	0.16	<u> </u>	35.54			$\neg \; \vdash$	(
oof												
oof otal area of e	L			474.5	1							(
	L			474.5 14.63	_	0	=	0				(
otal area of e	L				x	0	=	0				
otal area of e arty wall arty floor or windows and	lements, m²	use effective w		14.63 222.1 alue calcul	x				ns given ir	n paragrapi	h 3.2	(
otal area of e arty wall arty floor or windows and include the area	lements, m <sup>2</sup> roof windows,	use effective w s of internal wa		14.63 222.1 alue calcul	x				s given ir	n paragrapi	h 3.2	
otal area of e arty wall	roof windows, as on both sides	use effective w s of internal wa (A x U)		14.63 222.1 alue calcul	x	g formula 1	/[(1/U-valu ) + (32) =					05



if details of therm	al bridging	are not kn	own (36) =	= 0.05 x (3	11)								
Total fabric he	eat loss							(33) +	(36) =			235.23	(37)
Ventilation he	at loss ca	alculated	l monthly	У	ī	1	T	(38)m	= 0.33 × (	25)m x (5)	) T	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 200.23	196.51	192.85	175.7	172.49	157.55	157.55	154.79	163.31	172.49	178.98	185.77		(38)
Heat transfer	coefficier	nt, W/K						(39)m	= (37) + (	38)m			
(39)m= 435.46	431.73	428.08	410.93	407.72	392.78	392.78	390.01	398.54	407.72	414.21	421		
						•	•		Average =	Sum(39) <sub>1</sub>	12 /12=	410.91	(39)
Heat loss para	ameter (F	HLP), W	m²K			,		(40)m	= (39)m ÷	(4)		1	
(40)m= 1.9	1.89	1.87	1.79	1.78	1.72	1.72	1.7	1.74	1.78	1.81	1.84		<b>-</b>
Number of da	vs in moi	nth (Tah	le 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	1.79	(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)
(11)=	1 20												(11)
4 \\/atomboo	tion on one	v 00 / 10 00 10									14\A/b/v	2011	
4. Water hea	iting enei	rgy requi	rement:								kWh/ye	ear:	
Assumed occ											.04		(42)
if TFA > 13. if TFA £ 13.		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.	.9)			
Annual average		ter usac	ne in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		10	6.39	<u> </u>	(43)
Redu <mark>ce the</mark> annu									se target o		0.39		(10)
not more that 125	5 litres per p	person per	day (all w	rater use, l	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage	in litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 117.03	112.77	108.52	104.26	100.01	95.75	95.75	100.01	104.26	108.52	112.77	117.03		
Energy content o	f hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,i	n x nm x D	OTm / 3600		Tota <mark>l = Su</mark> oth (see Ta	` '		1 <mark>2</mark> 76.69	(44)
(45)m= 173.55	151.79	156.63	136.56	131.03	113.07	104.77	120.23	121.67	141.79	154.78	168.08		
	!	ļ			<u> </u>	<u> </u>	!		I Total = Su	l m(45) <sub>112</sub> =	<u> </u>	1673.95	(45)
If instantaneous	water heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m= 26.03	22.77	23.5	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21		(46)
Water storage												1	
Storage volun	` ,					ŭ		ame ves	sel		305		(47)
If community I	_			•			` '	ara) ant	or 'O' in /	47\			
Otherwise if n Water storage		not wate	er (unis ir	iciudes i	nstantai	ieous cc	ווטם וטווזכ	ers) ente	er o in (	47)			
a) If manufac		eclared l	oss facto	or is kno	wn (kWl	n/dav):				1	.63		(48)
Temperature					•	,,					.54		(49)
Energy lost from				ear			(48) x (49)	) =			.88		(50)
b) If manufac		•	-		or is not		(10) X (10)	, –		0.	.00		(30)
Hot water stor	age loss	factor fr	om Tabl								0		(51)
If community I	_		on 4.3										
Volume factor			O.								0		(52)
Temperature											0		(53)
Energy lost fro		•	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or	(54) in (5	5)								0.	.88		(55)



Water storage loss calculated for each month $((56)m = (55) \times (41)m)$										
(56)m= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29	(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= 27.29 24.65 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29 26.41 27.29	(57)									
Primary circuit loss (annual) from Table 3	(58)									
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m										
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)										
(59)m= 37.3 33.69 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3 36.09 37.3	(59)									
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m										
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)									
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (60)m$	1)m									
(62)m= 238.14 210.12 221.22 199.06 195.61 175.57 169.36 184.81 184.17 206.37 217.28 232.66	(62)									
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)										
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)										
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0	(63)									
Output from water heater										
(64)m= 238.14 210.12 221.22 199.06 195.61 175.57 169.36 184.81 184.17 206.37 217.28 232.66										
Output from water heater (annual) <sub>112</sub>	(64)									
Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]										
(65)m= 109.37 97.14 103.75 95.41 95.23 87.6 86.5 91.64 90.45 98.81 101.46 107.55	(65)									
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating										
include (57)m in calculation of (65)m only if cylinder is in the dwelling of not water is from community fleating										
5. Internal gains (see Table 5 and 5a):										
5. Internal gains (see Table 5 and 5a):										
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	(66)									
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)									
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98 151.98	(66)									
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	, ,									
5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	, ,									
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= 151.98  Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 39.53 35.11 28.55 21.62 16.16 13.64 14.74 19.16 25.72 32.66 38.11 40.63  Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 397.84 401.96 391.56 369.41 341.46 315.18 297.63 293.5 303.9 326.05 354.01 380.28	(67)									
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= 151.98 151.9	(67)									
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= 151.98 151.9	(67) (68)									
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= 151.98 151.9	(67) (68)									
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	(67) (68) (69)									
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	(67) (68) (69)									
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= 151.98 151.9	(67) (68) (69) (70)									
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(67) (68) (69) (70)									
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= 151.98 151.9	(67) (68) (69) (70)									
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	(67) (68) (69) (70)									
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	(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)	
Northeast 0.9x	0.77	X	3.08	x	11.28	x	0.55	x	0.65	] =	8.61	(75)
Northeast 0.9x	0.54	X	3.29	х	11.28	x	0.55	X	0.65	=	6.45	(75)
Northeast 0.9x	0.77	X	2.67	x	11.28	x	0.55	x	0.65	] =	7.46	(75)
Northeast 0.9x	0.54	X	8.17	x	11.28	x	0.55	x	0.65	] =	16.02	(75)
Northeast 0.9x	0.77	X	3.08	x	22.97	x	0.55	x	0.65	] =	17.53	(75)
Northeast 0.9x	0.54	X	3.29	х	22.97	x	0.55	X	0.65	=	13.13	(75)
Northeast 0.9x	0.77	X	2.67	x	22.97	x	0.55	x	0.65	=	15.19	(75)
Northeast 0.9x	0.54	X	8.17	x	22.97	x	0.55	X	0.65	=	32.61	(75)
Northeast 0.9x	0.77	X	3.08	х	41.38	x	0.55	X	0.65	=	31.57	(75)
Northeast 0.9x	0.54	X	3.29	x	41.38	x	0.55	X	0.65	=	23.65	(75)
Northeast 0.9x	0.77	X	2.67	x	41.38	x	0.55	x	0.65	=	27.37	(75)
Northeast 0.9x	0.54	X	8.17	x	41.38	x	0.55	x	0.65	=	58.75	(75)
Northeast 0.9x	0.77	X	3.08	x	67.96	x	0.55	X	0.65	=	51.85	(75)
Northeast 0.9x	0.54	X	3.29	x	67.96	x	0.55	x	0.65	=	38.84	(75)
Northeast 0.9x	0.77	X	2.67	x	67.96	x	0.55	X	0.65	=	44.95	(75)
Northeast 0.9x	0.54	X	8.17	X	67.96	X	0.55	X	0.65	=	96.49	(75)
Northeast 0.9x	0.77	X	3.08	x	91.35	x	0.55	x	0.65	=	69.7	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.29	х	91.35	<b>x</b>	0.55	x	0.65	=	52.22	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	x	91.35	x	0.55	x	0.65	=	60.42	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	x	91.35	Х	0.55	x	0.65	=	129.7	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	x	97.38	x	0.55	x	0.65	=	74.31	(75)
Northeast 0.9x	0.54	X	3.29	х	97.38	x	0.55	x	0.65	=	55.67	(75)
Northeast 0.9x	0.77	X	2.67	x	97.38	x	0.55	X	0.65	=	64.42	(75)
Northeast 0.9x	0.54	X	8.17	x	97.38	x	0.55	X	0.65	] =	138.27	(75)
Northeast 0.9x	0.77	X	3.08	X	91.1	X	0.55	X	0.65	=	69.52	(75)
Northeast 0.9x	0.54	X	3.29	x	91.1	x	0.55	X	0.65	=	52.08	(75)
Northeast 0.9x	0.77	X	2.67	x	91.1	x	0.55	X	0.65	=	60.26	(75)
Northeast 0.9x	0.54	X	8.17	X	91.1	x	0.55	X	0.65	=	129.35	(75)
Northeast 0.9x	0.77	X	3.08	X	72.63	x	0.55	X	0.65	=	55.42	(75)
Northeast 0.9x	0.54	X	3.29	X	72.63	x	0.55	X	0.65	=	41.52	(75)
Northeast 0.9x	0.77	X	2.67	x	72.63	x	0.55	X	0.65	=	48.04	(75)
Northeast 0.9x	0.54	X	8.17	x	72.63	x	0.55	X	0.65	=	103.12	(75)
Northeast 0.9x	0.77	X	3.08	X	50.42	x	0.55	X	0.65	=	38.47	(75)
Northeast 0.9x	0.54	X	3.29	X	50.42	X	0.55	X	0.65	=	28.82	(75)
Northeast 0.9x	0.77	X	2.67	x	50.42	x	0.55	X	0.65	=	33.35	(75)
Northeast 0.9x	0.54	X	8.17	x	50.42	x	0.55	x	0.65	=	71.59	(75)
Northeast 0.9x	0.77	X	3.08	x	28.07	x	0.55	x	0.65	=	21.42	(75)
Northeast 0.9x	0.54	X	3.29	x	28.07	x	0.55	X	0.65	=	16.04	(75)
Northeast 0.9x	0.77	X	2.67	x	28.07	x	0.55	X	0.65	] =	18.57	(75)



Northeast <sub>0.9x</sub>	0.54	X	8.17	X	28.07	X	0.55	X	0.65	=	39.85	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	x	14.2	x	0.55	x	0.65	=	10.83	(75)
Northeast <sub>0.9x</sub>	0.54	X	3.29	X	14.2	X	0.55	x	0.65	=	8.12	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.67	x	14.2	x	0.55	x	0.65	] =	9.39	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	x	14.2	x	0.55	x	0.65	=	20.16	(75)
Northeast <sub>0.9x</sub>	0.77	X	3.08	x	9.21	X	0.55	x	0.65	=	7.03	(75)
Northeast 0.9x	0.54	x	3.29	x	9.21	x	0.55	x	0.65	=	5.27	(75)
Northeast <sub>0.9x</sub>	0.77	x	2.67	x	9.21	x	0.55	x	0.65	=	6.1	(75)
Northeast <sub>0.9x</sub>	0.54	X	8.17	x	9.21	X	0.55	x	0.65	=	13.08	(75)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	36.79		0.55	x	0.65	=	52.05	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	36.79		0.55	x	0.65	=	10.3	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	36.79		0.55	x	0.65	=	65.63	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	х	62.67		0.55	x	0.65	=	88.66	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	62.67		0.55	x	0.65	=	17.55	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	62.67		0.55	x	0.65	=	111.8	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	85.75		0.55	x	0.65	=	121.31	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	85.75		0.55	x	0.65	=	24.01	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	85.75		0.55	X	0.65	-	152.96	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	х	106.25		0.55	x	0.65	=	150.31	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	х	106.25		0.55	x	0.65	=	29.75	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	106.25		0.55	X	0.65	=	189.53	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	119.01		0.55	x	0.65	] =	168.36	(79)
Southwest <sub>0.9x</sub>	0.77	x	1.13	x	119.01		0.55	x	0.65	=	33.32	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	х	119.01		0.55	x	0.65	=	212.29	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	x	118.15		0.55	x	0.65	] =	167.14	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	118.15		0.55	X	0.65	=	33.08	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	118.15		0.55	X	0.65	=	210.75	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	113.91		0.55	X	0.65	=	161.14	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	113.91		0.55	X	0.65	=	31.89	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	X	113.91		0.55	x	0.65	=	203.19	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	x	104.39		0.55	X	0.65	=	147.67	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	104.39		0.55	X	0.65	=	29.22	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	104.39		0.55	X	0.65	=	186.21	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	X	92.85		0.55	x	0.65	=	131.35	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	X	92.85		0.55	X	0.65	=	25.99	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	92.85		0.55	x	0.65	] =	165.63	(79)
Southwest <sub>0.9x</sub>	0.77	x	5.71	x	69.27		0.55	x	0.65	] =	97.99	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	69.27		0.55	x	0.65	=	19.39	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.2	x	69.27		0.55	x	0.65	=	123.56	(79)
Southwest <sub>0.9x</sub>	0.77	X	5.71	x	44.07		0.55	x	0.65	=	62.34	(79)
Southwest <sub>0.9x</sub>	0.77	X	1.13	x	44.07		0.55	x	0.65	=	12.34	(79)



Southwest <sub>0.9x</sub>													
	0.77	х	7.3	2	x .	44.07		0.55	x	0.65	=	78.61	(79)
Southwest <sub>0.9x</sub>	0.77	х	5.7	<u>'</u> 1	х =	31.49		0.55	_ x _	0.65	=	44.54	(79)
Southwest <sub>0.9x</sub>	0.77	х	1.1	3	х :	31.49		0.55	_ x _	0.65	=	8.82	(79)
Southwest <sub>0.9x</sub>	0.77	X	7.:	2	х :	31.49		0.55	_ x _	0.65	<u>=</u>	56.17	(79)
		<u> </u>											
Solar gains in	watts, ca	alculated	for eac	n month			(83)m = S	um(74)m .	(82)m			•	
(83)m= 166.53		439.63	601.72	726	743.64	707.42	611.2	495.21	336.82	201.79	141		(83)
Total gains –												l	
(84)m= 819.49	946.68	1067.79	1193.85	1280.22	1262.72	1204.66	1115.64	1019.06	896.93	803.43	775.07		(84)
7. Mean inte	rnal temp	erature	(heating	season	)								
Temperature	during h	eating p	eriods ir	the livir	ng area	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for I	iving are	ea, h1,m	(see Ta	able 9a)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 1	1	1	1	0.99	0.96	0.9	0.93	0.98	1	1	1		(86)
Mean interna	al temper	ature in	living are	ea T1 (fo	ollow ste	eps 3 to 7	' in Table	e 9c)					
(87)m= 19.23	18.83	19.14	19.6	20.07	20.52	20.76	20.72	20.35	19.77	19.17	18.71		(87)
Temperature	during h	neating n	eriods ir	rest of	dwelling	r from Ta	hle 9 Ti	h2 (°C)				l	
(88)m= 19.4	19.41	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(88)
	otor for a	aina far	root of d	volling	2 m (a	oo Toblo	00)						
Utilisation fa (89)m= 1		1	0.99	0.98	0.92	0.77	0.82	0.97	1	1	1		(89)
	1									1	·		()
Mean interna	16.59		17.78	of dwelli 18.45	ng 12 (1 19.11	19.41		/ in Tabl	e 9c)	17.15	16.43		(90)
(90)m= 16.36	10.59	17.05	17.76	16.45	19.11	19.41	19.37			17.15 g area ÷ (4		0.45	(91)
									LA - LIVIII	g arca + (-	-) –	0.15	(91)
Mean interna	<del></del>	<u> </u>			<u> </u>	1	<u> </u>						
(92)m= 16.79	16.93				19.32	19.61	19.57	19.1	18.28	17.45	16.77		
A 1 1' 4		17.36	18.05	18.69									(92)
Apply adjust	1	he mean	internal	temper	ature fro	om Table	4e, whe		·	17.45	16 77		
(93)m= 16.79	16.93	he mean	internal					ere appro	opriate 18.28	17.45	16.77		(92)
(93)m= 16.79 8. Space hea	16.93 ating requ	he mean 17.36 uirement	internal	tempera 18.69	ature fro 19.32	om Table 19.61	4e, whe	19.1	18.28			ulate	
(93)m= 16.79	16.93 ating requ mean int	he mean 17.36 uirement ternal ter	internal 18.05 mperatui	tempera 18.69	ature fro 19.32	om Table 19.61	4e, whe	19.1	18.28			culate	
(93)m= 16.79 8. Space head Set Ti to the	16.93 ating requ mean int	he mean 17.36 uirement ternal ter	internal 18.05 mperatui	tempera 18.69	ature fro 19.32	om Table 19.61	4e, whe	19.1	18.28			culate	
(93)m= 16.79  8. Space here Set Ti to the the utilisation	ating requesting mean into factor for Feb	he mean 17.36 uirement ternal ter or gains t	ninternal 18.05 mperatur using Ta	18.69 re obtainable 9a	19.32 ed at st	19.61 ep 11 of	4e, whe	19.1 o, so tha	18.28 t Ti,m=(	76)m an	d re-calc	culate	
(93)m= 16.79  8. Space here Set Ti to the the utilisation  Jan	ating requesting mean into factor for Feb	he mean 17.36 uirement ternal ter or gains t	ninternal 18.05 mperatur using Ta	18.69 re obtainable 9a	19.32 ed at st	19.61 ep 11 of	4e, whe	19.1 o, so tha	18.28 t Ti,m=(	76)m an	d re-calc	culate	
(93)m= 16.79  8. Space here Set Ti to the the utilisation  Jan  Utilisation far  (94)m= 1  Useful gains	nean into factor for g	he mean  17.36  uirement ternal ter or gains o  Mar ains, hm  1  , W = (94)	mperaturusing Ta Apr : 0.99	tempera 18.69 re obtainable 9a May 0.97	ed at st  Jun  0.91	om Table 19.61 ep 11 of Jul 0.78	4e, when 19.57 Table 9t Aug	19.1 D, so tha Sep	18.28 t Ti,m=(** Oct 0.99	76)m an Nov	d re-calc	culate	(93)
(93)m= 16.79  8. Space here Set Ti to the the utilisation  Utilisation fa  (94)m= 1  Useful gains  (95)m= 818.45	mean into factor for g	he mean 17.36 uirement ternal ter or gains of Mar ains, hm 1 , W = (94) 1062.84	mperaturusing Ta Apr : 0.99 4)m x (84	tempera 18.69 re obtainable 9a May 0.97 4)m	19.32 ed at st Jun 0.91	om Table 19.61 ep 11 of Jul	4e, who 19.57 Table 9t	19.1 o, so tha	18.28 t Ti,m=(	76)m an	d re-calc	culate	(93)
(93)m= 16.79  8. Space head Set Ti to the the utilisation far (94)m= 1 Useful gains (95)m= 818.45 Monthly ave	16.93  ating requirement in factor for gradient for gradi	he mean  17.36  uirement ternal ter or gains to Mar ains, hm  1 , W = (94) 1062.84	mperature 18.05 mperature 18.05 mperature 18.05 mperature	temper: 18.69 re obtain ble 9a May 0.97 4)m 1239.66 re from Ta	19.32 ed at st  Jun  0.91  1146.11	om Table 19.61 ep 11 of Jul 0.78	4e, when 19.57  Table 9h  Aug  0.83	19.1 Do, so that Sep 0.96	18.28 t Ti,m=(' Oct 0.99 889.79	76)m an Nov 1	Dec  1  774.3	culate	(93) (94) (95)
(93)m= 16.79  8. Space here Set Ti to the the utilisation Jan Utilisation fa (94)m= 1 Useful gains (95)m= 818.45 Monthly ave (96)m= 4.3	mean into factor for g  1 hmGm  944.51  rage exter  4.9	he mean 17.36 uirement ternal ter or gains of ains, hm 1 , W = (94 1062.84 ernal tem 6.5	mperature Apr 0.99 1180.36 perature 8.9	tempera 18.69 re obtainable 9a May 0.97 4)m 1239.66 e from Ta	19.32 ed at st  Jun  0.91  1146.11 able 8  14.6	om Table 19.61 ep 11 of Jul 0.78 939.29	4e, who 19.57  Table 9l  Aug  0.83	19.1 Do, so that Sep 0.96	18.28 t Ti,m=(' Oct 0.99 889.79	76)m an Nov	d re-calc	culate	(93)
(93)m= 16.79  8. Space here Set Ti to the the utilisation far (94)m= 1  Useful gains (95)m= 818.45  Monthly ave (96)m= 4.3  Heat loss rate	mean into factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for meaning factor for him factor for him factor for him factor for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for him factor for good for good for him factor for good for him factor for good for him factor for good for good for him factor for good for go	he mean  17.36  uirement ternal ter or gains of Mar ains, hm  1  , W = (94 1062.84  ernal tem 6.5  an intern	mperature 18.05  mperature Apr : 0.99  4)m x (84 1180.36 perature 8.9 al temperature	temperation 18.69  re obtainable 9a  May  0.97  4)m  1239.66 e from Ta  11.7 erature,	19.32 ed at st  Jun  0.91  1146.11 able 8  14.6  _m , W	om Table 19.61  ep 11 of  Jul  0.78  939.29  16.6  =[(39)m :	4e, who 19.57  Table 9t  Aug  0.83  922.43  16.4  x [(93)m	19.1  5, so that  Sep  0.96  974.2  14.1  - (96)m	18.28 t Ti,m=(** Oct 0.99 889.79 10.6 ]	76)m and Nov 1 801.74 7.1	Dec 1 774.3 4.2	culate	(93) (94) (95) (96)
(93)m= 16.79  8. Space here Set Ti to the the utilisation far (94)m= 1  Useful gains (95)m= 818.45  Monthly ave (96)m= 4.3  Heat loss rat (97)m= 5437.86	mean into factor for g  the factor for g  1, hmGm  944.51  rage exter  4.9  re for mean into factor for g  1  5192.3	he mean  17.36  uirement ternal ter or gains to Mar ains, hm  1 , W = (94 1062.84 ernal tem 6.5 an intern 4649.65	mperaturusing Ta Apr : 0.99 4)m x (8- 1180.36 perature 8.9 al tempe	temper: 18.69 re obtainable 9a May 0.97 4)m 1239.66 re from Ta 11.7 rerature, 2849.98	ed at st  Jun  0.91  1146.11  able 8  14.6  _m , W  1852.78	Dom Table 19.61  ep 11 of  Jul  0.78  939.29  16.6  =[(39)m: 1182.17	4e, when 19.57  Table 9l  Aug  0.83  922.43  16.4  x [(93)m-1237.33	19.1 19.1 5, so that Sep 0.96 974.2 14.1 – (96)m 1990.73	18.28 t Ti,m=(' Oct 0.99 889.79 10.6 ] 3129.45	76)m and Nov  1  801.74  7.1	Dec 1 774.3 4.2	culate	(93) (94) (95)
(93)m= 16.79  8. Space heating  Set Ti to the the utilisation farm  Utilisation farm  (94)m= 1  Useful gains  (95)m= 818.45  Monthly ave  (96)m= 4.3  Heat loss rate  (97)m= 5437.86  Space heating	mean into factor for general for mean into factor for general for for general for mean into factor for general for mean into factor for general for mean into factor for mean	he mean  17.36  uirement ternal ter or gains of Mar ains, hm  1 , W = (94 1062.84  ernal tem 6.5 an intern 4649.65 ement fo	mperaturusing Ta Apr : 0.99 4)m x (84 1180.36 perature 8.9 al tempe 3758.89 r each m	temper: 18.69 re obtain able 9a May 0.97 4)m 1239.66 re from Ta 11.7 rerature, 2849.98 month, k\	19.32 ed at st  Jun  0.91  1146.11 able 8  14.6  _m , W  1852.78  Vh/mon	om Table 19.61  ep 11 of  Jul  0.78  939.29  16.6  =[(39)m : 1182.17  th = 0.02	4e, when 19.57  Table 9h  Aug  0.83  922.43  16.4  x [(93)mm 1237.33	19.1  Sep  0.96  974.2  14.1  - (96)m  1990.73  )m - (95	18.28  t Ti,m=(' Oct 0.99  889.79  10.6 ] 3129.45 )m] x (4	76)m an Nov 1 801.74 7.1 4286.76 1)m	Dec  1  774.3  4.2  5292.59	culate	(93) (94) (95) (96)
(93)m= 16.79  8. Space heater  Set Ti to the the utilisation Jan  Utilisation far  (94)m= 1  Useful gains  (95)m= 818.45  Monthly ave  (96)m= 4.3  Heat loss rat  (97)m= 5437.86  Space heatin	mean into factor for g  the factor for g  1, hmGm  944.51  rage exter  4.9  re for mean into factor for g  1  5192.3	he mean  17.36  uirement ternal ter or gains to Mar ains, hm  1 , W = (94 1062.84 ernal tem 6.5 an intern 4649.65	mperaturusing Ta Apr : 0.99 4)m x (8- 1180.36 perature 8.9 al tempe	temper: 18.69 re obtainable 9a May 0.97 4)m 1239.66 re from Ta 11.7 rerature, 2849.98	ed at st  Jun  0.91  1146.11  able 8  14.6  _m , W  1852.78	Dom Table 19.61  ep 11 of  Jul  0.78  939.29  16.6  =[(39)m: 1182.17	4e, who 19.57  Table 9t  Aug  0.83  922.43  16.4  x [(93)m 1237.33 24 x [(97) 0	19.1  20, so that  Sep  0.96  974.2  14.1  - (96)m  1990.73  0m - (95)  0	18.28  t Ti,m=(' Oct 0.99  889.79  10.6 ] 3129.45 )m] x (4' 1666.31	76)m and Nov  1  801.74  7.1  4286.76 1)m 2509.22	Dec  1  774.3  4.2  5292.59  3361.6		(93) (94) (95) (96) (97)
(93)m= 16.79  8. Space heating  Set Ti to the the utilisation farm  Utilisation farm  (94)m= 1  Useful gains  (95)m= 818.45  Monthly ave  (96)m= 4.3  Heat loss rate  (97)m= 5437.86  Space heating	mean into factor for general for mean into factor for general for mean into factor for general for mean into factor for general for mean into factor for general for mean for mean for general for mean for general for mean for general for mean for general for	he mean  17.36  uirement ternal ter or gains to Mar ains, hm  1 , W = (94 1062.84 ernal tem 6.5 an intern 4649.65 ement fo 2668.59	ninternal 18.05  Imperature and services are accompanied in temperature are accompanied in te	temper: 18.69  re obtain ble 9a  May  0.97  4)m  1239.66  re from Ta  11.7  rerature, 2849.98  nonth, k\ 1198.07	19.32 ed at st  Jun  0.91  1146.11 able 8  14.6  _m , W  1852.78  Vh/mon	om Table 19.61  ep 11 of  Jul  0.78  939.29  16.6  =[(39)m : 1182.17  th = 0.02	4e, who 19.57  Table 9t  Aug  0.83  922.43  16.4  x [(93)m 1237.33 24 x [(97) 0	19.1  Sep  0.96  974.2  14.1  - (96)m  1990.73  )m - (95	18.28  t Ti,m=(' Oct 0.99  889.79  10.6 ] 3129.45 )m] x (4' 1666.31	76)m and Nov  1  801.74  7.1  4286.76 1)m 2509.22	Dec  1  774.3  4.2  5292.59  3361.6	19551.68 85.38	(93) (94) (95) (96)



9a. Energy requirements – Individual heating syst	tems includina	micro-CHP)				
Space heating:	J					<b></b>
Fraction of space heat from secondary/supplement	• •	(200) 4 (204)			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) × [1 -	- (203)] =		1	(204)
Efficiency of main space heating system 1					382.08	(206)
Efficiency of secondary/supplementary heating s	system, %				0	(208)
Jan Feb Mar Apr May	Jun Jul	Aug Sep	Oct No	ov Dec	kWh/ye	ear
Space heating requirement (calculated above)	0 0	0 0	1666.31 2509	.22 3361.6	1	
3436.84 2854.51 2668.59 1856.54 1198.07	0 0	0   0	1666.31 2509	.22 3361.6	J	(0.4.4)
$ (211) m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ 899.52  747.1  698.44  485.91  313.57 $	0 0	0 0	436.12 656.	73 879.83	1	(211)
099.32 141.1 090.44 463.91 313.37	0   0		ear) =Sum(211) <sub>15</sub>		5117.22	(211)
Space heating fuel (secondary), kWh/month			/(	1012	3117.22	(211)
$= \{[(98) \text{m x } (201)] \} \times 100 \div (208)$						
(215)m= 0 0 0 0 0	0 0	0 0	0 0	0	]	
	<u> </u>	Total (kWh/ye	ear) =Sum(215) <sub>15</sub>	1012	0	(215)
Water heating						
Output from water heater (calculated above)	75 57 400 00	404.04	000.07	20 000 00		
238.14 210.12 221.22 199.06 195.61 1 Efficiency of water heater	75.57 169.36	184.81 184.17	206.37 217.	28 232.66	200.20	(216)
	300.39 300.39	300.39 300.39	300.39 300.	39 300.39	300.39	(217)
Fuel for water heating, kWh/month	300.39	300.39	300.39   300.	300.39	J	(211)
$(219)$ m = $(64)$ m x $100 \div (217)$ m					_	
(219)m= 79.28 69.95 73.64 66.27 65.12 5	58.45 56.38	61.52 61.31	68.7 72.3	3 77.45		_
		Total = Sum(	····-		810.4	(219)
Annual totals Space heating fuel used, main system 1			kWh/y	ear	<b>kWh/yea</b> 5117.22	ir
						4
Water heating fuel used					810.4	
Electricity for pumps, fans and electric keep-hot						_
Total electricity for the above, kWh/year		sum of (230a	)(230g) =		0	(231)
Electricity for lighting					698.14	(232)
12a. CO2 emissions – Individual heating system	s including mic	cro-CHP				
	Energy		Emission f	actor	Emission	s
	kWh/year		kg CO2/kW	'h	kg CO2/ye	ear
Space heating (main system 1)	(211) x		0.519	=	2655.84	(261)
Space heating (secondary)	(215) x		0.519	_ ] =	0	(263)
Water heating	(219) x		0.519	_ ] =	420.6	(264)
Space and water heating		- (263) + (264) =	0.010	_		(265)
•	(231) x	, , , , , ,		7 _	3076.44	
Electricity for pumps, fans and electric keep-hot			0.519	_ = -	0	(267)
Electricity for lighting	(232) x		0.519	_ =	362.33	(268)



Total CO2, kg/year

**Dwelling CO2 Emission Rate** 

El rating (section 14)

sum of (265)...(271) =

 $(272) \div (4) =$ 

3438.77 (272)

15.02 (273)

83 (274)