

Energy & Sustainability Strategy

Proposed Residential and Commercial Development at Land Rear of No. 74 Church Rd, Barnes

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1. Executive Summary

1.1.1 This report has been produced on behalf of Anne Machin Architects to form part of the planning application to The London Borough of Richmond Upon Thames for the development at 74 Church Road.



1.1.2 The development consists of six residential units and five commercial units. Build Energy Ltd have been appointed to produce an Energy Strategy Report presenting how the development will comply with the requirements of both the GLA London Plan and The London Borough of Richmond Upon Thames. As required within these documents, a 35% improvement over Part L 2013 of the Building Regulations is to be evidenced. The strategy is based on the Mayor of London's Energy Hierarchy, as follows:

Use less energy (Be Lean)
 Supply energy efficiently (Be Clean)
 Use renewable energy (Be Green)

- 1.1.3 In order to minimise the use of energy by this development, a low carbon approach for the design of the building's fabric and associated systems has been used.
- 1.1.4 The fabric has been designed to be highly air tight, with a Design Air Permeability rate of 4.0 m³/hm² and the use of Accredited Construction Details throughout.
- 1.1.5 The use of gas fired Combined Heat and Power (CHP) and boiler units has been considered but for a development of this scale and heat demand, it has been deemed inappropriate. The potential to connect to an existing heat network has been investigated and no opportunities exist at present.
- 1.1.6 The use of photovoltaic solar panels has been identified as the optimum strategy for lowering CO₂ emissions over and above the improvements achieved through fabric and building services efficiency. A system of c.a.
 0.7kWp per domestic plot and c.a. 1.25kWp to serve the commercial premises facing south east and south west at 15° will be required to meet the London Plan target.
- 1.1.7 It has been identified that these measures have resulted in an average reduction in CO₂ emissions of 35.88% when measured against Part L 2013 Building Regulations.



2. Introduction

- 2.1.1 Anne Machin Architects are proposing to submit a planning application to The London Borough of Richmond Upon Thames for the development at 74 Church Road.
- 2.1.2 The proposed development at 74 Church Road comprises six residential units and five commercial units.
- 2.1.3 Build Energy Ltd have been appointed to produce a site-wide Energy Strategy report identifying how the development will address the policies set out by both the Greater London Authority's 'London Plan' document and The London Borough of Richmond Upon Thames. In line with these policies, the development must achieve the following measures of sustainability:
 - A 35% reduction over the baseline in line with the energy hierarchy.
- 2.1.4 The strategy is based on the Energy Hierarchy, as follows:

Use less energy (Be lean)

Supply energy efficiently (Be clean)

Use renewable energy (Be green)



- 2.1.5 The use of passive design and energy efficient features are key to reducing energy demand. The proposed energy efficiency measures include a well-insulated building fabric, alongside a ventilation strategy that aims to maximise heat recovery. These measures will go some way towards achieving compliance, however, Low or Zero-Carbon (LZC) energy technologies will be required in order to demonstrate compliance with requirements set out under relevant planning policy. The strategy is based on information provided by the project design team
- 2.1.6 The embodied energy of the development is out of the scope of this report. The focus will be on delivered energy demand.



3. Planning Policy Guidance & Legislation Affecting 74 Church Road

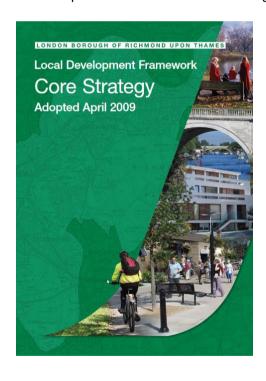
- 3.1 Relevant Local and Greater London Policy
- 3.1.1 The following policies will apply to the development;

London Plan 2015:

- Mayor of London SPD on Sustainable Design and Construction
- Policy 5.2 Minimising Carbon Dioxide Emissions
- Policy 5.3 Sustainable Design & Construction
- Policy 5.5 Decentralised Energy Networks
- Policy 5.9 Overheating and Cooling
- Policy 5.15 Water Use and Supplies

The London Borough of Richmond Upon Thames:

• Local Development Framework – Core Strategy





THE LONDON PLAN
SPATIAL DEVELOPMENT STRATEGY FOR GREATER LONDON
JULY 2011



- 3.2 Establishing Carbon Reduction Requirements
- 3.2.1 The Town and Country Planning (Development Management Procedure) (England) Order 2010 defines a minor residential development of consisting of nine dwellings or less. For all other uses, a minor development is one where the floor space to be built is less than 1,000 square metres or where the site area is less than 1 hectare.
- 3.2.2 The development proposed by Anne Machin Architects at 74 Church Road consists of less than ten dwellings, has a total floor area of less than 1,000 square metres and a site area is less than 1 hectare. As such is it is considered a minor development.
- 3.2.3 The carbon emissions of dwellings and non-dwellings created through refurbishment and through new construction are assessed under separate Building Regulations, known collectively as Part L. The relevant building regulations for the project at 74 Church Road are:
 - Approved Document L1A: Conservation of fuel and power in new dwellings (2013 edition with 2016 amendments).
 - Approved Document L2A: conservation of fuel and power in new buildings other than dwellings, 2013 edition with 2016 amendments.
- 3.2.4 Under Part L1a of the Building Regulations, new build homes are expected to reduce carbon emissions such that the Dwelling Emissions Rate (DER) falls below the Target Emissions Rate (TER), as measured through SAP.
- 3.2.5 Under Part L2a of the Building Regulations, new build non dwellings are required to reduce carbon emissions so that the Dwelling Emissions Rate (DER) falls below the Building Emissions Rate (BER). This is measured through SBEM calculations and BRUKL reporting.
- 3.2.6 The Greater London Authority Guidance on Preparing Energy Statements (March 2016) requires that major new build developments exceed the building regulations target by a further 35% on site, following the stages of the Energy Hierarchy. It is the at the discretion of Local Authority's to set further reduction targets for minor schemes where no GLA target exists.
- 3.2.7 The London Borough of Richmond Upon Thames has set a target of 35% within its 'Supplementary Planning Document Sustainable Construction Checklist Guidance Document'. This is described as follows: 'The existing London Borough of Richmond upon Thames policy DM SD 1 contained within the Development Management Plan and the London Plan (2015) require developments to reduce CO2 emissions by 35% beyond Building Regulations 2013'.
- 3.2.8 The carbon reduction requirements for the development proposed by Anne Machin Architects at 74 Church Road are therefore as follows:
 - A 35% reduction over Part L of the Building Regulations in line with the energy hierarchy.
- 3.3 Establishing Required Methodologies
- 3.3.1 This report has been produced in consultation with the Greater London Authority's 'Energy Planning Guidance on Preparing Energy Statements April 2015'.
- 3.3.2 The Greater London Authority requires that figures for carbon emissions produced by SAP or SBEM software in kg/CO2/annum are converted into tonnes/CO2/annum for comparison between stages of the Energy Hierarchy.
- 3.3.3 The London Borough of Richmond Upon Thames has produced 'Energy Statement Guidelines for Developers' within its 'Supplementary Planning Document Sustainable Construction Checklist Guidance Document (Adopted January 2016)'. These documents outline a different methodology, however in correspondence with The London Borough of Richmond Upon Thames it has been confirmed that the London Plan methodology is preferred.



4. Energy Strategy Objective

- 4.1.1 The purpose of this energy strategy is to demonstrate that climate change mitigation measures have been fully considered and appropriately selected and specified as part of the scheme's design.
- 4.1.2 In accordance with the guidance notes, after establishing the baseline energy demand and profile for the site, the strategy for the development at 74 Church Road follows the Mayor's Energy Hierarchy (Use Less Energy 'Be Lean', Supply Energy Efficiently 'Be Clean' and Use Renewable Energy 'Be Green') in appraising appropriate measures to reduce carbon emissions and other climate impacts from the development.
- 4.1.3 The following sections provide more details on each of the steps of the Energy Strategy following the London Plan's Energy Hierarchy. These are illustrated in the attached appendices of this report.
- 4.1.4 Within the London Plan, the energy hierarchy establishes the baseline energy use of the proposed development and then applies potential energy measures within the structure of the 'Energy Hierarchy'. The stages of the hierarchy are defined as follows:

Use Less Energy – 'Be Lean'	Reduce use through behaviour change Improve insulation Incorporate passive heating Install Energy Efficient lighting and appliances
Supply Energy Efficiently – 'Be Clean'	Use efficient heating equipment
Use Renewable Energy – 'Be Green'	Install renewables on site Import renewable energy

4.2 *Methodology*

- 4.2.1 Energy demand is estimated for the base case Target Emissions Rate (TER) and then improved through energy efficiency. Low and zero-carbon energy technology can then be applied to further enhance performance to meet the target.
- 4.2.2 Government approved software (SAP and SBEM) has been used to calculate energy consumption based on current SAP methodology (2013).
- 4.2.3 All proposed commercial space and a sample of two domestic plots within this development have been modelled.



5. Energy Strategy

- 5.1 Baseline Energy Assessment
- 5.1.1 Before energy efficiency measures are investigated, it is important to establish the baseline carbon emissions of the development, for comparison and evaluation of energy and efficiency proposals for the development.
- 5.1.2 The average Part L 2013 compliant carbon emissions can be viewed in the baseline tables in the appendixes of this report.
- 5.2 Be Lean
- 5.2.1 The primary focus for providing an energy efficient development is driven through the generation of a design that takes advantage of energy use reduction through improved building fabric and engineering services.
- 5.2.2 The energy demand of the development will be reduced through incorporation of measures including high levels of thermal insulation, detailing to reduce air permeability, construction details at junctions that reduce thermal bridging, and the use of low-energy lighting.
- 5.2.3 The use of building fabric specifications that better the minimum requirements of Part L as well as maximising daylight will allow for the reduction in the need for heating and lighting through better building design.
- 5.3 Be Clean
- 5.3.1 The next step in the energy hierarchy is the 'be clean' strategy of supplying the required energy, after all possible passive energy efficiency measures have been incorporated, as efficiently as possible.
- 5.3.2 The London Plan places great emphasis on decentralised energy generation (DE) using such technologies as CHP. All of the London Boroughs have over the course of several years been producing or commissioning heat map studies to explore the viability of decentralised heat networks. The London Borough of Richmond Upon Thames completed the 'London Borough of Richmond upon Thames Heat Mapping Study' in 2012. The London Heat Map has also been consulted.
- 5.3.3 There is currently no identifiable opportunity to connect to an existing or imminent network.



Figure 1 – London Heat Map view of 74 Church Road.



- 5.3.4 The possibility of connecting to future networks has also been considered, and after consultation with M&E advice it is apparent that the cost of the central plant and distribution and heat interface units is likely to be far in excess of a boiler and gas installation to each dwelling. The running costs are also likely to be higher due to the standing losses, management and maintenance of the central plant.
- 5.3.5 Combined Heat and Power units (CHP) require significant infrastructure and a substantial heat demand. In order to obtain maximum efficiency, it is necessary to have an energy demand profile which is evenly spread throughout the day and night. A CHP unit will operate efficiently when running continuously and so requires its energy to be used continuously to avoid wastage. This usage profile does not match that of the proposed development and hence a CHP system is not recommended for this site.
- 5.3.6 Under 'Clean' methodology, all flats have been specified with high efficiency gas boilers (efficiency of 89.5% or greater) and delayed start thermostats. Commercial units have been specified with air source heat pumps as described below.
- 5.4 Be Green
- 5.4.1 The third and final stage of the energy hierarchy is 'be green'. The potential of a range of renewable energy systems has been assessed to ascertain if their characteristics will be suited to serve the energy requirements of this development and thereby be used to offset CO₂ emissions.
- 5.4.2 A number of high efficiency or renewable technologies have been reviewed for use in this development. The review of green technologies identifies that the development will be suitable for the inclusion of photovoltaic solar panels providing 1.5kWp to each house.
- 5.5 Proposed Specification for 74 Church Road
- 5.5.1 Based on this review, the specification of the project at 74 Church Road has been selected to achieve or better the standards identified in Approved Document Part L wherever possible:

Building Fabric Performance:

- U-value of heat-loss floors 0.12 W/m²K
- U-value of heat-loss walls 0.16 W/m²K
- U-value of party walls 0 W/m²K (assumed fully filled cavity with sealed edges or solid)
- U-value of roofs 0.12 W/m²K
- U-value of windows and roof lights 1.4 W/m²K, whole-frame u-value
- U-value of doors 1.6 W/m²K domestic, 1.5 W/m²K commercial, whole frame u-value
- Thermal bridging to be addressed with Accredited Construction Details applied throughout domestic units.
- Air permeability of 4.0 m³/m².h @50Pa has been specified to be achieved on testing for each dwelling and commercial unit.



Domestic Heating and Hot Water:

- Gas boiler with efficiency of 90% with time and temperature zone control and delayed start thermostat in each dwelling.
- Flue Gas Heat Recovery Units (Ravenheat EnergyCatcher or similar).
- Waste Water Heat Recovery Units (Shower-save Recoh-vert RV3 or similar).

Commercial Heating and Hot Water:

- Heating and cooling via an air source heat pump with a heating COP of 4.0 and cooling ESEER of 4.5.
- Distribution efficiency for the heating system and cooling systems assumed to be as 90%.
- Variable speed pumping is assumed, with multiple differential pressure sensors in the system.
- Heat metering with alarms warning of out-of-range values not included.
- Hot water assumed to be point of use instantaneous electric water heating, without storage volumes
- Generation and distribution efficiency assumed to be 100%.

Renewable Energy Generation:

• Photovoltaic solar panel system of c.a. 0.7kWp per domestic plot and c.a. 1.25kWp to serve the commercial premises facing south east and south west at 15° will be required to meet the London Plan target.

Lighting:

- 100% low energy light fittings for domestic units
- Commercial spaces are to have photocell sensors throughout, with lighting dimmed automatically depending on levels of natural light in the space at any given time.
- Assumed design illuminance of 400lux to commercial areas.
- No time clock controls assumed to photocells. Parasitic power assumed as default 0.3 W/m2.
- Light metering with alarms warning of out-of-range values not included.

5.6 Energy Efficiency Results

5.6.1 By recording the baseline emissions for the development we are able to assess the effects of improvements detailed above on the 74 Church Road development. These are shown in the appendices in the conclusions of this report, and amount to a total reduction in carbon emissions of 35.88%.



6. Technology Consideration

- As part of this process, a number of technologies have been considered, with feasibility / viability and practicality considered given the various design considerations.
- 6.1.2 A feasibility study has been undertaken, identifying the following:
 - Appropriate technologies
 - Energy generated from Low and Zero Carbon Technologies per annum
 - Available funding grants
 - Life cycle cost of specification (including allowances for payback)
 - Local planning criteria (Inc. preferred solutions)
 - Feasibility of exporting heat / electricity from chosen system
- 6.1.3 In order to fully identify appropriate technologies, an initial evaluation has been undertaken based on the expected baseline carbon emissions. Baseline emissions are calculated on a development with identical geometry built to meet Building Regulations, thus using standard building fabric parameters and notional heating systems.



6.2 *Photovoltaics*

- 6.2.1 The PV panels should be orientated between southeast and southwest (optimally south). The optimal tilt angle (inclination of panel from horizontal) should be calculated to ensure the best possible output of the system during the year. In the UK, the angles of most pitched roofs are suitable for mounting PV panels.
- 6.2.2 Panels can also be mounted on A-frames on flat-roofed buildings. PV technology comes in a range of forms: PV panels that can be retrofitted to the roof of an existing building or equally, sunk to fit flush with the roof line; PV cells that are 'laminated' between sheets of glass to provide shading in a glazed area, and PV cladding.
- 6.2.3 PV systems are low maintenance as they have no moving parts and panels generally have 25 year warranties, although the lifetime of the panel can be expected to be beyond this time.



6.2.4 The PV systems should not be shaded. Shading caused by other buildings, greenery and roof 'furniture' such as chimneys or satellite dishes, even over a small area of the panel, can significantly reduce performance. Excess energy can be exported to the grid. Although the Feed-in Tariffs are generally not high, exporters can negotiate with their

utility company. Future consideration may be given to the benefits of battery storage.

Economic Considerations

6.2.5 Payback times for this technology are usually approximately twenty years; but this is reducing year on year as the technology matures and are set to reduce further as fuel prices increase. Integrating PV into a building and replacing other building materials can further offset the cost.

Suitability at the 74 Church Road Development

6.2.6 PV has been identified as a suitable technology for incorporation at 74 Church Road allowing the required 35% reduction in carbon emissions to be met. Photovoltaic solar panel system of c.a. 0.7kWp per domestic plot and c.a. 1.25kWp to serve the commercial premises facing south east and south west at 15° will be required to meet the London Plan target.





6.3 Solar Water Heating

- 6.3.1 A solar collector comprises the housing that contains piping, through which the carrier fluid circulates, and a glass panel to retain the radiation from the Sun. The temperature inside the collector increases and this heat is then transferred to a carrier fluid. In an open loop system, the hot water is heated directly.
- 6.3.2 Solar thermal panels are generally black in appearance for maximising energy absorption and the glass panels have a special coating in order to retain as much heat as possible.
- 6.3.3 Two types of collector exist: flat plate and evacuated tube. Flat plate collectors can be mounted on or flush with the roof. The air in the collection tubes can be evacuated to reduce heat losses within the frame by convection. Evacuated tube collectors need to be re-evacuated every few years. They are more difficult to install but are more efficient and allow higher temperature heating.



Benefits

6.3.4 Solar thermal collectors offer a good price-performance ratio. Solar hot water systems are best suited to developments with high hot water requirements, such as hotels, care homes and leisure centres. Many systems have been installed in the UK and they work well, even without direct sunlight.

Technical Considerations

6.3.5 Solar thermal systems should be sized to the hot water requirements of the user since any excess heat that is generated cannot be exported elsewhere. The optimal angle for mounting depends on when the water demand is greatest. Ideally, the collectors should be mounted onto a non-shaded, south-facing roof.

Economic Considerations

6.3.6 Solar thermal technology is a cost effective way to reduce carbon emissions, especially if it is replacing electric water heating.

Suitability at the 74 Church Road Development

6.3.7 Due to limited roof space at 74 Church Road, solar hot water cannot be used effectively alongside photovoltaic arrays. Accordingly it is considered preferable to install photovoltaic arrays over solar hot water where only one technology can be favoured.



6.4 Air Source Heat Pumps

- 6.4.1 Air source heat pumps work by converting the energy of the outside air into heat, creating a comfortable temperature inside the building as well as supplying energy for the hot water system. As with all heat pumps, air source models are most efficient when supplying low temperature systems such as underfloor heating.
- An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15°C. Cold water or another fluid is circulated through pipes, picking up the ambient temperature and then passing through the heat exchanger (the evaporator) in the heat pump unit.
- 6.4.3 The heat exchanger extracts heat from the fluid, using a refrigerant compression cycle to upgrade the heat to a usable temperature (+55°C). This heat is then transferred to the heating system via another heat exchanger, the condenser of the heat pump.



- 6.4.4 Accordingly ASHP heating systems generally run at a lower temperature than conventional heating systems. There are two main types of air source heat pumps. An air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are better suited to underfloor heating systems than radiator systems.
- An air-to-air system produces warm air, which is circulated by fans to heat the building. Whilst heat pumps are not a wholly renewable energy source due to use of electricity, the renewable component is considered as the heat is extracted from the air. It is measured as the difference between heat outputs, less the primary electrical energy input. Using this heat, for every Watt of electrical energy supplied to the system, 4 Watts or more of heating energy can be supplied to a heating system. This 'Coefficient of Performance' (CoP) of 4 is effectively an 'efficiency' of 400% for the system and compares very favourably with even the best gas condensing boiler's efficiency of around 85%. The smaller the temperature difference between the source and the output temperature of the heat pump (i.e. the temperature of the distribution system) the higher the heat pump's CoP.

Benefits

- 6.4.6 Unlike boilers, there is no pollution on-site and as the mix of power stations used to supply the electricity grid gets 'cleaner', with more renewable electricity generation being brought on line, so the carbon emissions from the heat pumps system will decrease even further.
- 6.4.7 The key operational benefit of air source heat pumps for the user is the reduction in fuel bills. In addition, space savings can be made over other plant types as an air source heat pump unit is compact, and requires no storage space for fuel.



Technical Considerations

Since air source heat pumps produce less heat than traditional boilers, it is essential that the building where the air source heat pump is proposed is well insulated and draught proofed for the heating system to be effective. Fans and compressors integral to the air source heat pump unit generate some noise, but this is generally acceptable especially where outdoor units can be located away from windows and adjacent buildings. By selecting a heat pump with an outdoor sound rating of 7.6 dB or lower and mounting the unit on a noise-absorbing base these issues can be resolved for the site.

Economic Considerations

6.4.9 Costs for installing a typical system vary but they are considerably more economical to install than an equivalent capacity ground source heat system and can produce similar levels of energy and carbon savings. Actual running costs and savings for space heating will vary depending on a number of factors - including the size and use pattern of the building and how well insulated it is.

Suitability at the 74 Church Road Development

Due to outdoor space constraints and noise considerations, it is preferred to opt for photovoltaic panels with high efficiency mains gas boilers for the proposed development at 74 Church Road.



6.5 Biomass Heating

- 6.5.1 Biomass can be burnt directly to provide heat in buildings using wood from forests, urban tree pruning, and farmed coppices or as liquid biofuel, such as bio diesel. In non-domestic applications, biomass boilers replace conventional fossil fuel boilers and come with automated features to enable reduced user intervention.
- 6.5.2 With the long term availability of fossil fuels such as oil and gas, and the persistent number of price rises of oil and natural gas a growing concern in the UK, alternative heating methods such as wood burning boilers are becoming more popular.
- 6.5.3 Due to technical advances in wood burning technology, and improvements in the preparation of wood fuels, efficiencies of new wood pellet burning boilers have increased to around 90%, with carbon monoxide emissions dropping dramatically.
- 6.5.4 There are three types of wood burning boiler logs, woodchips and wood pellets. Wood logs are the most readily available, generally produced as a by-product from forestry and woodland from sawmills, tree surgery and wind damage.



6.5.5 Wood chips have a high moisture content which tends to restrict their efficiency to only 50% and they tend to suffer from blockages hence we would be cautious about their use on this site. Storage space requirements are also high due to the irregularity of the chips. Wood pellets are made from dry waste wood, such as used pallets and off-cuts/sawdust from furniture manufacturers. The waste wood is compressed into uniform, high density pellets that are easier to transport, handle and store than other forms of wood fuel.

Technical and Economic Considerations

6.5.6 Biomass combustion systems (BCS) are generally more mechanically complex than conventional boiler heating systems, especially when it comes to fuel delivery, storage, handling and combustion. The complexity is necessary because of the different combustion characteristics of biomass as compared to conventional fossil fuels. The increased complexity means higher capital costs than for conventional systems. BCSs typically require more frequent maintenance and greater operator attention than conventional systems. As a result, the degree of operator dedication to the system is critical to its success. They often require special attention to fire insurance premiums, air quality standards, ash disposal options and general safety issues.

Suitability at the 74 Church Road Development

6.5.7 Due to the size of the proposed project, biomass energy has not been considered as an economically suitable technology for this development.



7. Other Sustainability Considerations

- 7.1 The Code for Sustainable Homes
- 7.1.1 Following the technical housing standards review, the government has withdrawn the Code for Sustainable Homes, and the scheme is no longer open to new registrations.
- 7.1.2 Anne Machin Architects values the sustainability credentials of the 74 Church Road development and has committed to the following measures alongside the carbon reduction strategies listed above.
- 7.2 BREEAM
- 7.2.1 A BREEAM pre-assessment has been undertaken to demonstrate how the commercial units will achieve the required BREEAM rating post construction. This can be viewed in the appendicies of this report.
- 7.3 Internal Potable Water Consumption
- 7.3.1 It is the aim of Anne Machin Architects to reduce the consumption of potable water in the 74 Church Road development from all sources, through the use of efficient fittings and flow restrictors where required.
- 7.3.2 Performance in domestic properties will be assessed under the methodologies set out in Part G of the Building Regulations, once a full design stage sanitary specification has been established.
- 7.3.3 The design will be such that potable water consumption meets a target of 105L per head per day or less for each dwelling at 74 Church Road.
- 7.3.4 This is equivalent to the consumption targets set under the now obsolete Code for Sustainable Homes Level 4.
- 7.4 Overheating Considerations
- 7.4.1 An overheating assessment has been carried out as a part of the process to produce SAP calculations. This assessment is related to the factors that contribute to internal temperature: solar gain (taking account of orientation, shading and glazing transmission), ventilation (taking account of window opening in hot weather), thermal capacity and mean summer temperature for the location of the dwelling. Full details of this methodology and relevant calculations can be found in the latest approved SAP document.
- 7.4.2 Using these criteria the proposed development at 74 Church Road has been found to be compliant with overheating rules within SAP.
- 7.5 Sourcing of Materials & Waste Reduction
- 7.5.1 Materials will be chosen to lower the environmental impact of the development at 74 Church Road wherever possible.
- 7.5.2 All timber used during the development will come from a 'legal source' and will not be on the CITES list, or in the case of Appendix III of the CITES list, it will not have been sourced from a country seeking to protect this species as listed in Appendix III.



8. Conclusion

8.1.1 This strategy is based on the Energy Hierarchy, as follows:

•	Use less energy	(Be lean)
•	Supply energy efficiently	(Be clean)
•	Use renewable energy	(Be green)

- 8.1.2 These measures result in a reduction in CO₂ emissions of 35.88% when measured against Part L 2013 Building Regulations.
- 8.1.3 The following charts details the reductions in CO₂ emissions as a result of following the energy hierarchy.

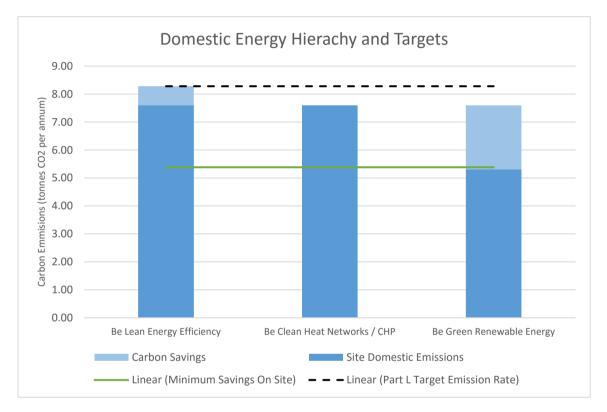


Figure 2 – Domestic Carbon Emissions at 74 Church Road at Each Stage of the Energy Hierarchy.

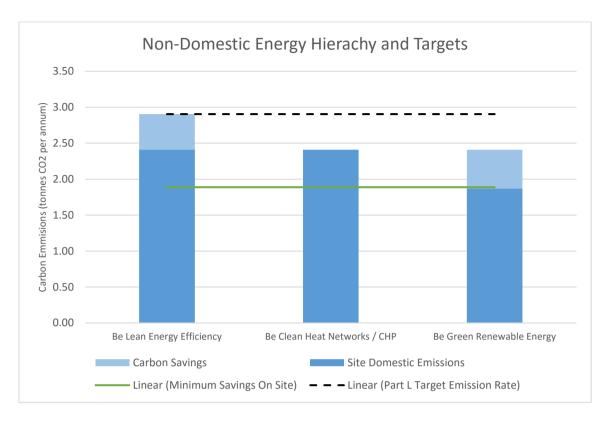


Figure 3 –Non-Domestic Carbon Emissions at 74 Church Road at Each Stage of the Energy Hierarchy.



9. Appendices

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Appendix A - Domestic Results Tables



Cumulative Emissions & Savings

The following tables are presented in accordance with the advice presented within 'Energy Planning - Greater London Authority guidance on preparing energy assessments'.

	Carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)		
	Regulated Unregu		
Baseline: Part L 2013 of the Building			
Regulations Compliant Development	8.28	2.98	
After energy demand reduction	7.60	2.98	
After heat network / CHP	7.60	2.98	
After renewable energy	5.30	2.98	

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

	Regulated Carbon dioxide savings		
	(Tonnes CO ₂ / annum)	(%)	
Savings from energy demand reduction	0.68	8.25	
Savings from heat network / CHP	0.00	0.00	
Savings from renewable energy	2.29	27.70	
Cumulative on site Savings	2.98	35.96	
Total Target Savings	2.90	35.00	
Annual Surplus	0.08		

 $\label{thm:continuous} \emph{Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings.}$

Results by Plot

Baseline

Baseline: Part L 2013 of the Building	Domestic Total (Sum)	Ground Floor	First Floor
Regulations Compliant Development	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	8.279	2.952	5.328

Be Lean

After energy demand reduction	Domestic Total (Sum)	Ground Floor	First Floor
	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	8.279	2.952	5.328
Be Lean	7.596	2.645	4.951
% Improvement	8.25	10.38	7.08

Be Lean & Clean

After heat network / CHP	Domestic Total (Sum)	Ground Floor	First Floor
	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	8.279	2.952	5.328
Be Lean & Clean	7.596	2.645	4.951
% Improvement	8.25	10.38	7.08

Be Lean, Clean & Green

After renewable energy	Domestic Total (Sum)	Ground Floor	First Floor
	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	8.279	2.952	5.328
Be Lean, Clean & Green	5.302	1.942	3.360
% Improvement	35.96	34.21	36.92

Unregulated Emissions

Emissions from Sources not Regulated under	Domestic Total (Sum)	Ground Floor	First Floor
Part L of the Building Regulations (Tonnes CO2 / annum)	2.98	1.44	1.54



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

		Pr	operty /	Address	Baselin	ne First F	loor Sa	mple		
Address :										
1. Overall dwelling dimensions	S:									
			Area	a(m²)		Av. Hei	ght(m)		Volume(m³)	
Ground floor					(1a) x	3.	03	(2a) =	133.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e))+(1n) 4	4.07	(4)			_		_
Dwelling volume					(3a)+(3b))+(3c)+(3d))+(3e)+	(3n) =	133.53	(5)
2. Ventilation rate:										_
		condary	y	other		total			m³ per hour	
Number of chimneys	0 +	0	+ [0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 +	0	+ [0] = [0	x:	20 =	0	(6b)
Number of intermittent fans						3	x	10 =	30	(7a)
Number of passive vents					Ī	0	x	10 =	0	(7b)
Number of flueless gas fires						0		40 =	0	(7c)
					_			Λ: _{" α} Ι	ange ner he	_
					_			AII CI	nanges per ho	ur –
Infiltration due to chimneys, flue						30		÷ (5) =	0.22	(8)
If a pressurisation test has been carr		d, proceed	l to (17), c	otherwise o	ontinue fr	om (9) to (16)			٦,0
Number of storeys in the dwe Additional infiltration	elling (ris)						[(0)	-1]x0.1 =	0	(9)
Structural infiltration: 0.25 for	stool or timber f	rama or	0 35 for	macon	v constr	ruction	[(9)]	-1JXU.1 =	0	(10)
if both types of wall are present, u	use the value corresp				•	uction			0	(11)
deducting areas of openings); if e									_	_
If suspended wooden floor, e	•	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, enter 0.0									0	(13)
Percentage of windows and o	doors draught str	ipped							0	(14)
Window infiltration				0.25 - [0.2					0	(15)
Infiltration rate						12) + (13) +			0	(16)
Air permeability value, q50, e	•		-		-	etre of e	nvelope	area	4.5999999046325	7 (17)
If based on air permeability valu									0.45	(18)
Air permeability value applies if a pre	essurisation test has	been don	e or a deg	gree air pe	meability	is being us	ed			_
Number of sides sheltered				(00) 4	'0 0 7 5 (4	10)1			3	(19)
Shelter factor				(20) = 1 -		[9)] =			0.78	(20)
Infiltration rate incorporating she				(21) = (18)	x (20) =				0.35	(21)
Infiltration rate modified for mor	nthly wind speed					, ,			7	
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

4.5

1.12

4.7

1.18

Monthly average wind speed from Table 7

Wind Factor $(22a)m = (22)m \div 4$

1.25

(22)m=

(22a)m=

5.1

1.27



	wing ioi si	nelter an	a wina s	speeu) =	(Z1a) X	(22a)m					
0.45 0.44 0.43		0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41		
Calculate effective air chang	ge rate for t	he appli	cable ca	se					!	•	1/00 \
If mechanical ventilation:	ppondiv N. (2	12h) _ (22c) Em. (a	auation (N	JE)) otho	muioo (22h	\ _ (22a\			0	(23a)
If exhaust air heat pump using A) = (23a)			0	(23b)
If balanced with heat recovery: e	-	_					2h.\ //	00h) [4	(00-)	0 . 4001	(23c)
a) If balanced mechanical		i		- 	- 	í `	 		<u> </u>	÷ 100] I	(24a)
(24a)m= 0 0 0	0	0	0	0 (1	0	0	0	0	0		(24a)
b) If balanced mechanical	ventilation	without	neat red	overy (i	0 (24b	0) m = (22) 0	 			1	(24b)
` '		<u> </u>		<u> </u>	<u> </u>		0	0	0		(240)
c) If whole house extract wif (22b)m < 0.5 x (23b)		•					5 x (23h)			
(24c)m =	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or	whole hous	L se nositiv		ventilatio	n from I	oft.	<u> </u>				
if (22b)m = 1, then (24							0.5]				
(24d)m= 0.6 0.6 0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24d)
Effective air change rate -	enter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				•	
(25)m= 0.6 0.6 0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
3. Heat losses and heat los	s naramet	≏r·									
ELEMENT Gross	Openin	gs	Net Ar		U-valı		AXU	<i>(</i>)	k-value		A X k
area (m²)	m) '	A ,r		W/m2		(W/l	<u>()</u>	kJ/m²-ł	\	kJ/K
Doors			1.89	X							
				〓 ,	1.6	0.041	3.024	=			(26)
Windows Type 1			1.02	x1	/[1/(1.4)+	0.04] =	1.35				(27)
Windows Type 2			1.02	x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] =	1.35 2.82				(27) (27)
Windows Type 2 Windows Type 3			1.02	x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	$0.04] = \begin{bmatrix} 0.04] = \begin{bmatrix} 0.04] = \end{bmatrix}$	1.35				(27)
Windows Type 2 Windows Type 3 Windows Type 4			1.02	x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+	$0.04] = \begin{bmatrix} 0.04] = \begin{bmatrix} 0.04] = \end{bmatrix}$	1.35 2.82				(27) (27)
Windows Type 2 Windows Type 3			1.02 2.13 0.52	x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69				(27) (27) (27)
Windows Type 2 Windows Type 3 Windows Type 4			1.02 2.13 0.52 1.89	x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69 2.51				(27) (27) (27) (27)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1			1.02 2.13 0.52 1.89	x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2			1.02 2.13 0.52 1.89 0.52 0.52	x1. x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b) (27b)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3	7.45	5	1.02 2.13 0.52 1.89 0.52 0.52	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728 0.728				(27) (27) (27) (27) (27b) (27b) (27b)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4	7.45	=	1.02 2.13 0.52 1.89 0.52 0.52 0.52	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728 0.728 0.728				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43		=	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	$ \begin{array}{c} 0.04] = [\\ 0.0$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39		=	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	$ \begin{array}{c} 0.04] = [\\ 0.0$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27) (27b) (27b) (27b) (27b) (29)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m²		=	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m² Party wall	2.08	indow U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$ \begin{array}{c} 0.04] = [\\ 0.0$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	s given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m² Party wall Party floor * for windows and roof windows, us	2.08 se effective wi	indow U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	s given in	paragraph	3.2	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides of	2.08 se effective wind internal wall a X U)	indow U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides of Fabric heat loss, W/K = S (A)	2.08 se effective wind internal wall (x x U)	indow U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	2) + (32a).		24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)11.57 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =(37)36.21 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Feb Mar Jul Aug Sep Dec .lan Apr May Jun Oct Nov (38)m =26.48 26.31 26.14 25.34 25.19 24.5 24.5 24.37 24.77 25.19 25.5 25.81 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =62.69 62.52 62.35 61.55 61.4 60.71 60.71 60.58 60.98 61.4 61.7 62.02 Average = $Sum(39)_{1...12}/12=$ (39)61.55 Heat loss parameter (HLP), W/m²K (40)m = (39)m \div (4)1.42 1.42 1.41 1.39 1.38 1.38 1.37 1.38 1.39 1.4 1.41 (40)m =(40)Average = $Sum(40)_{1...12}/12=$ 1.4 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)1.52 if TFA > 13.9, N = 1 + 1.76 x [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)70.26 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m =77.28 74.47 71.66 68.85 66.04 63.23 63.23 66.04 68.85 71.66 74.47 77.28 (44)Total = $Sum(44)_{1...12}$ = 843.09 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 =114.61 100.24 103.44 90.18 86.53 74.67 69.19 79.4 80.35 93.63 102.21 110.99 (45)Total = $Sum(45)_{1...12}$ = 1105.43 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 17.19 15.04 15.52 13.53 12.98 12.05 14.05 15.33 16.65 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 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 fror	m water	storage	e, kWh/ye	ear			(47) x (51)	x (52) x (5	53) =		0		(54)
•	(50) or (_	,				, ,	•			0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	r contains	dedicated	d solar sto	rage, (57)r	n = (56)m	x [(50) – (l	H11)] ÷ (50	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (an	inual) fro	om Table	3							0		(58)
Primar	y circuit	loss cal	culated f	for each	month (59)m = (58) ÷ 36	55 × (41)	m					
(mod	dified by	factor fr	om Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)	·	•	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss cal	culated	for each	month ((61)m =	(60) ÷ 36	35 × (41))m						
(61)m=	39.38	34.28	36.52	33.95	33.65	31.18	32.22	33.65	33.95	36.52	36.73	39.38		(61)
Total h	eat requ	ired 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=	153.99	134.52	139.96	124.13	120.18	105.85	101.41	113.05	114.3	130.15	138.94	150.38		(62)
Solar DH	HW input c	alculated	using App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0'	if no sola	r contributi	on to wate	er heating)	•	
(add ad	dditional	lines if	FGHRS	and/or V	VWHRS	applies,	, see Ap	pendix G	3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
WWHRS	-27.31	-24.02	-24.52	-20.23	-18.81	-15.53	-13.18	-15.95	-16.4	-20.23	-23.39	-26.38	•	(63) (G10)
Output	from wa	ater heat	ter											
(64)m=	126.68	110.5	115.43	103.91	101.38	90.32	88.23	97.1	97.9	109.92	115.55	123.99		
	-	-		-	-	-	-	Outp	ut from wa	ater heater	r (annual)₁	12	1280.91	(64)
														_
Heat g	ains fron	n water	heating,	, kWh/mo	onth 0.25	5 ´ [0.85	× (45)m	+ (61)m] + 0.8 x	((46)m	+ (57)m	+ (59)m]	_
Heat ga (65)m=	ains fron 47.95	n water 41.9	heating, 43.52	, kWh/mo	onth 0.25	5 ´ [0.85	× (45)m	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	(65)
(65)m=	47.95	41.9	43.52		37.18	32.62	31.06	34.81	35.2	40.26	43.17	46.75		(65)
(65)m=	47.95 de (57)n	41.9 n in calc	43.52 culation o	38.47	37.18 only if c	32.62	31.06	34.81	35.2	40.26	43.17	46.75		(65)
(65)m= inclu 5. Int	47.95 de (57)n ernal ga	41.9 n in calc ins (see	43.52 culation o	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62	31.06	34.81	35.2	40.26	43.17	46.75		(65)
(65)m= inclu 5. Int	47.95 de (57)n ernal ga	41.9 n in calc ins (see	43.52 culation of Table 5	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62	31.06	34.81	35.2	40.26	43.17	46.75		(65)
(65)m= inclu 5. Int	47.95 de (57)n ernal ga	41.9 n in calc ins (see s (Table	43.52 culation of Table 5	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62 cylinder is	31.06 s in the c	34.81 dwelling	35.2 or hot w	40.26 ater is fr	43.17 om com	46.75 munity h		(65)
inclu 5. Int Metabo (66)m=	47.95 de (57)n ernal ga blic gains Jan 91.09	41.9 n in calcoins (see S (Table Feb 91.09	43.52 culation of Table 5 (a) Wat Mar 91.09	38.47 of (65)m 5 and 5a) tts Apr	37.18 only if controls: May 91.09	32.62 cylinder is Jun 91.09	31.06 s in the c	34.81 dwelling Aug 91.09	35.2 or hot w Sep 91.09	40.26 ater is fr	43.17 om com	46.75 munity h		
inclu 5. Int Metabo (66)m=	47.95 de (57)n ernal ga blic gains Jan 91.09	41.9 n in calcoins (see S (Table Feb 91.09	43.52 culation of Table 5 (a) Wat Mar 91.09	38.47 of (65)m 5 and 5a) tts Apr 91.09	37.18 only if controls: May 91.09	32.62 cylinder is Jun 91.09	31.06 s in the c	34.81 dwelling Aug 91.09	35.2 or hot w Sep 91.09	40.26 ater is fr	43.17 om com	46.75 munity h		
inclu 5. Int Metabo (66)m= Lighting (67)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39	41.9 in in calcoins (see Feb 91.09 (calculate 26.1	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23	38.47 of (65)m and 5a) tts Apr 91.09 opendix l	37.18 only if c : May 91.09 L, equati	32.62 sylinder is Jun 91.09 ion L9 or 10.14	31.06 s in the c Jul 91.09 r L9a), a 10.96	34.81 dwelling Aug 91.09 lso see	35.2 or hot w Sep 91.09 Table 5	40.26 ater is fr Oct 91.09	43.17 om com Nov 91.09	46.75 munity h		(66)
inclu 5. Int Metabo (66)m= Lighting (67)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39	41.9 in in calcoins (see Feb 91.09 (calculate 26.1	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix L 16.07	37.18 only if c : May 91.09 L, equati	32.62 sylinder is Jun 91.09 ion L9 or 10.14	31.06 s in the c Jul 91.09 r L9a), a 10.96	34.81 dwelling Aug 91.09 lso see	35.2 or hot w Sep 91.09 Table 5	40.26 ater is fr Oct 91.09	43.17 om com Nov 91.09	46.75 munity h		(66)
inclu 5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85	41.9 n in calcoins (see S (Table Feb 91.09) (calculat 26.1 ns (calculat 198.89)	43.52 culation of Table 5 (a 5), Wat Mar 91.09 ted in Ap 21.23 ulated in 193.74	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix L 16.07	37.18 only if control May 91.09 L, equation 12.01 dix L, equation 168.95	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33	43.17 om com Nov 91.09	46.75 munity h		(66) (67)
inclu 5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85	41.9 n in calcoins (see S (Table Feb 91.09) (calculat 26.1 ns (calculat 198.89)	43.52 culation of Table 5 (a 5), Wat Mar 91.09 ted in Ap 21.23 ulated in 193.74	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append	37.18 only if control May 91.09 L, equation 12.01 dix L, equation 168.95	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33	43.17 om com Nov 91.09	46.75 munity h		(66) (67)
inclu 5. Int Metabo (66)m= Lightine (67)m= Appliar (68)m= Cookin (69)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63	41.9 n in calcoins (see s (Table Feb 91.09) (calculate 26.1) ns (calcoins (calcoins (calcoins 45.63)	43.52 culation of the Table 5	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append 182.78 ppendix 45.63	37.18 only if control May 91.09 L, equati 12.01 dix L, equati 168.95 L, equat	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L2 155.95	31.06 s in the control of the contro	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se	Sep 91.09 Fable 5 19.12 see Tall 150.37	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5	43.17 om com Nov 91.09 28.34	46.75 munity h Dec 91.09 30.21		(66) (67) (68)
inclu 5. Int Metabo (66)m= Lightine (67)m= Appliar (68)m= Cookin (69)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63	41.9 n in calcoins (see s (Table Feb 91.09) (calculate 26.1) ns (calcoins (calcoins (calcoins 45.63)	43.52 culation of a Table 5 (a Table 5), Wat Mar 91.09 ted in Ap 21.23 ulated in 193.74 ted in Ap 45.63	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append 182.78 ppendix 45.63	37.18 only if control May 91.09 L, equati 12.01 dix L, equati 168.95 L, equat	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L2 155.95	31.06 s in the control of the contro	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se	Sep 91.09 Fable 5 19.12 see Tall 150.37	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5	43.17 om com Nov 91.09 28.34	46.75 munity h Dec 91.09 30.21		(66) (67) (68)
inclu 5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63 a and fan	41.9 in in calcoins (see s (Table Feb 91.09) (calcular 26.1) ins (calcular 198.89) (calcular 45.63) is gains 10	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23 ulated in 193.74 ted in Ap 45.63 (Table 5	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix L 16.07 n Appendix 45.63 5a) 10	37.18 only if controls: May 91.09 L, equati 12.01 dix L, equati 168.95 L, equati 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 or 45.63	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 d, also see 45.63	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37 ee Table 45.63	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5 45.63	43.17 om com Nov 91.09 28.34 175.16	46.75 munity h Dec 91.09 30.21 188.16		(66) (67) (68) (69)
inclu 5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63 a and fan	41.9 in in calcoins (see s (Table Feb 91.09) (calcular 26.1) ins (calcular 198.89) (calcular 45.63) is gains 10	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23 ulated in 193.74 ted in Ap 45.63 (Table 5	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append 182.78 ppendix 45.63	37.18 only if controls: May 91.09 L, equati 12.01 dix L, equati 168.95 L, equati 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 or 45.63	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 d, also see 45.63	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37 ee Table 45.63	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5 45.63	43.17 om com Nov 91.09 28.34 175.16	46.75 munity h Dec 91.09 30.21 188.16		(66) (67) (68) (69)
inclu 5. Interpretation (65)m= inclu 5. Interpretation (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m=	47.95 de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63 and fan 10 s e.g. eva -60.73	41.9 In in calcoins (see s (Table Feb 91.09) (calculat 26.1) Ins (calculat 45.63) Its gains 10 Its aporatio -60.73	43.52 culation of the transfer of	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Appendix 45.63 5a) 10 ttive value	37.18 only if control May 91.09 L, equati 12.01 dix L, equati 168.95 L, equati 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 or 45.63	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37 ee Table 45.63	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5 45.63	43.17 om com Nov 91.09 28.34 175.16 45.63	46.75 munity h Dec 91.09 30.21 188.16 45.63		(66) (67) (68) (69) (70)
inclu 5. Interpretation (65)m= inclu 5. Interpretation (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63 and fan 10 s e.g. eva	41.9 In in calcoins (see s (Table Feb 91.09) (calculat 26.1) Ins (calculat 45.63) Its gains 10 Its aporatio -60.73	43.52 culation of the transfer of	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Appendix 45.63 5a) 10 ttive value	37.18 only if control May 91.09 L, equati 12.01 dix L, equati 168.95 L, equati 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 or 45.63	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37 ee Table 45.63	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5 45.63	43.17 om com Nov 91.09 28.34 175.16 45.63	46.75 munity h Dec 91.09 30.21 188.16 45.63		(66) (67) (68) (69) (70)
inclu 5. Interpretation (65)m= inclu 5. Interpretation (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	47.95 de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63 and fan 10 s e.g. eva -60.73 heating (64.45	41.9 In in calcoins (see s (Table Feb 91.09) (calculat 26.1) Ins (calculat 45.63) Is gains 10 Is gains (Table Feb 91.09) (calculat 45.63) Is gains 10 Is gains (Table Feb 91.09)	43.52 culation of a Table 5 culated in April 193.74 culated in	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix l 16.07 n Appendix 45.63 5a) 10 tive value -60.73	37.18 only if controls: May 91.09 L, equati 12.01 dix L, equati 168.95 L, equati 45.63 10 es) (Tab -60.73	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 or 45.63 10 ole 5) -60.73	31.06 s in the control of the contro	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 d, also see 45.63 10 -60.73	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37 ee Table 45.63	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5 45.63 10 -60.73	43.17 om com Nov 91.09 28.34 175.16 45.63 10 -60.73	46.75 munity h Dec 91.09 30.21 188.16 45.63 10 -60.73		(66) (67) (68) (69) (70)
inclu 5. Interpretation (65)m= inclu 5. Interpretation (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	de (57)n ernal ga blic gains Jan 91.09 g gains (29.39 nces gain 196.85 g gains 45.63 and fan 10 s e.g. eva -60.73 heating g	41.9 In in calcoins (see s (Table Feb 91.09) (calculat 26.1) Ins (calculat 45.63) Is gains 10 Is gains (Table Feb 91.09) (calculat 45.63) Is gains 10 Is gains (Table Feb 91.09)	43.52 culation of a Table 5 culated in April 193.74 culated in	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix l 16.07 n Appendix 45.63 5a) 10 tive value -60.73	37.18 only if controls: May 91.09 L, equati 12.01 dix L, equati 168.95 L, equati 45.63 10 es) (Tab -60.73	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 or 45.63 10 ole 5) -60.73	31.06 S in the control of the contr	34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 d, also see 45.63 10 -60.73	35.2 or hot w Sep 91.09 Table 5 19.12 see Tal 150.37 ee Table 45.63	40.26 ater is fr Oct 91.09 24.28 ble 5 161.33 5 45.63 10 -60.73	43.17 om com Nov 91.09 28.34 175.16 45.63 10 -60.73	46.75 munity h Dec 91.09 30.21 188.16 45.63 10 -60.73		(66) (67) (68) (69) (70) (71)



6. Solar gains:

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

_		Access Facto Table 6d		Area m²	a anu	Flux Table 6a	uons	g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.02	x	10.63	x	0.76	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.13	X	10.63	x	0.76	x	0.7	=	8.35	(74)
North	0.9x	0.77	x	1.02	x	20.32	x	0.76	x	0.7	=	7.64	(74)
North	0.9x	0.77	x	2.13	x	20.32	x	0.76	x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.02	x	34.53	x	0.76	x	0.7	=	12.99	(74)
North	0.9x	0.77	X	2.13	X	34.53	X	0.76	X	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.02	X	55.46	x	0.76	X	0.7	=	20.86	(74)
North	0.9x	0.77	x	2.13	X	55.46	X	0.76	X	0.7	=	43.56	(74)
North	0.9x	0.77	X	1.02	X	74.72	X	0.76	X	0.7	=	28.1	(74)
North	0.9x	0.77	x	2.13	X	74.72	X	0.76	X	0.7	=	58.67	(74)
North	0.9x	0.77	X	1.02	X	79.99	X	0.76	X	0.7	=	30.08	(74)
North	0.9x	0.77	X	2.13	X	79.99	X	0.76	X	0.7	=	62.81	(74)
North	0.9x	0.77	x	1.02	X	74.68	X	0.76	X	0.7	=	28.08	(74)
North	0.9x	0.77	x	2.13	x	74.68	x	0.76	X	0.7	=	58.64	(74)
North	0.9x	0.77	X	1.02	x	59.25	x	0.76	x	0.7	=	22.28	(74)
North	0.9x	0.77	X	2.13	X	59.25	X	0.76	X	0.7	=	46.52	(74)
North	0.9x	0.77	x	1.02	x	41.52	x	0.76	X	0.7	=	15.61	(74)
North	0.9x	0.77	X	2.13	x	41.52	x	0.76	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	1.02	x	24.19	x	0.76	X	0.7	=	9.1	(74)
North	0.9x	0.77	x	2.13	x	24.19	x	0.76	X	0.7	=	19	(74)
North	0.9x	0.77	X	1.02	x	13.12	x	0.76	x	0.7	=	4.93	(74)
North	0.9x	0.77	x	2.13	x	13.12	x	0.76	X	0.7	=	10.3	(74)
North	0.9x	0.77	X	1.02	x	8.86	x	0.76	x	0.7	=	3.33	(74)
North	0.9x	0.77	X	2.13	x	8.86	x	0.76	X	0.7	=	6.96	(74)
South	0.9x	0.77	x	0.52	x	46.75	x	0.76	X	0.7	=	8.96	(78)
South	0.9x	0.77	X	1.89	X	46.75	X	0.76	X	0.7	=	32.58	(78)
South	0.9x	0.77	X	0.52	X	76.57	X	0.76	X	0.7	=	14.68	(78)
South	0.9x	0.77	X	1.89	X	76.57	X	0.76	X	0.7	=	53.35	(78)
South	0.9x	0.77	X	0.52	X	97.53	X	0.76	X	0.7	=	18.7	(78)
South	0.9x	0.77	X	1.89	X	97.53	X	0.76	X	0.7	=	67.96	(78)
South	0.9x	0.77	x	0.52	x	110.23	x	0.76	X	0.7	=	21.13	(78)
South	0.9x	0.77	X	1.89	X	110.23	X	0.76	X	0.7	=	76.81	(78)
	0.9x	0.77	x	0.52	x	114.87	x	0.76	x	0.7	=	22.02	(78)
	0.9x	0.77	x	1.89	x	114.87	x	0.76	X	0.7	=	80.04	(78)
	0.9x	0.77	x	0.52	X	110.55	x	0.76	X	0.7	=	21.19	(78)
South	0.9x	0.77	X	1.89	X	110.55	X	0.76	X	0.7	=	77.03	(78)



South 0.9x	0.77	X	0.52	x	108.01	x	0.76	x	0.7	=	20.71	(78)
South 0.9x	0.77	X	1.89	x	108.01	x	0.76	x	0.7	=	75.26	(78)
South 0.9x	0.77	X	0.52	x	104.89	X	0.76	x	0.7	=	20.11	(78)
South 0.9x	0.77	X	1.89	x	104.89	x	0.76	x	0.7	=	73.09	(78)
South 0.9x	0.77	X	0.52	x	101.89	x	0.76	x	0.7	=	19.53	(78)
South 0.9x	0.77	X	1.89	x	101.89	x	0.76	x	0.7	=	70.99	(78)
South 0.9x	0.77	X	0.52	x	82.59	x	0.76	x	0.7] =	15.83	(78)
South 0.9x	0.77	X	1.89	x	82.59	x	0.76	x	0.7	=	57.55	(78)
South 0.9x	0.77	X	0.52	x	55.42	x	0.76	x	0.7	=	10.62	(78)
South 0.9x	0.77	X	1.89	x	55.42	x	0.76	X	0.7	=	38.61	(78)
South 0.9x	0.77	X	0.52	X	40.4	X	0.76	X	0.7	=	7.74	(78)
South 0.9x	0.77	X	1.89	X	40.4	X	0.76	X	0.7	=	28.15	(78)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights 0.9x	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7	=	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	x	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	157	x	0.76	x	0.7	=	39.09	(82)
_		_		-		_		•		- '		_



Dooflighto a a								1			_					¬,,,,,
Rooflights 0.9x	1	X	0.5	52	X		157	X		0.76	×	0.7		=	39.09	(82)
Rooflights 0.9x	1	X	0.5	52	X		157	X		0.76	X	0.7		=	39.09	(82)
Rooflights 0.9x	1	X	0.5	52	X		157	X		0.76	X	0.7		=	39.09	(82)
Rooflights 0.9x	1	X	0.5	52	X		115	X		0.76	X	0.7		=	28.63	(82)
Rooflights 0.9x	1	X	0.5	52	X		115	X		0.76	X	0.7		=	28.63	(82)
Rooflights _{0.9x}	1	X	0.5	52	X		115	X		0.76	X	0.7		=	28.63	(82)
Rooflights 0.9x	1	X	0.5	52	X		115	X		0.76	X	0.7		=	28.63	(82)
Rooflights _{0.9x}	1	X	0.5	52	X		66	X		0.76	X	0.7		=	16.43	(82)
Rooflights _{0.9x}	1	X	0.5	52	X		66	X		0.76	X	0.7		=	16.43	(82)
Rooflights 0.9x	1	X	0.5	52	X		66	x		0.76	x	0.7		=	16.43	(82)
Rooflights 0.9x	1	X	0.5	52	X		66	X		0.76	x	0.7		=	16.43	(82)
Rooflights 0.9x	1	x	0.5	52	X		33	x		0.76	x	0.7		=	8.22	(82)
Rooflights 0.9x	1	X	0.5	52	X		33	x		0.76	×	0.7		=	8.22	(82)
Rooflights _{0.9x}	1	X	0.5	52	X		33	х		0.76	x	0.7		=	8.22	(82)
Rooflights 0.9x	1	X	0.5	52	X		33	x		0.76	x	0.7		=	8.22	(82)
Rooflights 0.9x	1	x	0.5	52	X		21	x		0.76	×	0.7		=	5.23	(82)
Rooflights 0.9x	1	X	0.5	52	X		21	x		0.76	×	0.7		=	5.23	(82)
Rooflights _{0.9x}	1	X	0.5	52	X		21	X		0.76	×	0.7	Ħ	=	5.23	(82)
Rooflights 0.9x	1	x	0.5	52	X		21) x		0.76	×	0.7	一	=	5.23	(82)
Solar gains in v (83)m= 79.78 Total gains – in (84)m= 456.46	145.41 ternal a 518.74	222.37 nd solar 581.83	311.74 (84)m = 650.03	380.05 = (73)m 696.98	35 + (8	90.29 83)m 87.69	370.92 , watts 656.89	318 610	.36	n(74)m . 253.27 557.65	167.2 492.9	-! -	434			(83)
7. Mean intern			`													_
Temperature of	•	•			•			ole 9	, Th1	(°C)					21	(85)
Utilisation fact	Ť				Ť					_					l	
Jan	Feb	Mar	Apr	May	+	Jun	Jul	_	ug	Sep	Oct	+	+	ec		(00)
(86)m= 0.98	0.97	0.94	0.86	0.72		0.54	0.4	0.4	15	0.68	0.9	0.97	0.9	99		(86)
Mean internal		ature in		ea T1 (f	ollo	w ste	ps 3 to 7	7 in T							ı	
(87)m= 19.79	19.98	20.27	20.62	20.86	2	20.97	20.99	20.	99	20.92	20.6	20.14	19.	75		(87)
Temperature of	during h	eating p	eriods ir	rest of	dw	elling	from Ta	able 9	9, Th2	2 (°C)						
(88)m= 19.75	19.75	19.75	19.77	19.77	1	9.78	19.78	19.	78	19.78	19.77	19.76	19.	76		(88)
Utilisation fact	or for g	ains for i	rest of d	welling,	h2,	,m (se	e Table	9a)								
(89)m= 0.98	0.96	0.92	0.82	0.65	1	0.45	0.29	0.3	33	0.59	0.86	0.96	0.9	98		(89)
Mean internal	temper	ature in	the rest	of dwell	ling	T2 (f	ollow sta	ine a	to 7	in Tabl	e 9c)		•		1	
(90)m= 18.19	18.47	18.89	19.37	19.65	Ť	9.76	19.78	19.	-	19.72	19.36	18.71	18.	15		(90)
. ,												/ing area ÷ (0.54	(91)
Magazintana 1	40	oh /f		ا- مام	. 11! -	~\	. A T 4	. /4	£1 ^							 ` ′
Mean internal (92)m= 19.06	19.29	19.64	r the wh	ole dwe	$\overline{}$	g) = fi 20.42	LA × 11	+ (1		20.37	20.03	19.48	19.	0 2		(92)
Apply adjustm							l	<u> </u>					19.	UZ		(02)
Apply aujustill	ent to ti	ie iiieali	initenia	rempe	alu		יוו ומטופ	<i>-</i> +€,	WILEI	- appic	priate					



			r	,				,	r	1	1	· · · · · ·		
(93)m=	18.91	19.14	19.49	19.9	20.16	20.27	20.29	20.28	20.22	19.88	19.33	18.87		(93)
	oace hea													
	Ti to the ı ıtilisation					ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the t		Feb	Mar	<u>_</u> _		lup	lul	I Aug	Con	Oct	Nov	Doo		
l Itilia	Jan sation fac		L	Apr 	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=		0.96	0.92	0.83	0.68	0.49	0.34	0.38	0.63	0.87	0.95	0.98		(94)
	ful gains,			ļ				1						, ,
(95)m=		495.74	533.48	538.17	472.43	335.41	222.43	233.06	348.81	426.82	426.46	424.59		(95)
	thly avera			ı perature	e from Ta	able 8		I			l			
(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)
Hea	t loss rate	e for mea	an intern	nal tempe	erature, l	Lm , W =	-[(39)m	x [(93)m	– (96)m	1	<u> </u>			
(97)m=		890	809.77	676.91	519.33	344.01	223.78	235.33	373.22	569.84	754.73	909.65		(97)
Spa	ce heatin	g require	ement fo	r each n	nonth, k\	Vh/mont	h = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	350.64	264.94	205.56	99.89	34.89	0	0	0	0	106.41	236.35	360.89		
				!				Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1659.58	(98)
Spa	ce heatin	a require	ement in	kWh/m²	²/vear								37.66	(99)
		• ,				-1	1 12		VIID)				37.00	
	nergy red	•	nts – Ind	ividual h	eating sy	/stems I	ncluding	micro-C	HP)					
•	ce heatir tion of sp	_	at from s	econdar	v/sunnla	mentary	evetom					ı	0	(201)
	_					montary	-	(202) = 1	_ (201) _					┥`
	tion of sp			•	. ,			, ,	, ,	(000)1			1	(202)
Frac	tion of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Effic	iency of ı	main spa	ace heat	ing syste	em 1								90.9	(206)
Effic	iency of	seconda	ry/suppl	ementar	y heating	g system	ı, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Spa	ce heatin	g require	ement (c	alculate	d above)									
	350.64	264.94	205.56	99.89	34.89	0	0	0	0	106.41	236.35	360.89		
(211)	$m = \{[(98)]$)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	385.75	291.46	226.14	109.89	38.39	0	0	0	0	117.06	260.02	397.02		
			•	•				Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	1825.73	(211)
Spa	ce heatin	g fuel (s	econdar	v), kWh/	month									
•	8)m x (20	•		• /										
(215)m	0	0	0	0	0	0	0	0	0	0	0	0		
				•				Tota	l (kWh/yea	ar) =Sum(2	215),5,1012	F	0	(215)
Wate	r heating	1										!		
Outpu	ut <u>from w</u>	ater hea	ter (calc	ulated a	bove)									
	126.68	110.5	115.43	103.91	101.38	90.32	88.23	97.1	97.9	109.92	115.55	123.99		
Efficie	ency of w	ater hea	iter										80.8	(216)
(217)m	87.98	87.67	86.99	85.45	83.17	80.8	80.8	80.8	80.8	85.47	87.32	88.08		(217)
Fuel f	or water	heating,	kWh/m	onth				•	•	•				
. ,	m = (64)													
(219)m	143.99	126.03	132.7	121.59	121.9	111.78	109.2	120.18	121.17	128.6	132.33	140.76		_
								Tota	I = Sum(2				1510.23	(219)
	al totals				4					k'	Wh/year	•	kWh/yea	<u>r</u>
Space	e heating	iuei use	eu, main	system	I								1825.73	



Water heating fuel used			1510.23	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120	(230	0c)
boiler with a fan-assisted flue		45	<u> </u>	0e)
Total electricity for the above, kWh/year	sum of (230a	a)(230g) =	165 (231	1)
Electricity for lighting			207.61 (232	2)
10a. Fuel costs - individual heating systems:				
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48 x 0.01	63.54 (240	0)
Space heating - main system 2	(213) x	0 x 0.01	= 0 (241	1)
Space heating - secondary	(215) x	13.19 x 0.01	= 0 (242	2)
Water heating cost (other fuel)	(219)	3.48 × 0.01	52.56 (247	7)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01	= 21.76 (249	9)
(if off-peak tariff, list each of (230a) to (230g) sep Energy for lighting	parately as applicable and app (232)	ply fuel price according to		0)
Additional standing charges (Table 12)			120 (251	1)
Appendix Q items: repeat lines (253) and (254) a	as needed			
Appendix Q items: repeat lines (253) and (254) at Total energy cost (245)(245)	47) + (250)(254) =		285.24 (255	5)
			285.24 (255	5)
Total energy cost (245)(245			285.24 (255 0.42 (256	
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12)				6)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12)	47) + (250)(254) =		0.42 (256	6) 7)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (47) + (250)(254) = 256)] ÷ [(4) + 45.0] =		0.42 (256 1.35 (257	6) 7)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) SAP rating (Section 12)	47) + (250)(254) = 256)] ÷ [(4) + 45.0] =	Emission factor kg CO2/kWh	0.42 (256 1.35 (257	6) 7)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) SAP rating (Section 12)	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy		0.42 (256 1.35 (257 81.24 (258 Emissions	6) 7) 8)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) × (2	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year	kg CO2/kWh	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year	66) 77) 88)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (2	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x	kg CO2/kWh 0.216 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261	66) 77) 88) 11)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) SAP rating (Section 12) 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary)	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x (215) x	kg CO2/kWh 0.216 = 0.519 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261 0 (263	6) 7) 8) 11) 33) 4)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (2	256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.216 = 0.519 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261 0 (263 326.21 (264	11) 33) 44)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (2	256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261 0 (263 326.21 (264 720.57 (265	66) 77) 88) 11) 33) 44) 55)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (2	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261 0 (263 326.21 (264 720.57 (265	11) 33) 44) 77) 88)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (2	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x sum	kg CO2/kWh 0.216 = 0.519 = 0.519 = 0.519 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261 0 (263 326.21 (264 720.57 (265 85.64 (267 107.75 (268	66) 77) 88) 11) 33) 44) 55) 77) 88)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x (2	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ns including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x sum	kg CO2/kWh 0.216 = 0.519 = 0.519 = 0.519 = 0.519 = 0.519 =	0.42 (256 1.35 (257 81.24 (258 Emissions kg CO2/year 394.36 (261 0 (263 326.21 (264 720.57 (265 85.64 (267 107.75 (268 913.95 (272	66) 77) 88) 11) 33) 44) 55) 77) 88) 22)



	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2227.39	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	1842.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4069.86	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	506.55	(267)
Electricity for lighting	(232) x	0	=	637.37	(268)
'Total Primary Energy	sui	m of (265)(271) =		5213.78	(272)
Primary energy kWh/m²/year	(27	72) ÷ (4) =		118.31	(273)



User Details:

Assessor Name: Peter Mitchell Stroma Number: STRO007945
Software Name: Stroma FSAP 2012 Software Version: 1.0.3.6

Pro	perty Address:	Baselir	ne First Fl	oor San	nple		
Address:							
1. Overall dwelling dimensions:							
	Area(m²)		Av. Heig	ght(m)		Volume(m³))
Ground floor	44.07	(1a) x	3.0	3	(2a) =	133.53	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$	44.07	(4)					
Dwelling volume		(3a)+(3b)+(3c)+(3d)-	⊦(3e)+	(3n) =	133.53	(5)
2. Ventilation rate:							
main secondary heating heating	other		total			m³ per hou	•
Number of chimneys 0 + 0	+ 0] = [0	x 4	0 =	0	(6a)
Number of open flues 0 + 0	+ 0	;] = [0	x 2	0 =	0	(6b)
Number of intermittent fans		, <u> </u>	3	x 1	0 =	30	(7a)
Number of passive vents		Ī	0	x 1	0 =	0	(7b)
Number of flueless gas fires		Ė	0	x 4	0 =	0	(7c)
		L			ı		_
					Air ch	anges per ho	ur
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a))+(7b)+(7c) =	Γ	30	÷	· (5) =	0.22	(8)
If a pressurisation test has been carried out or is intended, proceed to	to (17), otherwise c	ontinue fi	rom (9) to (1	6)	'		_
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	/ consti	ruction		Ī	0	(11)
if both types of wall are present, use the value corresponding to the deducting areas of openings); if equal user 0.35	he greater wall area	(after			•		_
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					i	0	(13)
Percentage of windows and doors draught stripped					i	0	(14)
Window infiltration	0.25 - [0.2	x (14) ÷ 1	100] =		l I	0	(15)
Infiltration rate			12) + (13) +	(15) =	ŀ	0	(16)
Air permeability value, q50, expressed in cubic metres					area I	4.5999999046325	=
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$,			.00 0. 0	толоро	u.ou	0.45	(18)
Air permeability value applies if a pressurisation test has been done			is being use	ed	l	0.45	_(10)
Number of sides sheltered	,	Í	J		I	3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18)	x (20) =			İ	0.35	(21)
Infiltration rate modified for monthly wind speed							_
Jan Feb Mar Apr May Jun	Jul Aug	Sep	Oct	Nov	Dec		
Monthly average wind and different Table 7	•						

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

Monthly average wind speed from Table 7

Wind Factor $(22a)m = (22)m \div 4$

1.25

(22)m=

(22a)m=

5.1

1.27



Adjusted infiltration rate (allowing for shelter an	d wind spee	ed) = (21a) x (22a)m				
0.45 0.44 0.43 0.39 0.38	1 1	33 0.33 0.3	0.38	0.4	0.41		
Calculate effective air change rate for the applied of the section	cable case		-				(220)
If exhaust air heat pump using Appendix N, (23b) = (23a	a) x Fmv (eguat	tion (N5)) otherwise	(23h) = (23a)			0	(23a)
If balanced with heat recovery: efficiency in % allowing f			(200) – (200)			0	(23b)
a) If balanced mechanical ventilation with he			- (22h)m + (22h) v [4	1 (22a)	. 1001	(23c)
(24a)m= 0 0 0 0 0	 	0 0 0	` 	0	0	+ 100j	(24a)
b) If balanced mechanical ventilation without							(- 7
(24b)m= 0 0 0 0 0		0 0 0	` 	0	0		(24b)
c) If whole house extract ventilation or positive	re input vent	ilation from outsid	de				
if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$	•)			
(24c)m= 0 0 0 0 0	0	0 0 0	0	0	0		(24c)
d) If natural ventilation or whole house positive	ve input vent	tilation from loft	•		•	·	
if (22b)m = 1, then (24d)m = (22b)m other	erwise (24d)r	m = 0.5 + [(22b)m]	n² x 0.5]			İ	
(24d)m= 0.6 0.6 0.59 0.58 0.57	0.56 0.	56 0.55 0.5	0.57	0.58	0.59		(24d)
Effective air change rate - enter (24a) or (24b		` ' ' ' ` '				ı	
(25)m= 0.6 0.6 0.59 0.58 0.57	0.56 0.	56 0.55 0.5	0.57	0.58	0.59		(25)
3. Heat losses and heat loss parameter:							
ELEMENT Gross Openings area (m²) m²	Net Area A ,m²	U-value W/m2K	A X U (W/I	<)	k-value kJ/m²-ł		A X k kJ/K
D							
Doors	1.89	x 1.6	= 3.024				(26)
Doors Windows Type 1	1.89	× 1.6 x1/[1/(1.4)+ 0.04]					(26) (27)
			= 1.35				, ,
Windows Type 1	1.02	x1/[1/(1.4)+ 0.04]	= 1.35 = 2.82				(27)
Windows Type 1 Windows Type 2	1.02	x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04]	= 1.35 = 2.82 = 0.69				(27) (27)
Windows Type 1 Windows Type 2 Windows Type 3	1.02 2.13 0.52	x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04]	= 1.35 = 2.82 = 0.69 = 2.51				(27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	1.02 2.13 0.52 1.89	x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728				(27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1	1.02 2.13 0.52 1.89 0.52	x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728				(27) (27) (27) (27) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2	1.02 2.13 0.52 1.89 0.52 0.52	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728				(27) (27) (27) (27) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3	1.02 2.13 0.52 1.89 0.52 0.52 0.52	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728				(27) (27) (27) (27) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 2.08	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31 93.39	x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4) + 0.04] x1/[1/(1.4) + 0.04] x1/[1/(1.4) + 0.04] x1/[1/(1.4) + 0.04] x1/[1/(1.4) + 0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8				(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 Total area of elements, m²	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31 93.39 40.32	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04]	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8				(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 Total area of elements, m² Party wall	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x 0.16 x 0.12	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8	s given in	paragraph		(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 Total area of elements, m² Party wall Party floor	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculated	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x 0.16 x 0.12	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8	s given in	paragraph	3.2	(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 Total area of elements, m² Party wall Party floor * for windows and roof windows, use effective window U-value.	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculated	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x 0.16 x 0.12	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8	s given in	paragraph	3.2	(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 2.08 Total area of elements, m² Party wall Party floor * for windows and roof windows, use effective window U-ve** include the areas on both sides of internal walls and part Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k)	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculated titions	x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x1/[1/(1.4)+0.04] x 0.16 x 0.12 x 0 using formula 1/[(1/U)(26)(30)+(32)	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8				(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 7.45 Roof 50.39 Total area of elements, m² Party wall Party floor * for windows and roof windows, use effective window U-value include the areas on both sides of internal walls and party Fabric heat loss, W/K = S (A x U)	1.02 2.13 0.52 1.89 0.52 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculated titions	x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4)+ 0.04] x1/[1/(1.4) + 0.04] x1/[1/(1.4) + 0.04] x1/[1/(1.4) + 0.04] x 0.16 x 0.12 x 0 using formula 1/[(1/U) (26)(30) + (32) ((1)	= 1.35 = 2.82 = 0.69 = 2.51 = 0.728 = 0.728 = 0.728 = 0.728 = 5.69 = 5.8 = 0 -value)+0.04] at a constant of the con	2) + (32a). Medium	(32e) =	24.64	(27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)11.57 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =(37)36.21 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 =26.48 26.31 26.14 25.34 25.19 24.5 24.5 24.37 24.77 25.19 25.5 25.81 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =62.69 62.52 62.35 61.55 61.4 60.71 60.71 60.58 60.98 61.4 61.7 62.02 Average = $Sum(39)_{1...12}/12=$ (39)61.55 Heat loss parameter (HLP), W/m²K (40)m = (39)m \div (4)1.42 1.42 1.41 1.39 1.38 1.38 1.37 1.38 1.39 1.4 1.41 (40)m =(40)Average = $Sum(40)_{1...12}/12=$ 1.4 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)1.52 if TFA > 13.9, N = 1 + 1.76 x [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)70.26 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m =77.28 74.47 71.66 68.85 66.04 63.23 63.23 66.04 68.85 71.66 74.47 77.28 (44)Total = $Sum(44)_{1...12}$ = 843.09 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) 100.24 (45)m =114.61 103.44 90.18 86.53 74.67 69.19 79.4 80.35 93.63 102.21 110.99 (45)Total = $Sum(45)_{1...12}$ = 1105.43 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 17.19 15.04 15.52 13.53 12.98 12.05 14.05 15.33 16.65 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 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 fr	om watei	· storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or	(54) in (5	55)									0		(55)
Water storage	e loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	ns dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (57	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circui	t loss (ar	nual) fro	m Table	3							0		(58)
Primary circui	t loss cal	culated t	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(modified b	y factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)		•	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	alculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 39.38	34.28	36.52	33.95	33.65	31.18	32.22	33.65	33.95	36.52	36.73	39.38		(61)
Total heat red	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= 153.99	134.52	139.96	124.13	120.18	105.85	101.41	113.05	114.3	130.15	138.94	150.38		(62)
Solar DHW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	/) (enter '0'	if no sola	r contributi	on to wate	er heating)		
(add additiona	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix G	3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
WWHRS -27.31	-24.02	-24.52	-20.23	-18.81	-15.53	-13.18	-15.95	-16.4	-20.23	-23.39	-26.38		(63) (G1
Output from v	vater hea	ter											
(64)m= 126.68	110.5	115.43	103.91	101.38	90.32	88.23	97.1	97.9	109.92	115.55	123.99		
	-			-	-	-	Outp	out from wa	ater heate	r (annual)₁	12	1280.91	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m= 47.95	41.9	43.52	38.47	37.18	32.62	31.06	34.81	35.2	40.26	43.17	46.75		(65)
include (57	m in cal	culation of	of (65)m	only if c	ylinder is	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal g	ains (see	e Table 5	and 5a):									
Metabolic gai	ns (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Daa		
(66)m= 75.91	75.91	75.91	75.91	75.91	75.04			-	001	INOV	Dec	1	
Lighting gains	calcula (tad in Ar			75.91	75.91	75.91	75.91	75.91	75.91	75.91		(66)
(67)m= 11.76	1	rea III Y	pendix			<u> </u>		75.91					(66)
Appliances ga	10.44	8.49	pendix 6.43			<u> </u>		75.91				ı	(66) (67)
		8.49	6.43	L, equati 4.81	ion L9 oi 4.06	r L9a), a 4.38	lso see	75.91 Table 5	75.91 9.71	75.91	75.91		
(68)m= 131.89	ains (calc	8.49	6.43	L, equati 4.81	ion L9 oi 4.06	r L9a), a 4.38	lso see	75.91 Table 5	75.91 9.71	75.91	75.91		
(68)m= 131.89 Cooking gains	ains (calc	8.49 culated in	6.43 Append 122.47	4.81 dix L, eq	4.06 uation L	4.38 13 or L1 98.67	5.7 3a), also	75.91 Table 5 7.65 see Tal 100.75	9.71 ble 5 108.09	75.91 11.33	75.91 12.08		(67)
	ains (calc	8.49 culated in	6.43 Append 122.47	4.81 dix L, eq	4.06 uation L	4.38 13 or L1 98.67	5.7 3a), also	75.91 Table 5 7.65 see Tal 100.75	9.71 ble 5 108.09	75.91 11.33	75.91 12.08		(67)
Cooking gains	133.26 s (calculation) 30.59	8.49 sulated in 129.81 ated in A 30.59	6.43 Append 122.47 opendix 30.59	L, equati 4.81 dix L, eq 113.2 L, equat	4.06 uation L 104.49 ion L15	r L9a), a 4.38 13 or L1 98.67 or L15a)	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table	75.91 9.71 ble 5 108.09 5	75.91 11.33 117.36	75.91 12.08 126.07		(67) (68)
Cooking gains (69)m= 30.59	133.26 s (calculation) 30.59	8.49 sulated in 129.81 ated in A 30.59	6.43 Append 122.47 opendix 30.59	L, equati 4.81 dix L, eq 113.2 L, equat	4.06 uation L 104.49 ion L15	r L9a), a 4.38 13 or L1 98.67 or L15a)	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table	75.91 9.71 ble 5 108.09	75.91 11.33 117.36	75.91 12.08 126.07		(67) (68)
Cooking gain: (69)m= 30.59 Pumps and fa	ains (calculations) (8.49 culated in 129.81 ated in A 30.59 (Table 5	6.43 Append 122.47 opendix 30.59 5a)	L, equati 4.81 dix L, eq 113.2 L, equat 30.59	4.06 uation L 104.49 ion L15 30.59	r L9a), a 4.38 13 or L1 98.67 or L15a) 30.59	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table 30.59	9.71 ble 5 108.09 5 30.59	75.91 11.33 117.36 30.59	75.91 12.08 126.07 30.59		(67) (68) (69)
Cooking gains (69)m= 30.59 Pumps and fa (70)m= 10	ains (calculations) 133.26 (calculations) 30.59 ans gains 10	8.49 culated in 129.81 ated in A 30.59 (Table 5	6.43 Append 122.47 opendix 30.59 5a)	L, equati 4.81 dix L, eq 113.2 L, equat 30.59	4.06 uation L 104.49 ion L15 30.59	r L9a), a 4.38 13 or L1 98.67 or L15a) 30.59	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table 30.59	9.71 ble 5 108.09 5 30.59	75.91 11.33 117.36 30.59	75.91 12.08 126.07 30.59		(67) (68) (69)
Cooking gains (69)m= 30.59 Pumps and fa (70)m= 10 Losses e.g. e	ains (calculated solution) ains (calculated solution) and solution are solution) and solution are solution ar	8.49 sulated in 129.81 ated in A 30.59 (Table 5 10 on (negative)	6.43 Append 122.47 Appendix 30.59 5a) 10 tive valu	L, equati 4.81 dix L, eq 113.2 L, equat 30.59	4.06 uation L 104.49 ion L15 30.59	r L9a), a 4.38 13 or L1 98.67 or L15a) 30.59	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table 30.59	9.71 ble 5 108.09 5 30.59	75.91 11.33 117.36 30.59	75.91 12.08 126.07 30.59		(67) (68) (69) (70)
Cooking gains (69)m= 30.59 Pumps and fa (70)m= 10 Losses e.g. e (71)m= -60.73	ains (calculated solution) ains (calculated solution) and solution are solution) and solution are solution ar	8.49 sulated in 129.81 ated in A 30.59 (Table 5 10 on (negative)	6.43 Append 122.47 Appendix 30.59 5a) 10 tive valu	L, equati 4.81 dix L, eq 113.2 L, equat 30.59	4.06 uation L 104.49 ion L15 30.59	r L9a), a 4.38 13 or L1 98.67 or L15a) 30.59	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table 30.59	9.71 ble 5 108.09 5 30.59	75.91 11.33 117.36 30.59	75.91 12.08 126.07 30.59		(67) (68) (69) (70)
Cooking gains (69)m= 30.59 Pumps and fa (70)m= 10 Losses e.g. e (71)m= -60.73 Water heating	ains (calculations) (8.49 culated in 129.81 ated in A 30.59 (Table 5 10 on (negation 10 10 10 10 10 10 10 10 10 10 10 10 10	6.43 Appendix 30.59 5a) 10 tive valu -60.73	L, equati 4.81 dix L, equati 113.2 L, equati 30.59 10 es) (Tab	104.49 104.49 104.49 100 L15 30.59 10 1e 5) -60.73	r L9a), a 4.38 13 or L1 98.67 or L15a) 30.59 10 -60.73	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table 30.59 10 -60.73	75.91 9.71 ble 5 108.09 5 30.59 10 -60.73	75.91 11.33 117.36 30.59 10 -60.73	75.91 12.08 126.07 30.59 10 -60.73		(67) (68) (69) (70) (71)
Cooking gains $(69)m= 30.59$ Pumps and fa $(70)m= 10$ Losses e.g. e $(71)m= -60.73$ Water heating $(72)m= 64.45$	ains (calculations) (8.49 culated in 129.81 ated in A 30.59 (Table 5 10 on (negation 10 10 10 10 10 10 10 10 10 10 10 10 10	6.43 Appendix 30.59 5a) 10 tive valu -60.73	L, equati 4.81 dix L, equati 113.2 L, equati 30.59 10 es) (Tab	104.49 104.49 104.49 100 L15 30.59 10 1e 5) -60.73	r L9a), a 4.38 13 or L1 98.67 or L15a) 30.59 10 -60.73	so see	75.91 Table 5 7.65 see Tal 100.75 ee Table 30.59 10 -60.73	75.91 9.71 ble 5 108.09 5 30.59 10 -60.73	75.91 11.33 117.36 30.59 10 -60.73	75.91 12.08 126.07 30.59 10 -60.73		(67) (68) (69) (70) (71)



6. Solar gains:

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

Orienta	tion:	Access Factor Table 6d	r	Area m²	a a	Flux Table 6a		g_ Table 6b	м ри	FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.02	x	10.63	x	0.76	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.13	x	10.63	х	0.76	x	0.7	=	8.35	(74)
North	0.9x	0.77	X	1.02	х	20.32	X	0.76	x	0.7	=	7.64	(74)
North	0.9x	0.77	x	2.13	x	20.32	x	0.76	x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.02	x	34.53	x	0.76	x	0.7	=	12.99	(74)
North	0.9x	0.77	X	2.13	х	34.53	X	0.76	x	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.02	x	55.46	x	0.76	x	0.7	=	20.86	(74)
North	0.9x	0.77	X	2.13	х	55.46	X	0.76	x	0.7	=	43.56	(74)
North	0.9x	0.77	x	1.02	x	74.72	X	0.76	x	0.7	=	28.1	(74)
North	0.9x	0.77	x	2.13	x	74.72	x	0.76	x	0.7	=	58.67	(74)
North	0.9x	0.77	x	1.02	x	79.99	X	0.76	x	0.7	=	30.08	(74)
North	0.9x	0.77	X	2.13	x	79.99	x	0.76	x	0.7	=	62.81	(74)
North	0.9x	0.77	x	1.02	x	74.68	x	0.76	x	0.7	=	28.08	(74)
North	0.9x	0.77	x	2.13	x	74.68	X	0.76	x	0.7	=	58.64	(74)
North	0.9x	0.77	X	1.02	x	59.25	x	0.76	x	0.7	=	22.28	(74)
North	0.9x	0.77	X	2.13	x	59.25	x	0.76	x	0.7	=	46.52	(74)
North	0.9x	0.77	x	1.02	x	41.52	x	0.76	x	0.7	=	15.61	(74)
North	0.9x	0.77	X	2.13	x	41.52	x	0.76	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	1.02	x	24.19	x	0.76	x	0.7	=	9.1	(74)
North	0.9x	0.77	x	2.13	x	24.19	x	0.76	x	0.7	=	19	(74)
North	0.9x	0.77	X	1.02	x	13.12	x	0.76	x	0.7	=	4.93	(74)
North	0.9x	0.77	x	2.13	x	13.12	x	0.76	x	0.7	=	10.3	(74)
North	0.9x	0.77	X	1.02	x	8.86	x	0.76	x	0.7	=	3.33	(74)
North	0.9x	0.77	X	2.13	X	8.86	x	0.76	x	0.7] =	6.96	(74)
South	0.9x	0.77	X	0.52	x	46.75	x	0.76	x	0.7] =	8.96	(78)
South	0.9x	0.77	X	1.89	X	46.75	X	0.76	x	0.7] =	32.58	(78)
South	0.9x	0.77	X	0.52	X	76.57	X	0.76	X	0.7	=	14.68	(78)
South	0.9x	0.77	X	1.89	X	76.57	X	0.76	x	0.7	=	53.35	(78)
South	0.9x	0.77	X	0.52	X	97.53	X	0.76	X	0.7	=	18.7	(78)
South	0.9x	0.77	X	1.89	x	97.53	X	0.76	x	0.7	=	67.96	(78)
South	0.9x	0.77	X	0.52	X	110.23	x	0.76	x	0.7] =	21.13	(78)
South	0.9x	0.77	X	1.89	X	110.23	X	0.76	X	0.7	=	76.81	(78)
South	0.9x	0.77	X	0.52	X	114.87	X	0.76	x	0.7] =	22.02	(78)
South	0.9x	0.77	x	1.89	x	114.87	x	0.76	x	0.7] =	80.04	(78)
South	0.9x	0.77	x	0.52	x	110.55	X	0.76	x	0.7	=	21.19	(78)
South	0.9x	0.77	X	1.89	x	110.55	x	0.76	x	0.7	=	77.03	(78)



South 0.9x	0.77	X	0.52	x	108.01	x	0.76	x	0.7	=	20.71	(78)
South 0.9x	0.77	X	1.89	x	108.01	x	0.76	x	0.7	=	75.26	(78)
South 0.9x	0.77	X	0.52	x	104.89	X	0.76	x	0.7	=	20.11	(78)
South 0.9x	0.77	X	1.89	x	104.89	x	0.76	x	0.7	=	73.09	(78)
South 0.9x	0.77	X	0.52	x	101.89	x	0.76	x	0.7	=	19.53	(78)
South 0.9x	0.77	X	1.89	x	101.89	x	0.76	x	0.7	=	70.99	(78)
South 0.9x	0.77	X	0.52	x	82.59	x	0.76	X	0.7] =	15.83	(78)
South 0.9x	0.77	X	1.89	x	82.59	x	0.76	x	0.7	=	57.55	(78)
South 0.9x	0.77	X	0.52	x	55.42	x	0.76	x	0.7	=	10.62	(78)
South 0.9x	0.77	X	1.89	x	55.42	x	0.76	X	0.7	=	38.61	(78)
South 0.9x	0.77	X	0.52	X	40.4	X	0.76	X	0.7	=	7.74	(78)
South 0.9x	0.77	X	1.89	X	40.4	X	0.76	X	0.7	=	28.15	(78)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	X	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	157	x	0.76	x	0.7	=	39.09	(82)
_		_		-		_		•		- '		_



Rooflights 0.9x	1	X	0.5	52	x		157	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	1	X	0.5	52	x		157	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	1	X	0.5	52	x		157	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	1	X	0.5	52	x		115	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	1	x	0.5	52	x		115	x	0.76	×	0.7	_ =	28.63	(82)
Rooflights 0.9x	1	x	0.5	52	x		115	x	0.76	x	0.7	_ =	28.63	(82)
Rooflights 0.9x	1	x	0.5	52	х		115	x	0.76	×	0.7		28.63	(82)
Rooflights 0.9x	1	x	0.5	52	x		66	x	0.76	×	0.7	_ =	16.43	(82)
Rooflights 0.9x	1	x	0.5	52	x		66	x	0.76	x	0.7	_ =	16.43	(82)
Rooflights 0.9x	1	X	0.5	52	x		66	X	0.76	X	0.7	=	16.43	(82)
Rooflights 0.9x	1	X	0.5	52	х		66	x	0.76	x	0.7	=	16.43	(82)
Rooflights 0.9x	1	X	0.5	52	х		33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	1	X	0.5	52	х		33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	1	X	0.5	52	х		33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	1	X	0.5	52	x		33	x	0.76	X	0.7	=	8.22	(82)
Rooflights 0.9x	1	x	0.5	52	x		21	x	0.76	x	0.7	=	5.23	(82)
Rooflights 0.9x	1	x	0.5	52	х		21	x	0.76	x	0.7	=	5.23	(82)
Rooflights 0.9x	1	X	0.5	52	х		21	x	0.76	x	0.7	=	5.23	(82)
Rooflights 0.9x	1	x	0.5	52	x		21	x	0.76	x	0.7		5.23	(82)
					_									
Solar gains ir	watts, ca	lculated	for eac	h month	1			(83)m	= Sum(74)m	(82)m		_	_	
(83)m= 79.78	145.41	222.37	311.74	380.05	39	90.29	370.92	318	.36 253.27	167.2	97.34	67.1		(83)
Total gains –	internal a	nd solar	(84)m =	= (73)m	+ (8	33)m	, watts				_	_	_	
(84)m= 343.65	407.23	474.94	549.84	603.8	59	99.92	571.49	523	.92 466.33	394.8	9 341.76	323.86		(84)
7. Mean inte	rnal temp	erature	(heating	seasor	n)									
Temperature	e during h	eating p	eriods ir	n the livi	ng a	area f	rom Tab	ole 9,	Th1 (°C)				21	(85)
Utilisation fa	ctor for ga	ains for I	iving are	ea, h1,m	า (ระ	ee Ta	ble 9a)							
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m= 0.99	0.99	0.97	0.91	0.79	C	0.61	0.46	0.5	0.77	0.95	0.99	1		(86)
Mean intern	al tempera	ature in I	living are	ea T1 (f	ollo	w ste	os 3 to 7	in T	able 9c)	-	-	-		
(87)m= 19.57	19.77	20.1	20.5	20.81	1	0.95	20.99	20.		20.46	19.94	19.54]	(87)
Temperature	during h	eating n	eriods ir	rest of	dw	ellina	from Ta	hle 9	Th2 (°C)		<u>.</u>	!	•	
(88)m= 19.75	19.75	19.75	19.77	19.77	_	9.78	19.78	19.		19.77	19.76	19.76]	(88)
	otor for a	ning for r	oot of d	wolling	h2		o Toblo	00)	<u> </u>		<u>Į</u>		I	
Utilisation fa	0.98	0.96	0.88	0.72	т —	m (se	0.34	9a) 0.3	9 0.68	0.92	0.98	0.99	1	(89)
		!						!	!	<u>. </u>	0.90	0.99		(00)
Mean intern					Ť			Ė-	1	T -	1 40 40	1	l	(00)
(90)m= 17.88	18.18	18.65	19.22	19.59	1	9.75	19.78	19.		19.18		17.84		(90)
										ILA = LI	ving area ÷ (+) =	0.54	(91)
														—
Mean intern	al tempera	ature (fo	r the wh	ole dwe	elling	g) = fl	_A × T1	+ (1	– fLA) × T2					
Mean internation (92)m= 18.79 Apply adjust	19.04	19.43	19.91	20.25	2	20.4	20.43	20.	43 20.33	19.87		18.76		(92)



(93)m= 18.64 18.89 19.28 19.76 20.1 20.25 20.28 20.28 20.18 19.72 19.1 18.61	
	(93)
8. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate	
the utilisation factor for gains using Table 9a	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Utilisation factor for gains, hm: (94)m= 0.99 0.98 0.95 0.88 0.74 0.55 0.39 0.44 0.71 0.92 0.98 0.99	(94)
	(94)
Useful gains, hmGm , W = (94)m x (84)m (95)m= 340.08 398.72 452.44 484.86 448.78 329.63 221.32 231.05 330.96 364.44 335.06 321.2	(95)
Monthly average external temperature from Table 8	(00)
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m]	· /
(97)m= 899.2 874.64 796.89 668.64 515.83 343.17 223.6 235.01 370.59 560.09 740.41 893.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	
(98)m= 415.98 319.82 256.27 132.32 49.88 0 0 0 0 145.57 291.86 425.83	
Total per year (kWh/year) = Sum(98) _{15,912} = 2037.	51 (98)
Space heating requirement in kWh/m²/year 46.2	3 (99)
9a. Energy requirements – Individual heating systems including micro-CHP)	
Space heating:	(204)
Fraction of space heat from secondary/supplementary system 0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] = 1$	(204)
Efficiency of main space heating system 1 90.9	(206)
Efficiency of secondary/supplementary heating system, %	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kV	/h/year
Space heating requirement (calculated above)	•
415.98 319.82 256.27 132.32 49.88 0 0 0 145.57 291.86 425.83	
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$	(211)
457.62 351.84 281.92 145.56 54.87 0 0 0 160.14 321.07 468.46	,
Total (kWh/year) =Sum(211) _{15,1012} = 2241.	49 (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	
Total (kWh/year) =Sum(215) _{15,1012} = 0	(215)
Water heating	
Output from water heater (calculated above)	
126.68 110.5 115.43 103.91 101.38 90.32 88.23 97.1 97.9 109.92 115.55 123.99	
Efficiency of water heater 80.8	(216)
(217)m= 88.32 88.07 87.5 86.16 83.87 80.8 80.8 80.8 86.26 87.79 88.41	(217)
Fuel for water heating, kWh/month	
$(219)m = (64)m \times 100 \div (217)m$	
(219)m= 143.43 125.46 131.92 120.59 120.87 111.78 109.2 120.18 121.17 127.43 131.62 140.25	
Total = $Sum(219a)_{112}$ = 1503.	`
	/year
Space heating fuel used, main system 1 2241.	49



Water heating fuel used 1503.89 Electricity for pumps, fans and electric keep-hot central heating pump: (230c)120 boiler with a fan-assisted flue (230e)45 sum of (230a)...(230g) = Total electricity for the above, kWh/year 165 (231)Electricity for lighting (232)207.61 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)0.216 484.16 (215) x Space heating (secondary) (263)0.519 0 (219) x Water heating (264)0.216 324.84 (261) + (262) + (263) + (264) =Space and water heating 809 (265)(231) x Electricity for pumps, fans and electric keep-hot (267)0.519 85.64 (232) x Electricity for lighting (268)0.519 107.75 sum of (265)...(271) =Total CO2, kg/year (272)1002.39 **Dwelling CO2 Emission Rate** $(272) \div (4) =$

El rating (section 14)

(273)

(274)

22.75

85



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Pr	operty Addres	s: Baselir	ne Groun	d Floor	Sample		
Address:							
Overall dwelling dimensions:							
	Area(m²)	_	Av. Hei	ght(m)	_	Volume(m ³)
Ground floor	70.43	(1a) x	2.	42	(2a) =	170.44	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$	70.43	(4)					
Dwelling volume		(3a)+(3b)+(3c)+(3d))+(3e)+	(3n) =	170.44	(5)
2. Ventilation rate:							
main secondary heating heating	y other		total			m³ per hou	r
Number of chimneys 0 + 0	+ 0	= [0	x ·	40 =	0	(6a)
Number of open flues 0 + 0	+ 0	=	0	x	20 =	0	(6b)
Number of intermittent fans	J L		3	x '	10 =	30	(7a)
Number of passive vents		Ī	0	×	10 =	0	(7b)
Number of flueless gas fires		Ī	0	x -	40 =	0	(7c)
		L				_	
					Air ch	nanges per ho	ur
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)$			30		÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed	l to (17), otherwise	continue f	rom (9) to (1	16)			٦
Number of storeys in the dwelling (ns) Additional infiltration				[(0)	41-0-4	0	(9)
Structural infiltration: 0.25 for steel or timber frame or	0.25 for mass	ar accept	ruotion	[(9)	-1]x0.1 =	0	(10)
if both types of wall are present, use the value corresponding to		•	ruction			0	(11)
deducting areas of openings); if equal user 0.35	ine greater wan ar	ca (anci					
If suspended wooden floor, enter 0.2 (unsealed) or 0.	1 (sealed), else	e enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0						0	(13)
Percentage of windows and doors draught stripped						0	(14)
Window infiltration	0.25 - [0	.2 x (14) ÷	100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) +	(15) =		0	(16)
Air permeability value, q50, expressed in cubic metres	s per hour per	square m	etre of e	nvelope	area	7.599999904632	57 (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$), otherwise (18) =	: (16)				0.56	(18)
Air permeability value applies if a pressurisation test has been done	e or a degree air p	ermeability	is being us	ed			
Number of sides sheltered						3	(19)
Shelter factor	(20) = 1	- [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (1	8) x (20) =				0.43	(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						_	

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.55	0.54	0.53	0.47	0.46	0.41	0.41	0.4	0.43	0.46	0.48	0.51		
Calculate effe		_	rate for t	he appli	cable ca	se	•	•	•	•	•	, 	
If mechanical If exhaust air h			andiv N (2	3h) - (23a) × Emy (e	aguation (N	J5)) othe	nwisa (23h) = (23a)			0	(238
) = (23a)			0	(23h
If balanced with		•	•	_					21.) <i>(</i>	001-) [4 (00)	0	(230
a) If balance	ea mecha 0	anicai ve	ntilation	with nea	at recove	ery (MV)	$\frac{18}{0}$ (24a	$\frac{1}{0} = \frac{22}{2}$	2b)m + (0	$\frac{230) \times [}{0}$	$\frac{1 - (23c)}{0}$	100j 1	(24
											0	J	(240
b) If balance	ea mecha 0	anicai ve	ntilation	o	neat red		7V) (240 0	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (22)$	2b)m + (. 0	230)	Ιο	1	(24
				,	<u> </u>							J	(24
c) If whole h	n < 0.5 ×			•					5 × (23h	n)			
24c)m= 0	0.07	0	0	0	0	0	0	0	0	0	0	1	(24
d) If natural		on or wh	ole hous	e nositiv	/e innut	ventilatio	n from l	oft.				J	•
,	n = 1, the			•	•				0.5]				
(24d)m= 0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63		(24
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)	•	•	•		
25)m= 0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63]	(25
2 Heat lease	o ond he	ot lose r	aramat	241						•	•	1	
3. Heat losse	S and ne	·	Openin		Net Ar	200	U-valı	10	AXU		k-value		ΑΧk
ELEMENT	area	_	operiiri m		A,r		W/m2		(W/		kJ/m²-l		kJ/K
Doors					1.89	х	1.6	=	3.024				(26
Nindows Type	e 1				3.98	x1,	/[1/(1.4)+	0.04] =	5.28	一			(27
Windows Type	e 2				5.97	x ₁ ,	/[1/(1.4)+	0.04] =	7.91	=			(27
Floor					70.43	3 x	0.12		8.4516	=			(28
Walls	40.0	13	11.84	1	28.19	=	0.16	-	4.51	=		-	(29
Γotal area of ε			11.0	·	110.4	=	0.10		7.01				(31
Party wall	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,				=			0				(32
Party ceiling					45.23	=	0		0	<u> </u>			
* for windows and	l roof wind	04/0 4/00 0	ffootivo wi	ndow II ve	70.43		i formula 1	/[/1/ \volu	(0) (0 (04) (L So givon in	norogrank		(32
** include the area						ateu usirig	TOTTIUIA T	/[(I/ U- vail	1 0)+0.04] a	is giveri iri	parayrapi	1 3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.18	(33
Heat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35
or design asses	sments wh	ere the de	tails of the	constructi	ion are no	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
can be used inste													
Thermal bridg	•	,			•	<						10.35	(36
f details of therma Γotal fabric he		are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			00.50	
		alaulataa	l monthly	,						(25)m v (5)	١	39.53	(37
Ventilation hea	1				lup	lul	Λιια		= 0.33 × (<u> </u>	1	
Jan (38)m= 36.61	Feb 36.28	Mar 35.96	Apr 34.44	May 34.16	Jun 32.84	Jul 32.84	Aug 32.59	Sep 33.34	Oct 34.16	Nov 34.73	35.33		(38
,		l .	J4.44	J4. 10	32.04	32.04	32.39	<u> </u>	<u> </u>	<u> </u>	30.33	J	(50
Heat transfer						l			= (37) + (·	Γ	1	
39)m= 76.14	75.81	75.49	73.97	73.68	72.36	72.36	72.12	72.87	73.68	74.26	74.86	_	
									Average =	Sum(39) ₁	12 /12=	73.97	(39)



Heat Ic	ss para	meter (l	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.08	1.08	1.07	1.05	1.05	1.03	1.03	1.02	1.03	1.05	1.05	1.06		
					-	-	-	-		Average =	Sum(40) ₁ .	12 /12=	1.05	(40)
Numbe			nth (Tab				Ι			<u> </u>				
(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	iter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		26		(42)
Annua	averag	e hot wa					erage = designed t			so target e		.79		(43)
		_	person pei			_	-	o acriieve	a water us	se larger o	"			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot wate							Table 1c x		Гоор		1101			
44)m=	96.57	93.06	89.55	86.04	82.52	79.01	79.01	82.52	86.04	89.55	93.06	96.57		
·			l .					<u> </u>		Total = Su	m(44) ₁₁₂ =		1053.51	(44
Energy (content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,ı	m x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
45)m=	143.21	125.25	129.25	112.68	108.12	93.3	86.46	99.21	100.4	117	127.72	138.69		
							. 0:			Total = Su	m(45) ₁₁₂ =	•	1381.32	(45
		ater neati	ng at point •	of use (no	1	r storage), r	enter 0 in	boxes (46)						
46)m= Mater	21.48 storage	18.79	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.8		(46
	•) includir	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47
·		` ′) litres in					<u> </u>		`
	-	_			_		neous co	. ,	ers) ente	er '0' in ((47)			
	storage													
,			eclared I		or is kno	wn (kWl	n/day):					0		(48
•			m Table									0		(49
			storage	-				(48) x (49)) =			0		(50
•			eclared of factor fr	-								0		(51
		-	ee secti		- (7)					<u> </u>		V -
		from Ta										0		(52
Гетре	rature fa	actor fro	m Table	2b								0		(53
•			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54
	. ,	(54) in (5	•									0		(55
Vater	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)	m 	-			
56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56
cylinde	er contains	dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	x H	
57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57
Primar	y circuit	loss (ar	nual) fro	m Table	3							0		(58
	-	•	•			59)m =	(58) ÷ 36	65 × (41)	m					
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	olar wa	ter heatii	ng and a	cylinde	r thermo	stat)			
59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59



Combi loss ca	lculated	for each	month ('61)m =	(60) ÷ 36	35 x (41))m						
(61)m= 49.21	42.83	45.63	42.43	42.05	38.97	40.26	42.05	42.43	45.63	45.89	49.21		(61)
	uired for	water he	ـــــــــــا eating ca	alculated	l for eacl	n month	(62)m =	: 0.85 × ((45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 192.42	168.09	174.88	155.11	150.18	132.27	126.72	141.27	142.83	162.64	173.61	187.91		(62)
Solar DHW input	calculated	using App	endix G or	· Appendix	: H (negati	ve quantity	/) (enter '0	if no sola	r contribut	on to wate	er heating)	1	
(add additiona	I lines if	FGHRS	and/or V	//WHRS	applies.	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
WWHRS -37.65	-33.13	-33.81	-27.84	-25.86	-21.34	-18.07	-21.88	-22.51	-27.81	-32.2	-36.39	•	(63) (G10)
Output from w	ater hea	ter										_	
(64)m= 154.77	134.96	141.07	127.28	124.32	110.93	108.65	119.39	120.32	134.82	141.41	151.52		_
			-				Out	out from wa	ater heate	r (annual)₁	12	1569.43	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	κ [(46)m	+ (57)m	+ (59)m]	
(65)m= 59.92	52.36	54.38	48.07	46.46	40.76	38.81	43.5	43.99	50.31	53.94	58.42		(65)
include (57)	m in calc	culation of	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal ga	ains (see	Table 5	and 5a)):									
Metabolic gair	ns (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39		(66)
Lighting gains	(calculat	ted in Ar	pendix I	L, equati	ion L9 o	r L9a), a	lso see	Table 5	•		•		
(67)m= 45.68	40.57	32.99	24.98	18.67	15.76	17.03	22.14	29.72	37.73	44.04	46.94		(67)
Appliances ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			l	
(68)m= 295.97	299.04	291.3	274.82	254.03	234.48	221.42	218.35	226.09	242.56	263.36	282.91		(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also s	ee Table	5		•	•	
(69)m= 50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8		(69)
Pumps and fa	ns gains	(Table 5	 ба)					•	•		•		
(70)m= 10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses e.g. ev	/aporatio	n (nega	tive valu	es) (Tab	le 5)			•	•			•	
(71)m= -90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26		(71)
Water heating	gains (T	able 5)							-		-		
(72)m= 80.54	77.91	73.1	66.77	62.45	56.62	52.17	58.47	61.1	67.62	74.92	78.52		(72)
Total internal	gains =				(66)	m + (67)m	+ (68)m ·	+ (69)m + ((70)m + (7	1)m + (72)	m	•	
(73)m= 528.11	523.44	503.32	472.5	441.07	412.78	396.55	404.88	422.82	453.84	488.24	514.3		(73)
6. Solar gains	s:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and associ	ated equa	tions to co	onvert to th	e applicat	le orientat	ion.		
Orientation:		actor	Area		Flu		_	g	_	FF		Gains	
	Table 6d		m²		Tak	ole 6a	T	able 6b	Ta	able 6c		(W)	
North 0.9x	0.77	х	3.9	8	x 1	0.63	x	0.76	x	0.7	=	15.6	(74)
North 0.9x	0.77	Х	3.9	18	x 2	0.32	X	0.76	x	0.7	=	29.82	(74)
North 0.9x	0.77	X	3.9)8	x 3	4.53	x	0.76	x	0.7	=	50.67	(74)
North 0.9x	0.77	X	3.9	18	x 5	5.46	x	0.76	x	0.7	=	81.38	(74)



	_														
North	0.9x	0.77	X	3.9	8	X	7	4.72	X	0.76	X	0.7		109	.63 (74)
North	0.9x	0.77	X	3.9	18	X	7	9.99	X	0.76	X	0.7	=	117	7.36 (74)
North	0.9x	0.77	X	3.9	18	X	7	4.68	X	0.76	X	0.7	=	109	.58 (74)
North	0.9x	0.77	X	3.9	8	X	5	9.25	X	0.76	X	0.7	=	86	93 (74)
North	0.9x	0.77	X	3.9	18	x	4	1.52	X	0.76	x	0.7	=	60	92 (74)
North	0.9x	0.77	X	3.9	18	x	2	4.19	X	0.76	x	0.7		35.	49 (74)
North	0.9x	0.77	X	3.9	18	x	1	3.12	X	0.76	x	0.7		19	25 (74)
North	0.9x	0.77	X	3.9	18	x	8	3.86	X	0.76	x	0.7		13.	01 (74)
East	0.9x	1	X	5.9	7	x	1	9.64	X	0.76	x	0.7		43.	23 (76)
East	0.9x	1	X	5.9	17	x	3	8.42	X	0.76	x	0.7		84	56 (76)
East	0.9x	1	X	5.9	17	x	6	3.27	X	0.76	x	0.7		139	.26 (76)
East	0.9x	1	X	5.9	7	x	9	2.28	X	0.76	x	0.7		203	(76)
East	0.9x	1	X	5.9	17	x	11	13.09	X	0.76	x	0.7		248	.92 (76)
East	0.9x	1	X	5.9	17	x	11	15.77	X	0.76	x	0.7		254	.81 (76)
East	0.9x	1	X	5.9	17	x	11	10.22	X	0.76	x	0.7		242	(76)
East	0.9x	1	X	5.9	17	x	9	4.68	X	0.76	x	0.7		208	.38 (76)
East	0.9x	1	X	5.9	17	x	7	3.59	X	0.76	x	0.7		161	.97 (76)
East	0.9x	1	X	5.9	17	x	4	5.59	X	0.76	x	0.7		100	.34 (76)
East	0.9x	1	x	5.9	17	x	2	4.49	x	0.76	×	0.7		53	.9 (76)
East	0.9x	1	x	5.9	7	x	1	6.15	x	0.76	×	0.7		35	55 (76)
	_								-					•	
Solar g	ains in	watts, cal	lculated	for eac	n mont	h_			(83)m	= Sum(74)m	.(82)m			_	
Solar g	ains in 58.83	watts, cal	lculated 189.93	for eac 284.49	n mont 358.55	$\overline{}$	72.18	352.17	(<mark>83)</mark> m 295		<mark>(82)m</mark> 135.8	4 73.15	48.56		(83)
(83)m=	58.83		189.93	284.49	358.55	3		352.17	È			4 73.15	48.56]	(83)
(83)m=	58.83	114.38 nternal ar	189.93	284.49	358.55	3 + (352.17	È	.32 222.89		1	48.56 562.86		(83) (84)
(83)m= [Total ga (84)m= [58.83 ains — ii 586.94	114.38 nternal ar	189.93 nd solar 693.25	284.49 (84)m = 756.99	358.55 = (73)m 799.62	5 3 1 + (8 2 7	83)m ,	352.17 , watts	295	.32 222.89	135.8	1	<u> </u>		
(83)m= [Total ga (84)m= [7. Mea	58.83 ains — ii 586.94 an inter	114.38 Internal ar 637.82 Inal tempe	189.93 nd solar 693.25 erature	284.49 (84)m = 756.99 (heating	358.55 = (73)m 799.62 seaso	3 3 1 + (8 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96	352.17 , watts 748.71	700	.32 222.89	135.8	1	<u> </u>	2	(84)
(83)m= [Total ga (84)m= [7. Mea	58.83 ains — ir 586.94 an inter	114.38 Internal ar 637.82 Inal tempe	189.93 nd solar 693.25 erature eating p	284.49 (84)m = 756.99 (heating eriods in	358.55 = (73)m 799.62 seaso	3 3 3 1 + (8 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f	352.17 , watts 748.71	700	.2 222.89	135.8	1	<u> </u>		(84)
(83)m= [Total ga (84)m= [7. Mea	58.83 ains — ir 586.94 an inter	114.38 nternal ar 637.82 nal tempe during he	189.93 nd solar 693.25 erature eating p	284.49 (84)m = 756.99 (heating eriods in	358.55 = (73)m 799.62 seaso	3 3 3 1 + (3 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f	352.17 , watts 748.71	700 ple 9,	.2 222.89	135.8	3 561.39	<u> </u>	2	(84)
(83)m= [Total ga (84)m= [7. Mea	58.83 ains — in 586.94 an inter erature tion fac	114.38 Internal ar 637.82 Inal temperaturing heater for ga	189.93 and solar 693.25 erature eating p	284.49 (84)m = 756.99 (heating eriods in iving are	358.55 = (73)m 799.62 seaso the livea, h1,i	3 3 1 + (3 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta	352.17 , watts 748.71 from Tab	700 ple 9,	.2	135.8	3 561.39	562.86	2	(84)
(83)m= Total ga (84)m= Total ga (84)m= Utilisa	58.83 ains – ii 586.94 an inter erature tion fac Jan 0.99	114.38 Internal and 637.82 Inal temperaturing heater for garriage.	189.93 nd solar 693.25 erature eating p ins for I Mar 0.97	284.49 (84)m = 756.99 (heating eriods in iving are Apr 0.91	358.55 = (73)m 799.62 seaso n the livea, h1, May 0.77	3 3 1 + ((2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58	352.17 , watts 748.71 From Tab ble 9a) Jul 0.42	295 700 DIE 9,	32 222.89 0.2 645.71 Th1 (°C) ug Sep 7 0.72	135.8- 589.60 Oct	3 561.39 Nov	562.86	2	(84)
(83)m= Total ga (84)m= Total ga (84)m= Utilisa	58.83 ains – ii 586.94 an inter erature tion fac Jan 0.99	nternal ar 637.82 nal tempe during he tor for ga Feb 0.98	189.93 nd solar 693.25 erature eating p ins for I Mar 0.97	284.49 (84)m = 756.99 (heating eriods in iving are Apr 0.91	358.55 = (73)m 799.62 seaso n the livea, h1, May 0.77	3 3 3 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58	352.17 , watts 748.71 From Tab ble 9a) Jul 0.42	295 700 DIE 9,	.32 222.89 1.2 645.71 Th1 (°C) ug Sep 7 0.72 Table 9c)	135.8- 589.60 Oct	Nov 0.98	562.86	2	(84)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [58.83 ains – in 586.94 an interestature tion fact Jan 0.99 interna 20.07	nternal ar 637.82 nal tempera during he tor for ga Feb 0.98 I tempera 20.2	189.93 and solar 693.25 erature eating p tins for I Mar 0.97 ature in 20.43	284.49 (84)m = 756.99 (heating eriods ir iving are 0.91 living are 20.72	358.55 = (73)m 799.62 seaso n the livea, h1,n May 0.77 ea T1 (20.91	is 3 3 3 1 + (8 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58 w ste	352.17 , watts 748.71 From Tak ble 9a) Jul 0.42 ps 3 to 7 21	295 700 DIE 9, 0.4 7 in T	.32 222.89 .2 645.71 .2 .3 .2 .3 .3 .3 .3 .3	135.8- 589.60 Oct 0.93	Nov 0.98	Dec 0.99	2	(84)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [58.83 ains – in 586.94 an interestature tion fact Jan 0.99 interna 20.07	nternal ar 637.82 nal tempera during he tor for ga Feb 0.98 I tempera 20.2	189.93 and solar 693.25 erature eating p tins for I Mar 0.97 ature in 20.43	284.49 (84)m = 756.99 (heating eriods ir iving are 0.91 living are 20.72	358.55 = (73)m 799.62 seaso n the livea, h1,n May 0.77 ea T1 (20.91	3 3 3 1 1 1 1 1 1 1	83)m , 84.96 area f ee Ta Jun 0.58 w ste	352.17 , watts 748.71 From Tak ble 9a) Jul 0.42 ps 3 to 7 21	295 700 DIE 9, 0.4 7 in T	32 222.89 0.2 645.71 Th1 (°C) ug Sep 7 0.72 able 9c) 1 20.95 0, Th2 (°C)	135.8- 589.60 Oct 0.93	Nov 0.98	Dec 0.99	2	(84)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [Tempe (88)m= [58.83 ains – ii 586.94 an inter erature tion face Jan 0.99 interna 20.07 erature 20.02	nternal are 637.82 nal temper during he 10.98 tempera 20.2 during he 20.02	nd solar 693.25 erature eating p ins for I Mar 0.97 eating p 20.43 eating p	284.49 (84)m = 756.99 (heating eriods in iving are Apr 0.91 living are 20.72 eriods in 20.04	358.55 = (73)m 799.62 seaso n the livea, h1,1 May 0.77 ea T1 (20.91 n rest c	3 3 3 1 + (i 2 7 7 7 7 7 7 7 7 7	area f ee Ta Jun 0.58 w stee 20.99 velling	352.17 , watts 748.71 From Tab ble 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06	295 700 700 Al 0.4 7 in T 2 able § 20.	32 222.89 0.2 645.71 Th1 (°C) ug Sep 7 0.72 able 9c) 1 20.95 0, Th2 (°C)	135.8- 589.6d Oct 0.93	Nov 0.98	Dec 0.99	2	(84) 1 (85) (86) (87)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa	58.83 ains – ii 586.94 an interestion factor of the second	nternal ar 637.82 nal tempe during he tor for ga Feb 0.98 I tempera 20.2 during he 20.02	189.93 Ind solar 693.25 Perature Peating p Lins for I Mar 0.97 Puture in 20.43 Peating p 20.02	284.49 (84)m = 756.99 (heating eriods ir iving are 20.72 eriods ir 20.04	358.55 = (73)m 799.62 seaso n the lives, h1,n May 0.77 ea T1 (20.91 n rest of	3 3 3 3 1 + (3 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	area f ee Ta Jun 0.58 w ste e0.99 velling	352.17 watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Table e Table	295 7000 7000 All 0.44 7 in T 2 20.0 9a)	32 222.89 0.2 645.71 Th1 (°C) ug Sep 7 0.72 able 9c) 1 20.95 9, Th2 (°C) 06 20.05	135.8- 589.6- Oct 0.93 20.71	Nov 0.98 20.35	Dec 0.99 20.05	2	(84) (85) (86) (87) (88)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [58.83 ains – ii 586.94 an interestion factor Jan 0.99 interna 20.07 erature 20.02 tion factor 0.99	nternal ar 637.82 nal tempe during he tor for ga Feb 0.98 I tempera 20.2 during he 20.02 tor for ga	189.93 Ind solar 693.25 Perature Peating p Lins for I Mar 0.97 Inture in 20.43 Peating p 20.02 Lins for I 0.96	284.49 (84)m = 756.99 (heating eriods in iving are 20.72 eriods in 20.04 rest of dro.88	358.55 = (73)m 799.62 seaso n the livea, h1,n May 0.77 20.91 n rest of 20.05 welling 0.72	3 3 3 1 + (3 2 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	area f ee Ta Jun 0.58 w ste 0.99 relling 0.06 ,m (se 0.5	352.17 , watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06 pe Table 0.33	295 700 Al 0.4 0.4 7 in T 2 20.0 9a) 0.3	32 222.89 0.2 645.71 Th1 (°C) ug Sep 7 0.72 able 9c) 1 20.95 9, Th2 (°C) 06 20.05 8 0.64	135.8- 589.6d Oct 0.93 20.71 20.05	Nov 0.98	Dec 0.99	2	(84) 1 (85) (86) (87)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa (89)m= [Mean	58.83 ains – ii 586.94 an inter erature tion face Jan 0.99 interna 20.07 erature 20.02 tion face 0.99 interna	nternal ar 637.82 nal tempe during he tor for ga Feb 0.98 I tempera 20.2 during he 20.02 tor for ga	189.93 Ind solar 693.25 Perature Peating pains for I Mar 0.97 Inture in 1 20.43 Peating pains for I 0.96 Inture in 1 0.96	284.49 (84)m = 756.99 (heating eriods in iving are 20.72 eriods in 20.04 rest of do 0.88 the rest	358.55 = (73)m 799.62 seaso n the livea, h1, i May 0.77 ea T1 (20.91 n rest c 20.05 welling 0.72 of dwe	3 3 3 1 + (i 2 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58 w stel 20.99 velling 20.06 ,m (se 0.5	352.17 , watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06 pe Table 0.33 pllow ste	295 700 Al 0.4 7 in T 2 able § 20.0 9a) 0.3	32 222.89 32 645.71 33 Sep 34 7 0.72 35 7 0.72 36 20.95 36 20.05 37 7 7 7 38 0.64 39 10 10 10 30 10 10 31 10 10 32 10 10 33 10 10 34 10 10 35 10 10 36 10 10 37 10 10 38 0.64 39 10 10 30 10 10 31 10 10 32 10 10 33 10 10 34 10 10 35 10 10 36 10 10 37 10 10 38 0.64 39 10 10 30 10 30 10 30 10 10 30 10 10 30 10 10 30 10 1	135.8- 589.6- Oct 0.93 20.71 20.05 0.91 e 9c)	Nov 0.98 20.35 20.04	Dec 0.99 20.05 20.03	2	(84) (85) (86) (87) (88) (89)
(83)m= [Total ga (84)m= [7. Mea Tempo Utilisa (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [58.83 ains – ii 586.94 an interestion factor Jan 0.99 interna 20.07 erature 20.02 tion factor 0.99	nternal ar 637.82 nal tempe during he tor for ga Feb 0.98 I tempera 20.2 during he 20.02 tor for ga	189.93 Ind solar 693.25 Perature Peating p Lins for I Mar 0.97 Inture in 20.43 Peating p 20.02 Lins for I 0.96	284.49 (84)m = 756.99 (heating eriods in iving are 20.72 eriods in 20.04 rest of dro.88	358.55 = (73)m 799.62 seaso n the livea, h1,n May 0.77 20.91 n rest of 20.05 welling 0.72	3 3 3 1 + (i 2 7 7 7 7 7 7 7 7 7	area f ee Ta Jun 0.58 w ste 0.99 relling 0.06 ,m (se 0.5	352.17 , watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06 pe Table 0.33	295 700 Al 0.4 0.4 7 in T 2 20.0 9a) 0.3	32 222.89 32 645.71 33 Sep 34 7 0.72 35 7 0.72 36 20.95 36 20.05 37 7 7 7 38 0.64 39 10 10 10 30 10 10 31 10 10 32 10 10 33 10 10 34 10 10 35 10 10 36 20.02	135.8- 589.6i Oct 0.93 20.71 20.05 0.91 e 9c) 19.72	Nov 0.98 20.35 20.04 0.98	Dec 0.99 20.05 20.03 0.99		(84) (85) (86) (87) (88) (89)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa (89)m= [Mean	58.83 ains – ii 586.94 an inter erature tion face Jan 0.99 interna 20.07 erature 20.02 tion face 0.99 interna	nternal ar 637.82 nal tempe during he tor for ga Feb 0.98 I tempera 20.2 during he 20.02 tor for ga	189.93 Ind solar 693.25 Perature Peating pains for I Mar 0.97 Inture in 1 20.43 Peating pains for I 0.96 Inture in 1 0.96	284.49 (84)m = 756.99 (heating eriods in iving are 20.72 eriods in 20.04 rest of do 0.88 the rest	358.55 = (73)m 799.62 seaso n the livea, h1, i May 0.77 ea T1 (20.91 n rest c 20.05 welling 0.72 of dwe	3 3 3 1 + (i 2 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58 w stel 20.99 velling 20.06 ,m (se 0.5	352.17 , watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06 pe Table 0.33 pllow ste	295 700 Al 0.4 7 in T 2 able § 20.0 9a) 0.3	32 222.89 32 645.71 33 Sep 34 7 0.72 35 7 0.72 36 20.95 36 20.05 37 7 7 7 38 0.64 39 10 10 10 30 10 10 31 10 10 32 10 10 33 10 10 34 10 10 35 10 10 36 20.02	135.8- 589.6i Oct 0.93 20.71 20.05 0.91 e 9c) 19.72	Nov 0.98 20.35 20.04	Dec 0.99 20.05 20.03 0.99	2	(84) (85) (86) (87) (88) (89)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [Tempe (88)m= [Utilisa (89)m= [Mean (90)m= [58.83 ains – ii 586.94 an interesture tion face Jan 0.99 interna 20.07 erature 20.02 tion face 0.99 interna 18.8	114.38 Internal are 637.82 Internal temper during here 20.2 Internal are 20.2 Internal are 20.2 Internal are 20.9 Intern	189.93 Ind solar 693.25 Perature Peating pains for I 0.97 Inture in 1 20.43 Peating pains for I 0.96 Inture in 1 19.31	284.49 (84)m = 756.99 (heating eriods in iving are 20.72 eriods in 20.04 rest of dr 0.88 the rest 19.72	358.55 = (73)m 799.62 seaso n the livea, h1, may 0.77 ea T1 (20.91 n rest of 20.05 welling 0.72 of dwe 19.96	3 3 3 1 + (3 2 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58 ew ste 20.99 eelling 20.06 m (se 0.5 T2 (fc	352.17 , watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06 ee Table 0.33 pllow ste 20.06	295 700 700 700 700 700 700 700 700 700 70	32 222.89 32 645.71 33 Sep 34 7 0.72 35 7 0.72 36 20.95 36 20.05 37 7 7 7 38 0.64 39 10 10 10 30 10 10 31 10 10 32 10 10 33 10 10 34 10 10 35 10 10 36 20.02	135.8- 589.6i Oct 0.93 20.71 20.05 0.91 e 9c) 19.72	Nov 0.98 20.35 20.04 0.98	Dec 0.99 20.05 20.03 0.99		(84) (85) (86) (87) (88) (89) (90) (91)
(83)m= [Total ga (84)m= [7. Mea Tempe Utilisa (86)m= [Mean (87)m= [Utilisa (89)m= [Mean (90)m= [Mean (92)m= [58.83 ains – ii 586.94 an interestion face Jan 0.99 interna 20.07 erature 20.02 tion face 0.99 interna 18.8 interna	114.38 Internal ar 637.82 Internal temper during he tor for gar 20.2 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.98 Internal ar 20.99 I	189.93 Ind solar 693.25 Perature Peating points for I Mar 0.97 Inture in 1 20.43 Peating points for I 0.96 Inture in 1 19.31 Inture (foo	284.49 (84)m = 756.99 (heating eriods ir iving are 20.72 eriods ir 20.04 rest of dr 0.88 the rest 19.72 r the wh	358.55 = (73)m 799.62 seaso n the lives, h1,n May 0.77 ea T1 (20.91 n rest of 20.05 welling 0.72 of dwe 19.96	3 3 3 1 + (i 2 7 7 7 7 7 7 7 7 7	83)m , 84.96 area f ee Ta Jun 0.58 ee Ta 90.99 eelling 20.06 m (se 0.5 T2 (fo 20.05 eelling	352.17 , watts 748.71 from Table 9a) Jul 0.42 ps 3 to 7 21 from Ta 20.06 e Table 0.33 pllow ste 20.06 A × T1 20.45	295 700 Al	32 222.89 32 645.71 33 Sep 34 7 0.72 35 7 0.72 36 20.95 36 20.05 37 7 7 7 38 0.64 39 7 7 7 30 7 7 7 30 7 7 7 31 7 7 32 7 7 7 33 7 7 34 7 7 7 35 7 7 36 7 7 37 7 7 38 0.64 39 7 7 30 7 7 31 7 7 32 7 7 33 7 7 34 7 7 35 7 7 36 7 7 37 7 7 38 0.64 39 7 7 30 7 7 31 7 7 31 7 7 32 7 7 33 7 7 34 7 7 35 7 7 36 7 7 37 7 7 38 7 7 39 7 7 30 7 7 30 7 7 31 7 7 31 7 7 31 7 7 32 7 7 33 7 7 34 7 7 35 7 7 36 7 7 37 7 7 38 7 7 38 7 7 39 7 7 30 7 7 30 7 7 30 7 7 30 7 7 31	135.8- 589.6- 589.6- 0.93 20.71 20.05 0.91 e 9c) 19.72 LA = Liv	Nov 0.98 20.35 20.04 0.98 19.22 ving area ÷ (-	Dec 0.99 20.05 20.03 0.99		(84) (85) (86) (87) (88) (89)



Г									1	1		1		
(93)m=	19.17	19.34	19.62	19.99	20.2	20.29	20.3	20.3	20.26	19.98	19.54	19.16		(93)
			uirement											
				mperatui using Ta		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
rne util		Feb	Mar			lup	lid	Δυα	Con	Oct	Nov	Doo		
_ L Itilicat	Jan tion fac		ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.98	0.98	0.95	0.88	0.73	0.52	0.36	0.4	0.66	0.9	0.97	0.99		(94)
L				4)m x (84		****								, ,
Г	578.02	622.11	658.45	662.82	580.99	405.98	267.07	280.14	428.04	532.47	545.7	555.74		(95)
` ′ L				ı perature	e from Ta	able 8					<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 lo	oss rate	for mea	an intern	ial tempe	erature, l	Lm , W =	=[(39)m :	x [(93)m	– (96)m	1				
(97)m=			990.73	819.95	626.65	411.67	267.67	281.23	448.64	691.16	923.54	1120		(97)
Space	heating	g require	ement fo	r each n	nonth, k\	Vh/mont	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m=	412.55	317.6	247.21	113.13	33.97	0	0	0	0	118.07	272.05	419.81		
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1934.38	(98)
Space	e heatin	a require	ement in	kWh/m²	²/vear								27.47	(99)
·	·					-1	1 1"		VIID)				21.71	
			its – Ina	ividuai n	eating sy	/stems I	ncluaing	micro-C	CHP)					
-	e heatir	•	t from s	econdar	y/supple	mantary	evetam					ı	0	(201)
	•					memary	-	(202) = 1 -	(201) -					╡``
	•			nain syst	. ,				, ,	(222)			1	(202)
Fraction	on of to	al heatii	ng from	main sys	stem 1			(204) = (204)	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								90.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	 ear
Space	heating	g require	ement (c	alculate	d above)					ı			•	
	412.55	317.6	247.21	113.13	33.97	0	0	0	0	118.07	272.05	419.81		
(211)m	= {[(98]	m x (20	4)1 } x 1	00 ÷ (20)6)				<u>.</u>	<u>.</u>				(211)
(= /	453.84	349.39	271.96	124.46	37.37	0	0	0	0	129.89	299.28	461.84		,
L				!				Tota	L I (kWh/yea	ar) =Sum(2	1 211) _{15,1012}	=	2128.03	(211)
Space	e heatin	n fuel (s	econdar	y), kWh/	month									
•		•	00 ÷ (20	• •										
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
L								Tota	l (kWh/yea	ar) =Sum(2	1 215) _{15,1012}	<u> </u>	0	(215)
Water h	heating	I												
	_		ter (calc	ulated al	bove)									
· [154.77	134.96	141.07	127.28	124.32	110.93	108.65	119.39	120.32	134.82	141.41	151.52		
Efficien	ncy of w	ater hea	ter						•	•		•	80.8	(216)
(217)m=	87.9	87.63	86.95	85.26	82.77	80.8	80.8	80.8	80.8	85.22	87.17	87.98		(217)
Fuel for	r water	heating.	kWh/mo	onth	<u> </u>			<u>. </u>	Į	!	1	<u>. </u>		
		•	÷ (217)											
(219)m=	176.07	154.01	162.24	149.28	150.19	137.29	134.47	147.76	148.91	158.2	162.22	172.21		_
								Tota	I = Sum(2	19a) ₁₁₂ =			1852.85	(219)
Annual										k'	Wh/year		kWh/yea	<u>-</u>
Space I	heating	fuel use	ed, main	system	1								2128.03	╛
												•		_



Water heating fuel used			1852.85	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45	=	(230e)
Total electricity for the above, kWh/year	sum of (23	0a)(230g) =	165	(231)
Electricity for lighting			322.66	(232)
10a. Fuel costs - individual heating systems:				
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48 × 0.01	74.06	(240)
Space heating - main system 2	(213) x	0 x 0.01	= 0	(241)
Space heating - secondary	(215) x	13.19 x 0.01	= 0	(242)
Water heating cost (other fuel)	(219)	3.48 x 0.01	64.48	(247)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01	21.76	(249)
(if off-peak tariff, list each of (230a) to (230g) see Energy for lighting	parately as applicable and ap (232)	oply fuel price according to		(250)
Additional standing charges (Table 12)			120	(251)
Appendix Q items: repeat lines (253) and (254)	as needed			
	as needed 47) + (250)(254) =		322.86	(255)
			322.86	(255)
Total energy cost (245)(2				(255)
Total energy cost (245)(2 11a. SAP rating - individual heating systems Energy cost deflator (Table 12)			0.42	
Total energy cost (245)(2 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x	47) + (250)(254) = 256)] ÷ [(4) + 45.0] =		0.42	(256)
Total energy cost (245)(2 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (47) + (250)(254) = 256)] ÷ [(4) + 45.0] =		0.42	(256) (257)
Total energy cost (245)(2 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x	47) + (250)(254) = 256)] ÷ [(4) + 45.0] =	Emission factor kg CO2/kWh	0.42	(256) (257) (258)
Total energy cost (245)(2 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (255) x	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy		0.42 1.17 83.61 Emissions kg CO2/year	(256) (257) (258)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions - Individual heating system	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year	kg CO2/kWh	0.42 1.17 83.61 Emissions kg CO2/year	(256) (257) (258)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions – Individual heating system Space heating (main system 1)	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x	kg CO2/kWh	0.42 1.17 83.61 Emissions kg CO2/year 459.66	(256) (257) (258)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) SAP rating (Section 12) 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary)	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x (215) x	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 1.17 83.61 Emissions kg CO2/year 459.66 0 400.22	(256) (257) (258) (261) (263)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions - Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 1.17 83.61 Emissions kg CO2/year 459.66 0 400.22 859.87	(256) (257) (258) (261) (263) (264)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 1.17 83.61 Emissions kg CO2/year 459.66 0 400.22 859.87 85.64	(256) (257) (258) (261) (263) (264) (265)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions - Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.519 =	0.42 1.17 83.61 Emissions kg CO2/year 459.66 0 400.22 859.87 85.64 167.46	(256) (257) (258) (261) (263) (264) (265) (267)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.519 = 0.519 =	0.42 1.17 83.61 Emissions kg CO2/year 459.66 0 400.22 859.87 85.64 167.46 1112.97	(256) (257) (258) (261) (263) (264) (265) (267) (268)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) x (SAP rating (Section 12) 12a. CO2 emissions - Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Total CO2, kg/year	47) + (250)(254) = 256)] ÷ [(4) + 45.0] = ms including micro-CHP Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.216 = 0.519 = 0.519 = 0.519 = 0.519 =	0.42 1.17 83.61 Emissions kg CO2/year 459.66 0 400.22 859.87 85.64 167.46 1112.97	(256) (257) (258) (261) (263) (264) (265) (267) (268) (272)



	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2596.2	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2260.48	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		4856.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	506.55	(267)
Electricity for lighting	(232) x	0	=	990.56	(268)
'Total Primary Energy	s	sum of (265)(271) =		6353.79	(272)
Primary energy kWh/m²/year	((272) ÷ (4) =		90.21	(273)



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

		Pr	operty Addres	s: Baseli	ne Groun	d Floor	Sample		
Address :									
1. Overall dwelling dimension	ns:								
			Area(m²)		Av. He	ight(m)	_	Volume(m³)
Ground floor			70.43	(1a) x	2	.42	(2a) =	170.44	(3
Total floor area TFA = (1a)+(1b)+(1c)+(1d)·	+(1e)+(1n	70.43	(4)					
Dwelling volume				(3a)+(3b	o)+(3c)+(3d)+(3e)+	(3n) =	170.44	(5)
2. Ventilation rate:									
	main heating	secondary heating	y other		total			m³ per hou	r
Number of chimneys		+ 0	+ 0	= [0	X	40 =	0	(6
Number of open flues	0 -	+ 0	+ 0	=	0	x	20 =	0	 (6
Number of intermittent fans			J L		3	×	10 =	30	<u> </u>
Number of passive vents					0	×	10 =	0	
Number of flueless gas fires					0	×	40 =	0	
J				L					
							Air cl	hanges per ho	our
nfiltration due to chimneys, f	lues and fans	= (6a)+(6b)+(7a	a)+(7b)+(7c) =	Г	30		÷ (5) =	0.18	(8)
If a pressurisation test has been o				e continue t				0.10	
Number of storeys in the d	welling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10
Structural infiltration: 0.25 f	or steel or tim	ber frame or	0.35 for maso	nry const	ruction			0	(1
if both types of wall are present			the greater wall a	area (after					
deducting areas of openings); If suspended wooden floor			1 (sealed) els	:e enter Ω				0	(1:
If no draught lobby, enter 0	•	•	i (ocalca), cic	o criter o				0	- - (1:
Percentage of windows an									= (1/
Window infiltration	a doors araag	nt stripped	0.25 - f	0.2 x (14) ÷	1001 =			0	=\(\)
Infiltration rate				0) + (11) + (+ (15) =		_	= (1)
Air permeability value, q50	avnrassad in	cubic metre					area	7.599999904632	= '
f based on air permeability v	•			•	ietre or e	πνοιορο	aica		=
Air permeability value applies if a					ı is beina us	sed		0.56	(1
Number of sides sheltered	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							3	(1
Shelter factor			(20) = 1	- [0.075 x ([19)] =			0.78	(2
nfiltration rate incorporating	shelter factor		(21) = (18) x (20) =				0.43	 (2
nfiltration rate modified for m	onthly wind sp	peed							_
	 			$\overline{}$	i			٦	
Jan Feb Mai	r Apr M	∕lay	Jul Aug	g Sep	Oct	Nov	Dec		

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				-		
0.55	0.54	0.53	0.47	0.46	0.41	0.41	0.4	0.43	0.46	0.48	0.51			
Calculate effective of the control o		-	ale ioi l	пе арріі	саріе са	Se						()	(23
If exhaust air h			endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a))	` ☐(23l
If balanced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h) =)	
a) If balance	ed mecha	anical ve	ntilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]		⊿`
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0			(24
b) If balance	d mech	anical ve	ntilation	without	heat red	overy (N	ЛV) (24b)m = (22	2b)m + (23b)		•		
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0			(24
c) If whole h		tract ven		•					5 × (23b	o)				
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0			(24
d) If natural		on or wh en (24d)		•	•				0.51			l		
(24d)m= 0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63			(24
Effective air	change	rate - er	ıter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)			<u> </u>	J		
(25)m= 0.65	0.65	0.64	0.61	0.61	0.58	0.58	0.58	0.59	0.61	0.62	0.63			(25)
2 Heat lease	o ond be	ot lose r	aramat	251										
3. Heat losse ELEMENT	S and he	·	Openin		Net Ar	<u> </u>	U-valı	IΩ	AXU		k-value	2	АХ	' k
ELEIVIENI	area	_	m		A,r		W/m2		(W/I	K)	kJ/m²-l		kJ/l	
Doors					1.89	Х	1.6	= [3.024					(26)
Windows Type	1				3.98	x1,	/[1/(1.4)+	0.04] =	5.28					(27)
Windows Type	2				5.97	x1,	/[1/(1.4)+	0.04] =	7.91					(27)
Floor					70.43	3 x	0.12		8.4516					(28)
Walls	40.0)3	11.8	4	28.19) x	0.16	<u> </u>	4.51	$\overline{}$		\exists		(29)
Total area of e	lements	, m²			110.4	6								 (31)
Party wall					45.23	3 x	0	=	0					(32)
Party ceiling					70.43	3						Ħ F		(32
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] a	ns given in	paragraph	3.2		_
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.	.18	(33
Heat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	()	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Medium		25	50	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f			_
Thermal bridge	es : S (L	x Y) cal	culated i	using Ap	pendix l	<						10	35	(36
if details of therma Total fabric he		are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			39	.53	(37
Ventilation hea	at 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= 36.61	36.28	35.96	34.44	34.16	32.84	32.84	32.59	33.34	34.16	34.73	35.33			(38
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m				
(39)m= 76.14	75.81	75.49	73.97	73.68	72.36	72.36	72.12	72.87	73.68	74.26	74.86			
									Average =			I		_



Heat loss para	ameter (I	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.08	1.08	1.07	1.05	1.05	1.03	1.03	1.02	1.03	1.05	1.05	1.06		
								,	Average =	Sum(40) ₁ .	12 /12=	1.05	(40)
Number of day	<u> </u>	nth (Tab	le 1a)	ı		1	1			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	rement:								kWh/ye	ar:	
Assumed occu			[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.(0013 x (⁻	TFA -13.		26		(42)
if TFA £ 13.				`	,	•	, , -	,					
Annual average Reduce the annual									se target o		7.79		(43)
not more that 125	_		•		-	-	o acriieve	a water us	se largel o	ı			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i							_	ССР	1 001	1101			
(44)m= 96.57	93.06	89.55	86.04	82.52	79.01	79.01	82.52	86.04	89.55	93.06	96.57		
(1.)	1 00.00	00.00		02.02			02.02			m(44) ₁₁₂ =	L	1053.51	(44)
Energy content of	f hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x C	OTm / 3600			` '	L		
(45)m= 143.21	125.25	129.25	112.68	108.12	93.3	86.46	99.21	100.4	117	127.72	138.69		
	<u> </u>							-	rotal = Su	m(45) ₁₁₂ =	=	1381.32	(45)
If instantaneous v	vater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)					
(46)m= 21.48	18.79	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.8		(46)
Water storage									!	·	<u>!</u>		
Storage volum	ne (litres)) includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	-			-			' '						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		eclared l	nee facti	nr is kna	wn (k\//k	n/dav/).							(48)
Temperature f				JI IS KIIO	wii (Kvvi	i/uay).					0		
•							(48) x (49)				0		(49)
Energy lost from b) If manufact		_	-		or is not		(46) X (49)) =			0		(50)
Hot water stor			-								0		(51)
If community h	_		on 4.3										
Volume factor											0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	` , ` `	,									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хН	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	. ,	, ,						
(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= 0	0	0	0	0	0	0	0	0	0	0	0		(59)



Combi loss ca	lculated	for each	month ('61)m =	(60) ÷ 36	35 × (41))m						
(61)m= 49.21	42.83	45.63	42.43	42.05	38.97	40.26	42.05	42.43	45.63	45.89	49.21		(61)
	uired for	water he	eating ca	alculated	for eacl	n month	(62)m =	: 0.85 × ((45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 192.42	_	174.88	155.11	150.18	132.27	126.72	141.27	142.83	162.64	173.61	187.91		(62)
Solar DHW input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	on to wate	er heating)	1	
(add additiona	I lines if	FGHRS	and/or V	\whrs	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
WWHRS -37.65	-33.13	-33.81	-27.84	-25.86	-21.34	-18.07	-21.88	-22.51	-27.81	-32.2	-36.39	•	(63) (G10)
Output from w	ater hea	ter										_	
(64)m= 154.77	134.96	141.07	127.28	124.32	110.93	108.65	119.39	120.32	134.82	141.41	151.52		_
							Outp	out from wa	ater heate	r (annual) ₁	12	1569.43	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	
(65)m= 59.92	52.36	54.38	48.07	46.46	40.76	38.81	43.5	43.99	50.31	53.94	58.42		(65)
include (57)	m in calc	culation (of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal ga	ains (see	Table 5	and 5a)):									
Metabolic gair	ns (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83		(66)
Lighting gains	(calculat	ted in Ar	pendix l	L, equati	ion L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 18.27	16.23	13.2	9.99	7.47	6.31	6.81	8.86	11.89	15.09	17.61	18.78		(67)
Appliances ga	ins (calc	ulated in	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5			<u>.</u>	
(68)m= 198.3	200.36	195.17	184.13	170.2	157.1	148.35	146.29	151.48	162.52	176.45	189.55		(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	ee Table	5		•	•	
(69)m= 34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28		(69)
Pumps and fa	ns gains	(Table §	 5a)									•	
(70)m= 10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses e.g. ev	/aporatio	n (nega	tive valu	es) (Tab	le 5)							•	
(71)m= -90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26		(71)
Water heating	gains (T	able 5)										•	
(72)m= 80.54	77.91	73.1	66.77	62.45	56.62	52.17	58.47	61.1	67.62	74.92	78.52		(72)
Total internal	gains =				(66)	m + (67)m	+ (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m	•	
(73)m= 363.96	361.34	348.31	327.74	306.97	286.87	274.18	280.47	291.31	312.08	335.83	353.69		(73)
6. Solar gains	s:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and associ	ated equa	tions to co	onvert to th	e applicab	le orientat	ion.		
Orientation:		actor	Area		Flu		_	g		FF		Gains	
	Table 6d		m²		Tal	ole 6a	Т	able 6b	Ta	able 6c		(W)	
North 0.9x	0.77	X	3.9	8	x 1	0.63	x	0.76	x	0.7	=	15.6	(74)
North 0.9x	0.77	X	3.9	8	x 2	0.32	X	0.76	x	0.7	=	29.82	(74)
North 0.9x	0.77	X	3.9)8	x 3	4.53	x	0.76	x	0.7	=	50.67	(74)
North 0.9x	0.77	X	3.9	18	x 5	5.46	x	0.76	x	0.7	=	81.38	(74)



	_						_			_								
North	0.9x	0.77		x	3.9	8	X	7	4.72	X		0.76	x	0.7		=	109.63	(74)
North	0.9x	0.77		x	3.9	8	x	7	9.99	x		0.76	x	0.7		=	117.36	(74)
North	0.9x	0.77		x	3.9	8	x	7	'4.68	x		0.76	x	0.7		=	109.58	(74)
North	0.9x	0.77		x	3.9	8	x	5	9.25	x		0.76	x	0.7		=	86.93	(74)
North	0.9x	0.77		x	3.9	8	x	4	1.52	x		0.76	x	0.7		=	60.92	(74)
North	0.9x	0.77		x	3.9	8	x	2	4.19	x		0.76	x	0.7		=	35.49	(74)
North	0.9x	0.77		x	3.9	8	x	1	3.12	x		0.76	x	0.7		=	19.25	(74)
North	0.9x	0.77		x	3.9	8	x	8	8.86	x		0.76	x	0.7		=	13.01	(74)
East	0.9x	1		x	5.9	7	x	1	9.64	х		0.76	x	0.7		=	43.23	(76)
East	0.9x	1		x	5.9	7	x	3	88.42	x		0.76	x	0.7		=	84.56	(76)
East	0.9x	1		x	5.9	7	x	6	3.27	x		0.76	x	0.7		=	139.26	(76)
East	0.9x	1		x	5.9	7	x	9	2.28	x		0.76	x	0.7		=	203.11	(76)
East	0.9x	1		x	5.9	7	x	1	13.09	x		0.76	X	0.7		=	248.92	(76)
East	0.9x	1		x	5.9	7	x	1	15.77	x		0.76	x	0.7		= [254.81	(76)
East	0.9x	1		x	5.9	7	x	1	10.22	x		0.76	x	0.7		=	242.59	(76)
East	0.9x	1		x	5.9	7	x	9	4.68	x		0.76	x	0.7		=	208.38	(76)
East	0.9x	1		x	5.9	7	x	7	'3.59	x		0.76	x	0.7		=	161.97	(76)
East	0.9x	1		x	5.9	7	x	4	5.59	x		0.76	×	0.7		=	100.34	(76)
East	0.9x	1		x	5.9	7	x	2	4.49	x		0.76	x	0.7		=	53.9	(76)
East	0.9x	1		x	5.9	7	x	1	6.15	x		0.76	×	0.7		=	35.55	(76)
										_						•		
Solar g	ains in	watts, ca	lculate	ed	for each	n mont	th			(83)m	n = Sur	n(74)m	.(82)m					
(83)m=	58.83	114.38	189.93	3	284.49	358.55	5 3	72.18	352.17	295	.32	222.89	135.84	73.15	48.5	6		(83)
Total g	ains – i	nternal a	nd sol	ar	(84)m =	(73)m	า + (83)m	, watts									
(84)m=	422.79	475.72	538.2	4	612.23	665.5	1 6	59.05	626.35	575	.78	514.2	447.92	408.98	402.2	25		(84)
7. Me	an inter	nal temp	eratur	e (heating	seaso	n)											
		during h			Ĭ			area 1	from Tab	ole 9	, Th1	(°C)					21	(85)
Utilisa	ition fac	tor for ga	ains fo	r li	ving are	a, h1,	m (s	ee Ta	ble 9a)							ļ		
	Jan	Feb	Mai	r	Apr	May	y	Jun	Jul	А	ug	Sep	Oct	Nov	De	С		
(86)m=	1	1	0.99	T	0.96	0.86		0.67	0.5	0.5	56	0.84	0.98	1	1			(86)
Mean	interna	l tempera	ature i	n li	ving are	ea T1 ((follo	w ste	ns 3 to 7	in T	able	9c)		•		,		
(87)m=	19.85	19.99	20.24	_	20.58	20.84	Ì	20.97	20.99	20.		20.9	20.55	20.15	19.8	4		(87)
										<u> </u>					L			
(88)m=	20.02	during h	20.02		20.04	20.05	$\overline{}$	20.06	20.06	20.		20.05	20.05	20.04	20.0	3		(88)
										<u> </u>	00	20.00	20.00	20.04	20.0	0		(55)
		tor for ga		r re	ı					_				1				(00)
(89)m=	1	0.99	0.98		0.94	0.81		0.58	0.4	0.4	46	0.77	0.97	0.99	1			(89)
Mean	interna	l tempera	ature i	n th	ne rest	of dwe	lling	T2 (f	ollow ste	ps 3	to 7	in Table	9c)					
(90)m=	18.48	18.69	19.05		19.55	19.89	2	20.04	20.06	20.	.06	19.97	19.52	18.94	18.4	8		(90)
												fL	A = Liv	ring area ÷ (4	4) =		0.42	(91)
Mean	interna	l tempera	ature (for	the who	ole dw	ellin/	g) = fl	LA × T1	+ (1	– fLA) × T2						
(92)m=	19.05	19.23	19.54	`	19.97	20.29	\neg	20.43	20.45	20.		20.36	19.95	19.44	19.0	4		(92)
Apply	adjustr	nent to th	ne mea	an	internal	tempe	eratu	ıre fro	m Table	4e,	where	e appro	priate					



					.		1	.		1		ı	
(93)m= 18.9		19.39	19.82	20.14	20.28	20.3	20.3	20.21	19.8	19.29	18.89		(93)
8. Space h													
Set Ti to the the utilisati			•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
		Mar			lun	1	Aug	Son	Oct	Nov	Doo		
Utilisation			Apr 	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m= 1	0.99	0.98	0.94	0.81	0.61	0.42	0.48	0.78	0.96	0.99	1		(94)
Useful gair	!	ļ	ļ		0.01		1 01.10	00	1 0.00	1 0.00			` '
(95)m= 421.	T T	527.7	572.44	541.88	398.75	266.11	278.2	400.43	430.66	405.87	401.08		(95)
Monthly av	erage exte	rnal tem	ı perature	from Ta	L able 8	l	<u> </u>		l	<u> </u>			
(96)m= 4.3		6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss r	ate for me	an interr	nal tempe	erature, l	Lm,W =	=[(39)m :	x [(93)m	– (96)m	1	!	<u> </u>		
(97)m= 1111			808.1	621.7	410.77	267.53	280.97	445.16	677.82	905.29	1099.84		(97)
Space hea	ting requir	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97)m – (95	m] x (4	1)m			
(98)m= 513.	78 404.99	331.53	169.67	59.38	0	0	0	0	183.89	359.59	519.88		
		•	•		<u>.</u>		Tota	l per year	(kWh/yea	r) = Sum(9	8) _{15,912} =	2542.71	(98)
Space hea	tina requir	ement in	kWh/m²	²/vear								36.1	(99)
				•				VIID)				30.1	
9a. Energy		nts – Ina	ividuai n	eating sy	ystems i	nciuaing	micro-C	MP)					
Space hea Fraction of	•	at from s	econdar	v/sunnle	mentary	svstem					ı	0	(201)
	•				momary	•	(202) = 1	_ (201) _					╡ `
Fraction of	•		•	, ,				, ,	(000)1			1	(202)
Fraction of		_	-				(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency	of main spa	ace heat	ing syste	em 1								90.9	(206)
Efficiency	of seconda	ry/suppl	ementar	y heating	g systen	າ, %						0	(208)
Jai	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space hea	ting requir	ement (c	alculate	d above))								
513.	78 404.99	331.53	169.67	59.38	0	0	0	0	183.89	359.59	519.88		
(211)m = {[(98)m x (20)4)] } x 1	100 ÷ (20	06)									(211)
565.2	21 445.54	364.72	186.66	65.33	0	0	0	0	202.29	395.59	571.92		
	•	•	•		•	•	Tota	l (kWh/yea	ar) =Sum(2	211),5,1012	<u></u>	2797.26	(211)
Space hea	ting fuel (s	econdar	y), kWh/	month									
$= \{[(98)m x]\}$	(201)] } x 1	00 ÷ (20	08)										
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		
	-			-	-	-	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	_	0	(215)
Water heat	ing										·		
Output from	I	1	1					1		1		l	
154.		141.07	127.28	124.32	110.93	108.65	119.39	120.32	134.82	141.41	151.52		_
Efficiency of	water hea				•			•				80.8	(216)
(217)m= 88.3	4 88.15	87.63	86.28	83.81	80.8	80.8	80.8	80.8	86.33	87.8	88.41		(217)
Fuel for wat	•												
(219)m = (6)			T	140.22	127.20	124.47	147.76	140.01	150.10	161.06	171 20		
(219)m= 175.	153.11	160.99	147.52	148.33	137.29	134.47	147.76	148.91 I = Sum(2	156.16	161.06	171.39	404047	7/040
A	.1-						Tota	ı – Sum(Z		A/II. & :		1842.17	(219)
Annual total Space heat		niem he	svetem	1					k'	Wh/year	· 	kWh/yea	r
opado neat	ng ruor ust	ou, main	JyJIGIII	•								2131.20	



Water heating fuel used 1842.17 Electricity for pumps, fans and electric keep-hot central heating pump: (230c)120 boiler with a fan-assisted flue (230e)45 sum of (230a)...(230g) = Total electricity for the above, kWh/year 165 (231)Electricity for lighting (232)322.66 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)0.216 604.21 (215) x Space heating (secondary) (263)0.519 0 (219) x Water heating (264)0.216 397.91 (261) + (262) + (263) + (264) =Space and water heating 1002.12 (265)(231) x Electricity for pumps, fans and electric keep-hot (267)0.519 85.64 (232) x Electricity for lighting (268)0.519 167.46 sum of (265)...(271) =Total CO2, kg/year (272)1255.21

 $(272) \div (4) =$

Dwelling CO2 Emission Rate

El rating (section 14)

(273)

(274)

17.82

85



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 133.53 (5)$ 2. Ventilation rate: $\begin{array}{ccccccccccccccccccccccccccccccccccc$				Pro	operty /	Address	: Green	First Flo	or Samp	ole		
Area(m²) Av. Height(m) Volume(m³) Area(m²) Av. Height(m) Volume(m³) Area(m²) Area(m	Address:											
Company Comp	1. Overall dwelling dimension	ons:										
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)					Area	a(m²)		Av. He	ight(m)		Volume(m	³)
Dwelling volume	Ground floor				4	4.07	(1a) x	3	.03	(2a) =	133.53	(3a
2. Ventilation rate: Main Secondary Other Lotal Material Material Number of chimneys O	Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+	(1n)	4	4.07	(4)					
Number of chimneys	Dwelling volume						(3a)+(3l	o)+(3c)+(3c	l)+(3e)+	(3n) =	133.53	(5)
Number of chimneys	2. Ventilation rate:											
Number of chimneys					,	other		total			m³ per hou	ır
Number of intermittent fans 3	Number of chimneys			_	+	0	_ = [0	X	40 =	0	(6a
Number of passive vents 0	Number of open flues	0	+	0	 +	0	-	0	x	20 =	0	(6b
Number of flueless gas fires 0	Number of intermittent fans				J L			3	x	10 =	30	(7a
Number of flueless gas fires Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of passive vents							0	x	10 =	0	(7b
Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	·						L		x	40 =		╡`
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30							L				<u> </u>	(,,
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (18) Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Q (12) If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = (15) Infiltration rate (17) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = (20) = 1 - [0.075 × (19)] = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (21) = (18) × (20) = (22) = (18) × (20) = (23) × (24) × (20) × (24) × (24) × (24) × (24) × (24) × (24) × (24) × (Air ch	anges per h	our
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (18) Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Q (12) If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Infiltration due to chimneys, f	lues and fans	s = (6a) + (6a)	6b)+(7a))+(7b)+(7	7c) =	Г	30		÷ (5) =	0.22	(8)
Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ± 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ± 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	•						continue f			. (5)	0.22	(*)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 1nfiltration rate incorporating shelter factor (21) = (18) × (20) = 1nfiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Number of storeys in the d	welling (ns)									0	(9)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 O (13) Percentage of windows and doors draught stripped Window infiltration 0.25 - $[0.2 \times (14) \div 100] =$ O (15) Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = $[(17) \div 20] + (8)$, otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] =$ O (15) (16) 0.42 (18) 3 (19) Capped a continuous permeability is being used Infiltration rate incorporating shelter factor (21) = (18) \times (20) = Infiltration rate modified for monthly wind speed	Additional infiltration								[(9)	-1]x0.1 =	0	(10
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12 If no draught lobby, enter 0.05, else enter 0 0 (13 Percentage of windows and doors draught stripped 0 (14 Window infiltration $0.25 \cdot [0.2 \times (14) \div 100] = 0$ (15 Infiltration rate $0.25 \cdot [0.2 \times (14) \div 100] = 0$ (16 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $0.25 \cdot [0.2 \times (14) \div 100] = 0$ (18 Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered $0.42 \cdot [0.075 \times (19)] = 0.78 \cdot [0.075 \times (19)] = 0.33 \cdot [0.033 \cdot (21) = 0.033 \cdot (21) = 0.$	Structural infiltration: 0.25	for steel or tin	nber fran	ne or C	0.35 for	mason	ry const	ruction			0	(11
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ÷ 100] = Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = Infiltration rate incorporating shelter factor (21) = (18) x (20) = Infiltration rate modified for monthly wind speed				ding to t	he great	er wall are	ea (after			•		
If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - $[0.2 \times (14) \div 100] =$ Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = $[(17) \div 20] + (8)$, otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] =$ Infiltration rate incorporating shelter factor (21) = $(18) \times (20) =$ Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec				or 0 1	(soalo	امر	ontor ()			ı		7(40
Percentage of windows and doors draught stripped Window infiltration 0.25 - $[0.2 \times (14) \div 100] =$ Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] =$ Infiltration rate incorporating shelter factor (21) = $(18) \times (20) =$ Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	•	•	•	01 0.1	(Scale	iu), eise	cilici o					=
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.25 - [0.2 \times (14) \div (15) + ($	• •			od								= '
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	-	u uoois uiauį	gni sinpp	eu		0 25 - [0 1	2 x (14) ±	1001 -				=
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec									. (15) _			=
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		·				. , . ,			, ,			=
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] =		•			•	•	•	netre or e	invelope	area		=
Number of sides sheltered Shelter factor $ (20) = 1 - [0.075 \times (19)] = $		•						, io boing u	and		0.42	(18
Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		pressurisation to	est rias bet	en done	or a deg	угее ан ре	ынеаышу	r is being u	seu	Ī	2	7(10
Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec						(20) = 1 -	[0.075 x ([19)] =				— '
Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		shelter factor				(21) = (18	3) x (20) =					=
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec											3.00	
		- 	. 	Jun T	Jul	Aua	Sen	Oct	Nov	Dec		
	ļ l			·		, .ug	1 Sob	1 500	1 .407	1 200		

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltration rate (allowing for	shelter an	nd wind s	peed) =	(21a) x	(22a)m					
0.42 0.41	0.4 0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39		
Calculate effective air cha	•	the appli	icable ca	se							
If mechanical ventilatio		(22h) (22	a) Fm;//a	auatian (N	VIEVV othor	muiaa (22h	\ (225\			0	(23a)
If exhaust air heat pump usir) = (23a)			0	(23b)
If balanced with heat recover		_					21.)	001) [4 (00.)	0	(23c)
a) If balanced mechani			1	- ` ` 	, ``	ŕ	<u> </u>	- 	<u> </u>	÷ 100]	(240)
(24a)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechani					É È	i `	 	- 		l	(24b)
(24b)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extra if $(22b)m < 0.5 \times (200)m$		•	•				5 v (23h	,)			
$\frac{11(225)11(0.5)(25)}{(24c)m} = \frac{0.5 \times (25)}{0}$	0 0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation			<u> </u>				_				, ,
if (22b)m = 1, then							0.5]				
(24d)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effective air change rat	te - enter (24	a) or (24l	b) or (24	c) or (24	d) in box	x (25)	•		•	'	
(25)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. Heat losses and heat	loss parame	ter:									
ELEMENT Gross	Open		Net Ar	ea	U-valı	ue	AXU		k-value)	ΑΧk
area (m	1 ²)	m²	A ,r	m² 	W/m2	!Κ 	(W/I	<u>()</u>	kJ/m²-ł	<	kJ/K
Daara											
Doors			1.89	X	1.6	= [3.024				(26)
Windows Type 1			1.89	号 .	1.6 /[1/(1.4)+	!	3.024 1.35				(26) (27)
				x1/		0.04] =					
Windows Type 1			1.02	x1/	/[1/(1.4)+	0.04] =	1.35				(27)
Windows Type 1 Windows Type 2			2.13	x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.35 2.82				(27) (27)
Windows Type 1 Windows Type 2 Windows Type 3			1.02 2.13 0.52	x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69				(27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51				(27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2			1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3	7.	45	1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728 0.728			7 6	(27) (27) (27) (27) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4	7.		1.02 2.13 0.52 1.89 0.52 0.52 0.52	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many control of the	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0	08	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04]	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many party wall Party floor * for windows and roof windows to include the areas on both sides.	2.0 5, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph	3.2	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many many many many many many many	s, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8			24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many many many many many many many	s, use effective les of internal w S (A x U) x k)	08 window U-v. alls and par	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0	2) + (32a).			(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m Party wall Party floor * for windows and roof windows ** include the areas on both side Fabric heat loss, W/K = S	s, use effective les of internal w S (A x U) x k)	one of the one of the	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12 0 a formula 1. (26)(30)	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0 ue)+0.04] a	2) + (32a). : Medium	(32e) =	24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)11.57 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =(37)36.21 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Feb Mar Jul Aug Sep Dec .lan Apr May Jun Oct Nov (38)m =25.91 25.76 25.61 24.92 24.79 24.19 24.19 24.07 24.42 24.79 25.05 25.33 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =62.12 61.97 61.82 61.13 60.4 60.4 60.28 60.63 61 61.26 61.54 61 Average = Sum(39)_{1...12} /12= (39)61.13 Heat loss parameter (HLP), W/m²K (40)m = (39)m \div (4)1.41 1.41 1.39 1.38 1.37 1.37 1.37 1.38 1.38 1.39 (40)m =1.4 (40)Average = $Sum(40)_{1...12}/12=$ 1.39 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)1.52 if TFA > 13.9, N = 1 + 1.76 x [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)70.26 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m =77.28 74.47 71.66 68.85 66.04 63.23 63.23 66.04 68.85 71.66 74.47 77.28 (44)Total = $Sum(44)_{1...12}$ = 843.09 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 =114.61 100.24 103.44 90.18 86.53 74.67 69.19 79.4 80.35 93.63 102.21 110.99 (45)Total = $Sum(45)_{1...12}$ = 1105.43 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 17.19 15.04 15.52 13.53 12.98 12.05 14.05 15.33 16.65 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 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 fro		-	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or	. , .	,									0		(55)
Water storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	n				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)r	m = (56)m	x [(50) – (l	H11)] ÷ (50	0), else (57	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	inual) fro	om Table	3							0		(58)
Primary circuit	t loss cal	culated 1	for each	month (59)m = ((58) ÷ 36	5 × (41)	m					
(modified by	/ factor fi	om Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	thermo	stat)		•	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	35 × (41)	m						
(61)m= 39.38	34.28	36.52	33.95	33.65	31.18	32.22	33.65	33.95	36.52	36.73	39.38		(61)
Total heat req	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 153.99	134.52	139.96	124.13	120.18	105.85	101.41	113.05	114.3	130.15	138.94	150.38		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity) (enter '0'	if no sola	r contributi	on to wate	er heating)	l	
(add additiona	al lines if	FGHRS	and/or V	NWHRS	applies.	, see Ap	pendix G	S)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS 31.28	26.91	26.75	16.41	11.49	7.99	7.57	8.58	8.64	17.72	27.31	30.99	'	(63) (G2)
WWHRS -27.31	-24.02	-24.52	-20.23	-18.81	-15.53	-13.18	-15.95	-16.4	-20.23	-23.39	-26.38		(63) (G10)
Output from w	ater hea	ter											
(64)m= 93.51	81.94	86.93	85.87	88.27	80.83	79.11	86.91	87.63	90.45	86.47	91.11		
				4		4 7							
				<u> </u>			Outp	ut from wa	ater heater	· (annual)₁	12	1039.04	(64)
Heat gains fro	m water	heating,	kWh/mo	 วทth 0.2	5 ′ [0.85	× (45)m	·				ļ		(64)
Heat gains fro	m water	heating,	, kWh/mo	onth 0.25	5 ´ [0.85 32.62	× (45)m	·				ļ		(64) (65)
(65)m= 47.95	41.9	43.52	38.47	37.18	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
(65)m= 47.95 include (57)	41.9 m in cald	43.52 culation	38.47 of (65)m	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
(65)m= 47.95 include (57) 5. Internal ga	41.9 m in cald ains (see	43.52 culation of	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
(65)m= 47.95 include (57)	41.9 m in cald ains (see	43.52 culation of	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
include (57) 5. Internal game	41.9 m in calc ains (see	43.52 culation of Table 5 5), Wat	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62 Sylinder is	31.06 s in the c	+ (61)m 34.81 dwelling	35.2 or hot w	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h]	_
include (57) 5. Internal games Metabolic gair Jan	41.9 m in calc ains (see ns (Table Feb 91.09	43.52 culation (e Table 5), Wat Mar 91.09	38.47 of (65)m 5 and 5a) tts Apr 91.09	37.18 only if c : May 91.09	32.62 Sylinder is Jun 91.09	31.06 s in the c	+ (61)m 34.81 dwelling Aug 91.09	35.2 or hot w Sep 91.09	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h]	(65)
(65)m= 47.95 include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09	41.9 m in calc ains (see ns (Table Feb 91.09	43.52 culation (e Table 5), Wat Mar 91.09	38.47 of (65)m 5 and 5a) tts Apr 91.09	37.18 only if c : May 91.09	32.62 Sylinder is Jun 91.09	31.06 s in the c	+ (61)m 34.81 dwelling Aug 91.09	35.2 or hot w Sep 91.09	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h]	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39	m in calcains (see Feb 91.09 (calcula 26.1	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07	37.18 only if c : May 91.09 L, equati	32.62 cylinder is Jun 91.09 ion L9 or	31.06 s in the c Jul 91.09 r L9a), a	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25	35.2 or hot w Sep 91.09 Table 5	0ct 91.09	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains	m in calconnum in	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07	37.18 only if c : May 91.09 L, equati	32.62 cylinder is Jun 91.09 ion L9 or	31.06 s in the c Jul 91.09 r L9a), a	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25	35.2 or hot w Sep 91.09 Table 5	0ct 91.09	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85	m in calcains (see Feb 91.09 (calcula 26.1 198.89	43.52 culation of a Table 5 (a 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append	37.18 only if c : May 91.09 L, equati 12.01 dix L, equali 168.95	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95	31.06 s in the c Jul 91.09 r L9a), a 10.96 13 or L1:	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22	Sep 91.09 Fable 5 19.12 see Tal 150.37	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65) (66) (67)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains	m in calcains (see Feb 91.09 (calcula 26.1 198.89 (calcula calcula cal	43.52 culation of a Table 5 (a) Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ated in Ap	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append	37.18 only if c): May 91.09 L, equati 12.01 dix L, equati 168.95 L, equat	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95	31.06 s in the c Jul 91.09 r L9a), a 10.96 13 or L1:	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se	Sep 91.09 Fable 5 19.12 see Tal 150.37	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65) (66) (67)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63	m in calcons (Table Feb 91.09 (calcula 26.1 198.89 c (calcula 45.63	43.52 culation of a Table 5 culation of a Ta	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Append 182.78 ppendix 45.63	37.18 only if c : May 91.09 L, equati 12.01 dix L, equali 168.95	32.62 ylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L1: 147.27 or L15a)	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22	Sep 91.09 Fable 5 19.12 see Talle te Table	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09 28.34	+ (59)m 46.75 munity h Dec 91.09 30.21]	(65) (66) (67) (68)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames	m in calcons (Table Feb 91.09 (calcula 26.1 198.89 c (calcula 45.63	43.52 culation of a Table 5 culation of a Ta	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append 182.78 ppendix 45.63	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 ylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L1: 147.27 or L15a)	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se	Sep 91.09 Fable 5 19.12 see Talle te Table	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09 28.34	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16]	(65) (66) (67) (68)
include (57) 5. Internal games and far (70)m= 47.95 include (57) 5. Internal games and far (57) Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and far (70)m= 10	m in calcons (See Preb 1.09) (calcula 26.1) Lins (calcula 198.89) (calcula 45.63) Ins gains 10	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ated in Ap 45.63 (Table 5)	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Append 182.78 ppendix 45.63 5a) 10	37.18 only if c May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63	31.06 s in the control of the contro	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 ee Table 45.63	Oct 91.09 24.28 ble 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21]	(65) (66) (67) (68) (69)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames (70)m= 10 Losses e.g. expenses Losses e.g. expenses Losses e.g. expenses Include (57) Jan Jan Jan Jan Jan Jan Jan Ja	m in calcons (See Page 19.09) (calcula 26.1) lins (calcula 198.89) (calcula 45.63) ns gains 10 //aporatic	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ated in Ap 45.63 (Table 5)	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Append 182.78 ppendix 45.63 5a) 10	37.18 only if c May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63	31.06 s in the control of the contro	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 ee Table 45.63	Oct 91.09 24.28 ble 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16]	(65) (66) (67) (68) (69)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and famous	m in calc ains (see as (Table Feb 91.09 (calcula 26.1 ains (calcula 198.89 a (calcula 45.63 ans gains 10 vaporatio -60.73	43.52 culation of Part Part Part Part Part Part Part Part	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 Appendix 45.63 5a) 10 tive value	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95 tion L15 45.63	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L13 147.27 or L15a) 45.63	+ (61)m 34.81 dwelling Aug 91.09 dso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63	Oct 91.09 24.28 ole 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63]	(65) (66) (67) (68) (69) (70)
include (57) 5. Internal game Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances game (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fame (70)m= 10 Losses e.g. even (71)m= -60.73 Water heating	m in calc ains (see as (Table Feb 91.09 (calcula 26.1 ains (calcula 198.89 a (calcula 45.63 ans gains 10 vaporatio -60.73	43.52 culation of Part Part Part Part Part Part Part Part	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 Appendix 45.63 5a) 10 tive value	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95 tion L15 45.63	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L13 147.27 or L15a) 45.63	+ (61)m 34.81 dwelling Aug 91.09 dso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63	Oct 91.09 24.28 ole 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63]	(65) (66) (67) (68) (69) (70)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames (70)m= 10 Losses e.g. even (71)m= -60.73 Water heating (72)m= 64.45	m in calcalins (see less (Tables Feb 91.09) (calcula 26.1 lins (calcula 45.63) rs gains 10 (calcula 45.63) gains (Tables 62.35)	43.52 culation of Part Part Part Part Part Part Part Part	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Appendix 45.63 5a) 10 tive value -60.73	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63 10 es) (Tab	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63 10 le 5) -60.73	31.06 s in the control of the contro	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63 10 -60.73	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63 10 -60.73	Oct 91.09 24.28 ole 5 161.33 5 45.63 10 -60.73	+ (57)m 43.17 om com Nov 91.09 28.34 175.16 45.63 10 -60.73	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63 10 -60.73]	(65) (66) (67) (68) (69) (70) (71)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames (70)m= 10 Losses e.g. even (71)m= -60.73 Water heating	#1.9 m in calc ains (see ns (Table Feb 91.09 (calcula 26.1 ins (calcula 45.63 ns gains 10 /aporatic -60.73 gains (T 62.35 gains =	43.52 culation of Part Part Part Part Part Part Part Part	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Appendix 45.63 5a) 10 tive value -60.73	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63 10 es) (Tab	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63 10 ole 5) -60.73	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L1: 147.27 or L15a) 45.63	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63 10 -60.73	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63 10 -60.73	Oct 91.09 24.28 ole 5 161.33 5 45.63 10 -60.73	+ (57)m 43.17 om com Nov 91.09 28.34 175.16 45.63 10 -60.73	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63 10 -60.73]	(65) (66) (67) (68) (69) (70) (71)



6. Solar gains:

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

_		Access Facto Table 6d		Area m²	a anu	Flux Table 6a	uons	g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.02	x	10.63	x	0.76	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.13	X	10.63	x	0.76	x	0.7	=	8.35	(74)
North	0.9x	0.77	x	1.02	x	20.32	x	0.76	x	0.7	=	7.64	(74)
North	0.9x	0.77	x	2.13	x	20.32	x	0.76	x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.02	x	34.53	x	0.76	x	0.7	=	12.99	(74)
North	0.9x	0.77	X	2.13	X	34.53	X	0.76	X	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.02	X	55.46	x	0.76	X	0.7	=	20.86	(74)
North	0.9x	0.77	x	2.13	X	55.46	X	0.76	X	0.7	=	43.56	(74)
North	0.9x	0.77	X	1.02	X	74.72	X	0.76	X	0.7	=	28.1	(74)
North	0.9x	0.77	x	2.13	X	74.72	X	0.76	X	0.7	=	58.67	(74)
North	0.9x	0.77	X	1.02	X	79.99	X	0.76	X	0.7	=	30.08	(74)
North	0.9x	0.77	X	2.13	X	79.99	X	0.76	X	0.7	=	62.81	(74)
North	0.9x	0.77	X	1.02	X	74.68	X	0.76	X	0.7	=	28.08	(74)
North	0.9x	0.77	x	2.13	x	74.68	x	0.76	X	0.7	=	58.64	(74)
North	0.9x	0.77	X	1.02	x	59.25	x	0.76	x	0.7	=	22.28	(74)
North	0.9x	0.77	X	2.13	x	59.25	x	0.76	X	0.7	=	46.52	(74)
North	0.9x	0.77	x	1.02	x	41.52	x	0.76	X	0.7	=	15.61	(74)
North	0.9x	0.77	X	2.13	x	41.52	x	0.76	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	1.02	x	24.19	x	0.76	X	0.7	=	9.1	(74)
North	0.9x	0.77	X	2.13	x	24.19	x	0.76	X	0.7	=	19	(74)
North	0.9x	0.77	X	1.02	x	13.12	x	0.76	x	0.7	=	4.93	(74)
North	0.9x	0.77	x	2.13	x	13.12	x	0.76	X	0.7	=	10.3	(74)
North	0.9x	0.77	X	1.02	X	8.86	X	0.76	X	0.7	=	3.33	(74)
North	0.9x	0.77	X	2.13	X	8.86	X	0.76	X	0.7	=	6.96	(74)
South	0.9x	0.77	X	0.52	X	46.75	X	0.76	X	0.7	=	8.96	(78)
South	0.9x	0.77	X	1.89	X	46.75	X	0.76	X	0.7	=	32.58	(78)
	0.9x	0.77	X	0.52	X	76.57	X	0.76	X	0.7	=	14.68	(78)
	0.9x	0.77	X	1.89	X	76.57	X	0.76	X	0.7	=	53.35	(78)
South	0.9x	0.77	X	0.52	X	97.53	X	0.76	X	0.7	=	18.7	(78)
South	0.9x	0.77	X	1.89	X	97.53	X	0.76	X	0.7	=	67.96	(78)
South	0.9x	0.77	x	0.52	x	110.23	x	0.76	X	0.7	=	21.13	(78)
South	0.9x	0.77	X	1.89	X	110.23	X	0.76	X	0.7	=	76.81	(78)
	0.9x	0.77	x	0.52	x	114.87	x	0.76	x	0.7	=	22.02	(78)
	0.9x	0.77	x	1.89	x	114.87	x	0.76	X	0.7	=	80.04	(78)
	0.9x	0.77	x	0.52	X	110.55	x	0.76	X	0.7	=	21.19	(78)
South	0.9x	0.77	X	1.89	X	110.55	X	0.76	X	0.7	=	77.03	(78)



South 0.9x	0.77	X	0.52	x	108.01	x	0.76	x	0.7	=	20.71	(78)
South 0.9x	0.77	X	1.89	x	108.01	x	0.76	x	0.7	=	75.26	(78)
South 0.9x	0.77	X	0.52	x	104.89	X	0.76	x	0.7	=	20.11	(78)
South 0.9x	0.77	X	1.89	x	104.89	x	0.76	x	0.7	=	73.09	(78)
South 0.9x	0.77	X	0.52	x	101.89	x	0.76	x	0.7	=	19.53	(78)
South 0.9x	0.77	X	1.89	x	101.89	x	0.76	x	0.7	=	70.99	(78)
South 0.9x	0.77	X	0.52	x	82.59	x	0.76	X	0.7] =	15.83	(78)
South 0.9x	0.77	X	1.89	x	82.59	x	0.76	x	0.7	=	57.55	(78)
South 0.9x	0.77	X	0.52	x	55.42	x	0.76	x	0.7	=	10.62	(78)
South 0.9x	0.77	X	1.89	x	55.42	x	0.76	X	0.7	=	38.61	(78)
South 0.9x	0.77	X	0.52	X	40.4	X	0.76	X	0.7	=	7.74	(78)
South 0.9x	0.77	X	1.89	X	40.4	X	0.76	X	0.7	=	28.15	(78)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights 0.9x	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	x	0.76	x	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	157	x	0.76	x	0.7	=	39.09	(82)
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Rootlights 0.9s			_												
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	X	15	57	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0 av	Rooflights 0.9x	1	X	0.5	2	X	1	57	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	Rooflights 0.9x	1	X	0.5	2	X	1	57	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	1	15	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	1	15	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	1	15	X	0.76	х	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	1	15	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	6	66	x	0.76	X	0.7	=	16.43	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	×	0.5	2	х	6	66	x	0.76	X	0.7		16.43	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	6	66	x	0.76	X	0.7		16.43	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	6	66	x	0.76	x	0.7	=	16.43	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	3	33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	3	33	x	0.76	X	0.7	=	8.22	(82)
Rooflights 0.9x	Rooflights 0.9x	1	x	0.5	2	x	3	33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	Rooflights 0.9x	1	X	0.5	2	х	3	33	x	0.76	x	0.7		8.22	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	2	21	X	0.76	x	0.7	- -	5.23	(82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m	Rooflights _{0.9x}	1	×	0.5	2	х	2	21	X	0.76	x	0.7		5.23	(82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 79.78	Rooflights 0.9x	1	×	0.5	2	х	2	21	x	0.76	X	0.7		5.23	(82)
(83)me 79.78 145.41 222.37 311.74 380.05 390.29 370.92 318.36 253.27 167.2 97.34 67.1 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)me 456.46 518.74 581.83 650.03 696.98 687.69 656.89 610.61 557.65 492.91 446.78 434.3 (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) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)me 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 0.99 0.99 0.99 0.99	Rooflights _{0.9x}	1	i x	0.5	2	x	2	21	х	0.76	x	0.7	= =	5.23	(82)
(83)me 79.78 145.41 222.37 311.74 380.05 390.29 370.92 318.36 253.27 167.2 97.34 67.1 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)me 456.46 518.74 581.83 650.03 696.98 687.69 656.89 610.61 557.65 492.91 446.78 434.3 (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) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)me 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 0.99 0.99 0.99 0.99	Solar gains in wa	atte calcu	lated	for eacl	n month	ı			(83)m	= Sum(74)m	n (82)n	1			
Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 456.46 518.74 581.83 650.03 696.98 687.69 656.89 610.61 557.65 492.91 446.78 434.3 (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) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.97 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	<u> </u>		-			$\overline{}$	90.29						67.1]	(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.4 0.45 0.68 0.9 0.97 0.99 0.97 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)		ernal and	solar	(84)m =	: (73)m	+ (8	33)m ,	watts	<u> </u>	Į	ļ				
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= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04	(84)m= 456.46 5	518.74 58	1.83	650.03	696.98	68	37.69	656.89	610	.61 557.65	492.9	91 446.78	434.3		(84)
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= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04	7 Mean interna	l tempera	ture (heating	season)									
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= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) FLA = Living area ÷ (4) = 0.54 (91) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04						_	area fr	om Tah	ole 9	Th1 (°C)				21	(85)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	•	•	• •			_			J.O 0,	(3)					(0.07
(86)m= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.77 19.78 19.78 19.78 19.37 18.73 18.18 18.18 19.79 19.78 19.78 19.78 19.79 19.78 19.78 19.79			$\overline{}$			-			Aı	ua Sep	00	t Nov	Dec	1	
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)			-			+	-		 		+-	-	-	_	(86)
(87)m=					T1 /f	حال		0 2 to 7	 7 in T					_	
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)						_	— i		г —		20.6	1 20.15	19.76	7	(87)
(88)m=	` '								<u> </u>				1 .5.75	_	()
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.73 19.37 18.73 18.18 (90) ### Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	·					1	Ť		T			0 40.77	10.77	1	(QQ)
(89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	(88)m= 19.76	19.76	9.76	19.77	19.78	13	9.79	19.79	19.	19.78	19.7	8 19.77	19.77	_	(00)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= $\begin{bmatrix} 18.22 & 18.5 & 18.91 & 19.38 & 19.66 & 19.77 & 19.78 & 19.78 & 19.73 & 19.37 & 18.73 & 18.18 & (90) \\ & & & & & & & & & & & & & & & & & & $						_			r –		_			٦	
	(89)m= 0.98	0.96 0.	.92	0.82	0.65	C).45	0.29	0.3	0.59	0.86	0.96	0.98		(89)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	Mean internal te	emperatur	re in t	he rest	of dwell	ing	T2 (fo	llow ste	ps 3	to 7 in Tal	ble 9c)			_	
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	(90)m= 18.22	18.5	3.91	19.38	19.66	1	9.77	19.78	19.	78 19.73	19.3	7 18.73	18.18		(90)
(92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)											fLA = L	iving area ÷ (4) =	0.54	(91)
(92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	Mean internal to	emperatur	re (for	r the wh	ole dwe	llino	g) = fL	A × T1	+ (1	– fLA) × T2	2				<u> </u>
Apply adjustment to the mean internal temperature from Table 4e, where appropriate		.	<u> </u>			~	-		`		1	4 19.5	19.04		(92)
	Apply adjustme	nt to the r	nean	internal	temper	atu	re fron	n Table	4e,	where app	ropriat	e	•	<u>-</u>	



(93)m= 18.93	19.16	19.51	19.91	20.16	20.27	20.29	20.29	20.23	19.89	19.35	18.89		(93)
8. Space he	eating requ	uirement											
Set Ti to the			•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation	1								I -	I	I _		
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa				i -				r					(0.1)
(94)m= 0.97	0.96	0.92	0.83	0.68	0.49	0.34	0.38	0.62	0.86	0.95	0.98		(94)
Useful gains	1	· `	r ·	r –				ı	ı				(0.7)
(95)m= 444.25		533.04	537.22	470.83	334.11	221.49	232.14	347.65	426.31	426.34	424.56		(95)
Monthly ave		T T	·					1	1				(0.0)
(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							- ` 	`					
(97)m= 908.74		804.11	672.97	516.34	342.42	222.79	234.32	371.36	566.73	750.26	903.79		(97)
Space heat	- 	ı	r each n	nonth, k\			24 x [(97)m – (95)m] x (4	r			
(98)m= 345.58	3 260.72	201.67	97.73	33.85	0	0	0	0	104.47	233.23	356.55		_
							Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1633.8	(98)
Space heat	ing require	ement in	kWh/m²	²/year								37.07	(99)
9a. Energy re	eguiremer	nts – Indi	ividual h	eating sy	vstems i	ncluding	n micro-C	:HP)					
Space heat		no ma	iviadai ii	oamig o		nora an ig	, 1111010 C	<i>,</i> , ,					
Fraction of	•	at from s	econdar	v/supple	mentary	system						0	(201)
Fraction of	•				,	,	(202) = 1	- (201) =				1	(202)
	•		-	. ,			,	, ,	(202)]				╡` ′
Fraction of t		•	-				(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency of	f main spa	ace heat	ing syste	em 1								90.9	(206)
Efficiency o	f seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	 ar
Space heat	ing require	ement (c	alculate	d above))							•	
345.58	3 260.72	201.67	97.73	33.85	0	0	0	0	104.47	233.23	356.55		
(211)m = {[(9	18)m x (20	1 <u>4</u>)1	00 - (20)6)				I.	I.				(211)
380.17		221.86	107.52	37.24	0	0	0	0	114.93	256.57	392.24		(=11)
			101.02	0				l (kWh/yea				1797.37	(211)
On and book								(a., Ga(-	- 1 15,1012	2	1191.31	(211)
Space heat	• .		• •	montn									
$= \{[(98)m \times (2000)] = (215)m = 0$	0	00 + (20	0	0	0	0	0	0	0	0	0		
(213)111= 0				0	U	U		l (kWh/yea				0	(215)
							Tota	ii (KVVII/yea	ar) =5urri(2	213) _{15,1012}	<u>-</u>	0	(213)
Water heating	_		1-1-1-1-1										
Output from 93.51		ter (caic 86.93	85.87	88.27	80.83	79.11	86.91	87.63	90.45	86.47	91.11		
Efficiency of			05.07	00.21	00.00	13.11	1 00.31	07.00	30.43	00.47	71.11	00.0	(216)
			05.55	00.00	00.0	60.5	00.5	60.5	05.55	07.55	00.01	80.8	
(217)m= 88.54		87.6	85.88	83.37	80.8	80.8	80.8	80.8	85.92	87.93	88.64		(217)
Fuel for wate	-												
(219)m = (64) (219)m = 105.6		99.24	m 99.99	105.89	100.03	97.91	107.56	108.45	105.27	98.35	102.78		
(= .0)	1 02.04	I ***	1 00.00	. 30.00	. 55.00	J	<u> </u>	I = Sum(2	<u> </u>	1 30.00	1 . 52.70	1223.93	(219)
Appual tat-	lo.						. 0.00	2011(2		Mb4			
Annual total Space heating		ad main	system	1					K	Wh/year		kWh/yea 1797.37	
Space ricatii	.9 .40. 430	, mani	5,5(5)11	•								1131.31	



					_
Water heating fuel used				1223.93]
Electricity for pumps, fans and electric k	eep-hot				
central heating pump:			120]	(230c)
boiler with a fan-assisted flue			45]	(230e)
Total electricity for the above, kWh/year		sum of (230a)(230g) =		165	(231)
Electricity for lighting				207.61	(232)
Electricity generated by PVs				-576.34	(233)
10a. Fuel costs - individual heating sys	tems:				
	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	62.55	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	42.59	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	21.76	(249)
(if off-peak tariff, list each of (230a) to (2 Energy for lighting	230g) separately as applica (232)	able and apply fuel price ac	cording to x 0.01 =	Table 12a 27.38	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (2	35) x) 13.19	x 0.01 =	0	(252)
Appendix Q items: repeat lines (253) an	d (254) as needed	10.10	_		J (
Total energy cost	(245)(247) + (250)(254) =			274.29	(255)
11a. SAP rating - individual heating sys	stems				
Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =			1.29	(257)
SAP rating (Section 12)				81.96	(258)
12a. CO2 emissions – Individual heatin	ng systems including micro	-CHP			
	Energy kWh/year	Emission f kg CO2/kW		Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216	=	388.23	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	264.37	(264)
Space and water heating	(261) + (262) + (2	263) + (264) =		652.6	(265)
Electricity for pumps, fans and electric k	eep-hot (231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	107.75	(268)
Energy saving/generation technologies			_		_
Item 1		0.519	=	-299.12	(269)



Total CO2, kg/year

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

546.86 (272)

CO2 emissions per m²

 $(272) \div (4) =$

12.41 (273)

El rating (section 14)

92 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2192.79	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	1493.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3685.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	506.55	(267)
Electricity for lighting	(232) x	0	=	637.37	(268)
Energy saving/generation technologies					
Item 1		3.07	=	-1769.38	(269)
'Total Primary Energy	sum	of (265)(271) =		3060.51	(272)
Primary energy kWh/m²/year	(272)) ÷ (4) =		69.45	(273)



User Details:

Assessor Name:Peter MitchellStroma Number:STRO007945Software Name:Stroma FSAP 2012Software Version:Version: 1.0.3.6

Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17) . If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ (18) (18) (19)		Pro	perty Addres	s: Green	First Flo	or Samp	ole		
Marating Marating	Address:								
Ground floor	1. Overall dwelling dimensions:								
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)			Area(m²)		Av. He	ight(m)		Volume(m³)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 133.53 (5)	Ground floor		44.07	(1a) x	3	.03	(2a) =	133.53	(3a)
2. Ventilation rate: Main Secondary Number of chimneys 0	Total floor area TFA = $(1a)+(1b)+(1c)+(1c)$	ld)+(1e)+(1n)	44.07	(4)					
Number of chimneys	Dwelling volume			(3a)+(3l	o)+(3c)+(3d	l)+(3e)+	.(3n) =	133.53	(5)
Number of chimneys 0 + 0 + 0 = 0 x40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x20 = 0 (6b) Number of intermittent fans 3 x10 = 30 (7a) Number of intermittent fans 3 x10 = 0 (7b) Number of passive vents 0 x40 = 0 (7b) Number of flueless gas fires 0 x40 = 0 (7c) Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 + (5) = 0.22 (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction If both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 0 (13) Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) + 100] = 0 (15) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17) If based on air permeability value, then (18) = [(17) + 20)+(8), otherwise (18) = (16) Air permeability value, applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (20) = 1 - [0.075 x (19)] = 0.78 (20) Infiltration rate modified for monthly wind speed	2. Ventilation rate:								
Number of chimneys 0 + 0 + 0 + 0 = 0 x40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x20 = 0 (6b) Number of intermittent fans 3 x10 = 30 (7a) Number of passive vents 0 x10 = 0 (7c) Number of flueless gas fires 0 x40 = 0 (7c) Number of flueless gas fires 0 x40 = 0 (7c) Number of flueless gas fires 0 x40 = 0 (7c) Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 (7c) Number of storeys in the dwelling (ns) Additional infiltration (9) to (16) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Percentage of windows and doors draught stripped Window infiltration 0 25 - [0.2 x (14) ÷ 100] = 0 (15) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17) If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value, applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21)			other		total			m³ per hou	r
Number of intermittent fans 3		7 . 	+ 0	= [0	x	40 =	0	(6a)
Number of passive vents 0	Number of open flues 0	+ 0	+ 0	<u> </u>	0	x	20 =	0	(6b)
Number of flueless gas fires 0	Number of intermittent fans				3	x	10 =	30	(7a)
Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of passive vents			Ī	0	x	10 =	0	(7b)
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c)$ = 30 $\div (5)$ = 0.22 (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 $\cdot [0.2 \times (14) \div 100]$ = 0.15 Infiltration rate (8) $\cdot (10) \cdot (11) \cdot (12) \cdot (13) \cdot (15)$ = 0.16 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) $= [(17) \div 20] \cdot (8)$, otherwise (18) $= (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) $= 1 \cdot [0.075 \times (19)] =$ 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Number of flueless gas fires			Ī	0	X	40 =	0	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30				L					
Number of storeys in the dwelling (ns) Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Quantification (13) Percentage of windows and doors draught stripped Window infiltration (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec							Air ch	anges per ho	ur
Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 (15) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.78 (20) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Infiltration due to chimneys, flues and fai	ns = (6a) + (6b) + (7a)	+(7b)+(7c) =		30		÷ (5) =	0.22	(8)
Additional infiltration	If a pressurisation test has been carried out or i	s intended, proceed t	to (17), otherwise	continue	rom (9) to ((16)			
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 O (12) If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.78 O (31) (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec								0	(9)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 [20] Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Additional infiltration					[(9)	-1]x0.1 =	0	(10)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13) Percentage of windows and doors draught stripped 0 (14) Window infiltration rate 0 (15) Infiltration rate 0 (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then 0 (18) 0 (19) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered 0 (20) 0 0 (15) 0 (16) 0 (17) 0 (18) 0 (19) Infiltration rate incorporating shelter factor 0 (20) 0 0 (21) 0 (19) 0 (19) Infiltration rate modified for monthly wind speed	Structural infiltration: 0.25 for steel or	timber frame or 0	.35 for maso	ry const	ruction			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			ne greater wall a	rea (after					
If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - $[0.2 \times (14) \div 100] =$ 0 (15) Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = $[(17) \div 20] + (8)$, otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] =$ Infiltration rate incorporating shelter factor (21) = $(18) \times (20) =$ Dan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec			(coalod) also	antor O					7(12)
Percentage of windows and doors draught stripped Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $0.25 - [0.2 \times (14) \div 100] =$ $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $0.25 - [0.2 \times (14) \div 100] =$ $0.25 - [0.2 \times (14) \div (15) =$ $0.25 - [0.2 \times (14) \div (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14) \div (14) \times (15) =$ $0.25 - [0.2 \times (14$	·	,	(Scaled), cist	enter o					= ' '
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17) If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ 0.42 (18) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered $(20) = 1 - [0.075 \times (19)] = 0.78$ (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.33$ (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	•								=
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0 (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 4 (17) If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ 0.42 (18) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.78 (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.33 (21) Infiltration rate modified for monthly wind speed	•	lugiit stripped	0.25 - [0	2 x (14) ÷	1001 -				=
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = Infiltration rate incorporating shelter factor (21) = (18) x (20) = Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec						⊦ (15) –			=
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed		d in outlie metree					oroo		=
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec				-	ietre or e	rivelope	area		≓
Number of sides sheltered $ (20) = 1 - [0.075 \times (19)] = 0.78 $ Shelter factor $ (21) = (18) \times (20) = 0.33 $ (21) Infiltration rate modified for monthly wind speed $ \boxed{ Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec } $, is heina us	has		0.42	(18)
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78 $		redi nad been dene	or a aogree an p	omioability	io boilig ac	Jou		3	1 (19)
Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21) Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec			(20) = 1	- [0.075 x (19)] =				⊣ ``
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Infiltration rate incorporating shelter factor	or	(21) = (1	8) x (20) =				0.33	=
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Infiltration rate modified for monthly wind	d speed							_
		 	Jul Aug	Sep	Oct	Nov	Dec]	
	Monthly average wind speed from Table	* 1		•	•		•	ı	

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltration rate (allowing for	shelter an	nd wind s	peed) =	(21a) x	(22a)m					
0.42 0.41	0.4 0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39		
Calculate effective air cha	•	the appli	icable ca	se							
If mechanical ventilatio		(22h) (22	a) Fm;//a	auatian (N	VIEVV othor	muiaa (22h	\ (225\			0	(23a)
If exhaust air heat pump usir) = (23a)			0	(23b)
If balanced with heat recover		_					21.)	001) [4 (00.)	0	(23c)
a) If balanced mechani			1	- ` ` 	, ``	ŕ	<u> </u>	- 	<u> </u>	÷ 100] I	(240)
(24a)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechani					É È	i `	 	- 		1	(24b)
(24b)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extra if $(22b)m < 0.5 \times (200)$		•	•				5 v (23h	,)			
$\frac{11(225)11(0.5)(25)}{(24c)m} = \frac{0.5 \times (25)}{0}$	0 0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation			<u> </u>				_				, ,
if (22b)m = 1, then							0.5]				
(24d)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effective air change rat	te - enter (24	a) or (24l	b) or (24	c) or (24	d) in box	x (25)	•		•	'	
(25)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. Heat losses and heat	loss parame	ter:									
ELEMENT Gross	Open		Net Ar	ea	U-valı	ue	AXU		k-value)	ΑΧk
area (m	1 ²)	m²	A ,r	m² 	W/m2	2Κ 	(W/I	<u>()</u>	kJ/m²-ł	<	kJ/K
Daara											
Doors			1.89	X	1.6	= [3.024				(26)
Windows Type 1			1.89	号 .	1.6 /[1/(1.4)+	!	3.024 1.35				(26) (27)
				x1/		0.04] =					
Windows Type 1			1.02	x1/	/[1/(1.4)+	0.04] =	1.35				(27)
Windows Type 1 Windows Type 2			2.13	x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.35 2.82				(27) (27)
Windows Type 1 Windows Type 2 Windows Type 3			1.02 2.13 0.52	x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69				(27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51				(27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2			1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3	7.	45	1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728 0.728			7 6	(27) (27) (27) (27) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4	7.		1.02 2.13 0.52 1.89 0.52 0.52 0.52	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27) (27b) (27b) (27b) (27b) (29)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many control of the	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0	08	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04]	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many party wall Party floor * for windows and roof windows to include the areas on both sides.	2.0 5, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many many many many many many many	s, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8			24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, management of the second of the seco	s, use effective les of internal w S (A x U) x k)	08 window U-v. alls and par	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0	2) + (32a).			(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m Party wall Party floor * for windows and roof windows ** include the areas on both side Fabric heat loss, W/K = S	s, use effective les of internal w S (A x U) x k)	one of the one of the	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12 0 a formula 1. (26)(30)	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0 ue)+0.04] a	2) + (32a). : Medium	(32e) =	24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)11.57 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =(37)36.21 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Feb Mar Jul Aug Sep Dec .lan Apr May Jun Oct Nov (38)m =25.91 25.76 25.61 24.92 24.79 24.19 24.19 24.07 24.42 24.79 25.05 25.33 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =62.12 61.97 61.82 61.13 60.4 60.4 60.28 60.63 61 61.26 61.54 61 Average = Sum(39)_{1...12} /12= (39)61.13 Heat loss parameter (HLP), W/m²K (40)m = (39)m \div (4)1.41 1.41 1.39 1.38 1.37 1.37 1.37 1.38 1.38 1.39 (40)m =1.4 (40)Average = $Sum(40)_{1...12}/12=$ 1.39 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)1.52 if TFA > 13.9, N = 1 + 1.76 x [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)70.26 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m =77.28 74.47 71.66 68.85 66.04 63.23 63.23 66.04 68.85 71.66 74.47 77.28 (44)Total = $Sum(44)_{1...12}$ = 843.09 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) 100.24 (45)m =114.61 103.44 90.18 86.53 74.67 69.19 79.4 80.35 93.63 102.21 110.99 (45)Total = $Sum(45)_{1...12}$ = 1105.43 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 17.19 15.04 15.52 13.53 12.98 12.05 14.05 15.33 16.65 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 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		-	, kWh/ye	ar			(47) x (51)	x (52) x (53) =	(0		(54)
Enter (50) or (5	, ,	,								(0		(55)
Water storage I	oss calc	ulated f	or each	month			((56)m = (55) × (41)r	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicated	solar sto	rage, (57)r	n = (56)m	x [(50) – (I	H11)] ÷ (5	0), else (57	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit I	oss (anr	nual) fro	m Table	3						(0		(58)
Primary circuit I	oss calc	ulated f	or each	month (59)m = (58) ÷ 36	55 × (41)	m					
(modified by	factor fro	om Tab	e H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss cald	culated fo	or each	month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 39.38	34.28	36.52	33.95	33.65	31.18	32.22	33.65	33.95	36.52	36.73	39.38		(61)
Total heat requi	ired for v	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= 153.99	134.52	139.96	124.13	120.18	105.85	101.41	113.05	114.3	130.15	138.94	150.38		(62)
Solar DHW input ca	alculated u	ising App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0	if no sola	r contributi	on to wate	r heating)		
(add additional	lines if F	GHRS	and/or V	VWHRS	applies,	see Ap	pendix C	S)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS 32.65	27.9	27.7	18.7	12.5	7.99	7.57	8.58	8.64	20.63	28.35	32.3		(63) (G2)
WWHRS -27.31	-24.02	-24.52	-20.23	-18.81	-15.53	-13.18	-15.95	-16.4	-20.23	-23.39	-26.38		(63) (G10)
Output from wa	ter heate	er											
(64)m= 92.15	80.95	85.98	83.58	87.26	80.83	79.11	86.91	87.63	87.53	85.43	89.8		
							Outp	ut from wa	ater heater	(annual) ₁	12	1027.16	(64)
Heat gains from	n water h	neating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m							(64)
Heat gains from (65)m= 47.95	n water h	neating, 43.52	kWh/mo	onth 0.25	5 ´ [0.85 32.62	× (45)m 31.06							(64) (65)
	41.9	43.52	38.47	37.18	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
(65)m= 47.95	41.9 n in calcu	43.52 ulation	38.47 of (65)m	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
include (57)m 5. Internal gai	41.9 n in calcu	43.52 ulation of	38.47 of (65)m and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
(65)m= 47.95 include (57)m	41.9 n in calcu	43.52 ulation of	38.47 of (65)m and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
include (57)m 5. Internal gain Metabolic gains	41.9 n in calcuins (see	43.52 ulation of Table 5 5), Wat	38.47 of (65)m and 5a)	37.18 only if c	32.62 ylinder is	31.06 s in the c	+ (61)m 34.81 dwelling	35.2 or hot w	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h	1	
include (57)m 5. Internal gai Metabolic gains Jan	41.9 in calcuins (see Table : Feb 75.91	43.52 ulation of Table 5 5), Wat Mar 75.91	38.47 of (65)m 6 and 5a) ts Apr 75.91	37.18 only if c : May 75.91	32.62 ylinder is Jun 75.91	31.06 s in the c Jul 75.91	+ (61)m 34.81 dwelling Aug 75.91	35.2 or hot w Sep	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h	1	(65)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91	41.9 in calcuins (see Table : Feb 75.91	43.52 ulation of Table 5 5), Wat Mar 75.91	38.47 of (65)m 6 and 5a) ts Apr 75.91	37.18 only if c : May 75.91	32.62 ylinder is Jun 75.91	31.06 s in the c Jul 75.91	+ (61)m 34.81 dwelling Aug 75.91	35.2 or hot w Sep	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h	1	(65)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76	11.9 in calculate 10.44	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49	38.47 of (65)m and 5a) ts Apr 75.91 opendix l 6.43	37.18 only if c : May 75.91 L, equati 4.81	32.62 ylinder is Jun 75.91 ion L9 or 4.06	31.06 s in the c Jul 75.91 L9a), a 4.38	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7	35.2 or hot w Sep 75.91 Table 5	(46)m 40.26 ater is fr Oct 75.91	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain	11.9 in calculate 10.44	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49	38.47 of (65)m and 5a) ts Apr 75.91 opendix l 6.43	37.18 only if c : May 75.91 L, equati 4.81	32.62 ylinder is Jun 75.91 ion L9 or 4.06	31.06 s in the c Jul 75.91 L9a), a 4.38	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7	35.2 or hot w Sep 75.91 Table 5	(46)m 40.26 ater is fr Oct 75.91	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89	n in calculate 10.44 133.26	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81	38.47 of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 a Append	37.18 only if c May 75.91 L, equati 4.81 dix L, equati 113.2	Jun 75.91 ion L9 or 4.06 uation L' 104.49	Jul 75.91 1 L9a), a 4.38 13 or L1: 98.67	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Tal	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65) (66) (67)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain	n in calculate 10.44 133.26	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81	38.47 of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 a Append	37.18 only if c May 75.91 L, equati 4.81 dix L, equali	Jun 75.91 ion L9 or 4.06 uation L' 104.49	Jul 75.91 1 L9a), a 4.38 13 or L1: 98.67	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Tal	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65) (66) (67)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59	n in calculate 10.44 ns (calculate 30.59	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59	38.47 of (65)m 5 and 5a) ts Apr 75.91 opendix I 6.43 a Append 122.47 opendix 30.59	37.18 only if c May 75.91 L, equati 4.81 dix L, equati 113.2 L, equat	Jun 75.91 ion L9 or 4.06 uation L2 ion L15	Jul 75.91 L9a), a 4.38 13 or L1 98.67 or L15a)	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Talle te Table	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91 11.33	+ (59)m 46.75 munity h Dec 75.91 12.08	1	(65) (66) (67) (68)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans	n in calculate 10.44 ns (calculate 30.59	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59	38.47 of (65)m 5 and 5a) ts Apr 75.91 opendix I 6.43 a Append 122.47 opendix 30.59	37.18 only if c May 75.91 L, equati 4.81 dix L, equati 113.2 L, equat	Jun 75.91 ion L9 or 4.06 uation L2 ion L15	Jul 75.91 L9a), a 4.38 13 or L1 98.67 or L15a)	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Talle te Table	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91 11.33	+ (59)m 46.75 munity h Dec 75.91 12.08	1	(65) (66) (67) (68)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10	11.9 in calculate 133.26 (calculate 30.59 s gains (43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 n Append 122.47 opendix 30.59 of (65)m	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59	Jul 75.91 13 or L1: 98.67 or L15a)	+ (61)m 34.81 dwelling 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 ee Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07	1	(65) (66) (67) (68) (69)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva	n in calculate (calculate 30.59) s gains (apporation	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 n Append 122.47 opendix 30.59 of (65)m	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 30.59 10 lle 5)	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59	1	(65) (66) (67) (68) (69)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eval (71)m= -60.73	41.9 n in calculate 75.91 calculate 10.44 ns (calculate 30.59 s gains (10 apporation -60.73	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negation of the control of th	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix I 6.43 n Appendix 122.47 opendix 30.59 of and 5a) 10 tive value	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equati 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59	Jul 75.91 13 or L1: 98.67 or L15a)	+ (61)m 34.81 dwelling 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 ee Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07	1	(65) (66) (67) (68) (69) (70)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gains (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva (71)m= -60.73 Water heating gains (41.9 n in calculate 75.91 calculate 10.44 ns (calculate 30.59 s gains (10 apporation -60.73	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negatine 100.73	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix I 6.43 n Appendix 122.47 opendix 30.59 of and 5a) 10 tive value	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 30.59 10 lle 5)	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59 10	1	(65) (66) (67) (68) (69) (70) (71)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva (71)m= -60.73 Water heating gains ((72)m= 64.45	n in calculate (calculate 30.59) s gains (10 apporation -60.73 gains (Ta 62.35	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negation of the control of	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix l 6.43 n Appendix 30.59 of and 5a) 10 tive value -60.73	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equati 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59 10 le 5) -60.73	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 , also se 30.59 10 -60.73	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59 10 -60.73	Oct 75.91 9.71 ble 5 108.09 5 30.59 10 -60.73	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59 10 -60.73	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59 10 -60.73	1	(65) (66) (67) (68) (69) (70)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gains (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva (71)m= -60.73 Water heating companies ((72)m= 64.45 Total internal companies (Total internal companies ((57)m= 64.45	41.9 n in calculate (calculate 30.59 s gains (10 apporation -60.73 gains (Ta 62.35 gains =	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negation of the control of	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix l 6.43 n Appendix 30.59 of and 5a) 10 tive value -60.73	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59 10 le 5) -60.73	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59 10 -60.73	Oct 75.91 9.71 ble 5 108.09 5 30.59 10 -60.73	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59 10 -60.73	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59 10 -60.73	1	(65) (66) (67) (68) (69) (70) (71)



6. Solar gains:

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

Orienta	tion:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b	м ри	FF Table 6c	Gains (W)		
North	0.9x	0.77	x	1.02	x	10.63	x	0.76	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.13	x	10.63	х	0.76	x	0.7	=	8.35	(74)
North	0.9x	0.77	X	1.02	х	20.32	X	0.76	x	0.7	=	7.64	(74)
North	0.9x	0.77	x	2.13	х	20.32	x	0.76	x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.02	x	34.53	x	0.76	x	0.7	=	12.99	(74)
North	0.9x	0.77	X	2.13	х	34.53	X	0.76	x	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.02	x	55.46	x	0.76	x	0.7	=	20.86	(74)
North	0.9x	0.77	X	2.13	х	55.46	X	0.76	x	0.7	=	43.56	(74)
North	0.9x	0.77	x	1.02	x	74.72	X	0.76	x	0.7	=	28.1	(74)
North	0.9x	0.77	x	2.13	x	74.72	x	0.76	x	0.7	=	58.67	(74)
North	0.9x	0.77	X	1.02	x	79.99	x	0.76	x	0.7	=	30.08	(74)
North	0.9x	0.77	X	2.13	x	79.99	x	0.76	x	0.7	=	62.81	(74)
North	0.9x	0.77	x	1.02	x	74.68	x	0.76	x	0.7	=	28.08	(74)
North	0.9x	0.77	x	2.13	x	74.68	X	0.76	x	0.7	=	58.64	(74)
North	0.9x	0.77	X	1.02	x	59.25	x	0.76	x	0.7	=	22.28	(74)
North	0.9x	0.77	X	2.13	x	59.25	x	0.76	x	0.7	=	46.52	(74)
North	0.9x	0.77	x	1.02	x	41.52	x	0.76	x	0.7	=	15.61	(74)
North	0.9x	0.77	X	2.13	x	41.52	x	0.76	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	1.02	x	24.19	x	0.76	x	0.7	=	9.1	(74)
North	0.9x	0.77	x	2.13	x	24.19	x	0.76	x	0.7	=	19	(74)
North	0.9x	0.77	X	1.02	x	13.12	x	0.76	x	0.7	=	4.93	(74)
North	0.9x	0.77	x	2.13	x	13.12	x	0.76	x	0.7	=	10.3	(74)
North	0.9x	0.77	X	1.02	x	8.86	x	0.76	x	0.7	=	3.33	(74)
North	0.9x	0.77	X	2.13	X	8.86	x	0.76	x	0.7] =	6.96	(74)
South	0.9x	0.77	X	0.52	x	46.75	x	0.76	x	0.7] =	8.96	(78)
South	0.9x	0.77	X	1.89	X	46.75	X	0.76	x	0.7] =	32.58	(78)
South	0.9x	0.77	X	0.52	X	76.57	X	0.76	X	0.7	=	14.68	(78)
South	0.9x	0.77	X	1.89	X	76.57	X	0.76	x	0.7	=	53.35	(78)
South	0.9x	0.77	X	0.52	X	97.53	X	0.76	X	0.7	=	18.7	(78)
South	0.9x	0.77	X	1.89	x	97.53	X	0.76	x	0.7	=	67.96	(78)
South	0.9x	0.77	X	0.52	X	110.23	x	0.76	x	0.7] =	21.13	(78)
South	0.9x	0.77	X	1.89	X	110.23	X	0.76	X	0.7	=	76.81	(78)
South	0.9x	0.77	X	0.52	X	114.87	X	0.76	x	0.7] =	22.02	(78)
South	0.9x	0.77	x	1.89	x	114.87	x	0.76	x	0.7] =	80.04	(78)
South	0.9x	0.77	x	0.52	x	110.55	X	0.76	x	0.7	=	21.19	(78)
South	0.9x	0.77	X	1.89	x	110.55	x	0.76	x	0.7	=	77.03	(78)



South 0.9x	0.77	X	0.52	x	108.01	x	0.76	x	0.7	=	20.71	(78)
South 0.9x	0.77	X	1.89	x	108.01	x	0.76	x	0.7	=	75.26	(78)
South 0.9x	0.77	X	0.52	x	104.89	X	0.76	x	0.7	=	20.11	(78)
South 0.9x	0.77	X	1.89	x	104.89	x	0.76	x	0.7	=	73.09	(78)
South 0.9x	0.77	X	0.52	x	101.89	x	0.76	x	0.7	=	19.53	(78)
South 0.9x	0.77	X	1.89	x	101.89	x	0.76	x	0.7	=	70.99	(78)
South 0.9x	0.77	X	0.52	x	82.59	x	0.76	X	0.7] =	15.83	(78)
South 0.9x	0.77	X	1.89	x	82.59	x	0.76	x	0.7	=	57.55	(78)
South 0.9x	0.77	X	0.52	x	55.42	x	0.76	x	0.7	=	10.62	(78)
South 0.9x	0.77	X	1.89	x	55.42	x	0.76	X	0.7	=	38.61	(78)
South 0.9x	0.77	X	0.52	x	40.4	X	0.76	X	0.7	=	7.74	(78)
South 0.9x	0.77	X	1.89	x	40.4	X	0.76	X	0.7	=	28.15	(78)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights 0.9x	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	x	0.76	x	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	157	x	0.76	x	0.7	=	39.09	(82)
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Roofligi	<u> </u>	1	X	0.5	2	X	157	X	0.76	X	0.7	=	39.09	(82)
Roofligl	<u> </u>	1	X	0.5	2	X	157	X	0.76	X	0.7	=	39.09	(82)
Roofligl	<u> </u>	1	X	0.5	52	X	157	X	0.76	X	0.7	=	39.09	(82)
Roofligl	nts _{0.9x}	1	X	0.5	2	X	115	X	0.76	X	0.7	=	28.63	(82)
Roofligl	<u> </u>	1	X	0.5	52	x	115	X	0.76	X	0.7	=	28.63	(82)
Roofligh	nts _{0.9x}	1	X	0.5	2	x	115	X	0.76	X	0.7	=	28.63	(82)
Roofligl	nts 0.9x	1	X	0.5	2	x	115	X	0.76	X	0.7	=	28.63	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	x	66	x	0.76	x	0.7	=	16.43	(82)
Roofligl	nts _{0.9x}	1	x	0.5	2	x	66	X	0.76	x	0.7	=	16.43	(82)
Roofligl	nts 0.9x	1	X	0.5	52	x	66	x	0.76	x	0.7	=	16.43	(82)
Roofligl	nts _{0.9x}	1	х	0.5	2	x	66	X	0.76	X	0.7	=	16.43	(82)
Roofligl	nts _{0.9x}	1	х	0.5	2	x	33	X	0.76	X	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	x	33	x	0.76	x	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	x	33	x	0.76	х	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	x	0.5	2	x	33	x	0.76	x	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	x	21	x	0.76	x	0.7	=	5.23	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	x	21	х	0.76	x	0.7	=	5.23	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	x	21	x	0.76	x	0.7	=	5.23	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	x	21	x	0.76	x	0.7	=	5.23	(82)
						•		•						
Solar g	gains in wa	atts, calcul	lated	for each	n month			(83)m	n = Sum(74)m .	(82)m				
(83)m=	79.78	145.41 222	2.37	311.74	380.05	39	00.29 370.92	318	.36 253.27	167.2	97.34	67.1]	(83)
													1	()
Total g	ains – inte	ernal and	solar	(84)m =	= (73)m ·	+ (8	33)m , watts						_	(22)
Total g (84)m=			solar 4.94	(84)m = 549.84	= (73)m 603.8	·	33)m , watts 99.92 571.49	523		394.89	-	323.86]	(84)
(84)m=	343.65		4.94	549.84	603.8	59					-	I		
(84)m= 7. Me	343.65 4	407.23 474 al temperat	4.94 ture (549.84 (heating	603.8 season	59		523	.92 466.33		-	I	21	
(84)m= 7. Me Temp	343.65 an internaterature du	407.23 474 al temperaturing heati	ture (549.84 (heating eriods in	603.8 season	59 ng a	99.92 571.49	523	.92 466.33		-	I	21	(84)
(84)m= 7. Me Temp	343.65 an internaterature du	407.23 474 al temperation for gains	ture (549.84 (heating eriods in	603.8 season	59 ng a	99.92 571.49 area from Tal	523 ole 9	.92 466.33		341.76	I	21	(84)
(84)m= 7. Me Temp	an internaterature duation facto	407.23 474 al temperation for gains Feb N	ture (ing pe	549.84 (heating eriods in	season the livi) ng a	99.92 571.49 area from Talee Table 9a)	523 ole 9	.92 466.33 , Th1 (°C)	394.89	341.76	323.86	21	(84)
(84)m= 7. Me Temp Utilisa (86)m=	an internation factor Jan 0.99	al temperaturing heation for gains Feb N 0.99 0.	ture (ing personal for ling) If for ling for lin	549.84 (heating eriods in ving are Apr	season the living ea, h1,m May	59 ng a (se	op.92 571.49 area from Tal ee Table 9a) Jun Jul 0.61 0.46	523 cole 9 A 0.5	.92 466.33 , Th1 (°C) ug Sep 51 0.77	394.89 Oct	341.76 Nov	323.86 Dec	21	(84)
(84)m= 7. Me Temp Utilisa (86)m=	an internation factor Jan 0.99	al temperaturing heating for gains Feb M 0.99 0.99	ture (ing personal for ling) If for ling for lin	549.84 (heating eriods in ving are Apr	season the living ea, h1,m May	ng a (se	area from Talee Table 9a) Jun Jul	523 cole 9 A 0.5	.92 466.33 , Th1 (°C) ug Sep 51 0.77	394.89 Oct	Nov 0.99	323.86 Dec	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m=	an internation factor Jan 0.99 internal to 19.58	al temperaturing heating for gains Feb M 0.99 0. emperature 19.79 20	ture (ing positions for limited for limite	549.84 (heating eriods in Apr 0.91 iving are 20.51	season the livings, h1,m May 0.79 ea T1 (for 20.81	59 nng a 1 (se 0	99.92 571.49 area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99	523 cole 9 A 0.5 7 in T 20.	.92 466.33 , Th1 (°C) ug Sep 51 0.77 Table 9c) 98 20.88	394.89 Oct 0.95	Nov 0.99	323.86 Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp	an internation factor Jan 0.99 internal to 19.58	al temperaturing heating for gains Feb N 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99	ture (ing positions) for limited from 197 e in limited from 197 e in grant from 197 e	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in are 20.51	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81	59) ng a (see) 0 0 0 dw/	area from Talee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta	523 cole 9 A 0.5 7 in T 20.	.92 466.33 , Th1 (°C) ug Sep 51 0.77 Table 9c) 98 20.88 9, Th2 (°C)	Oct 0.95	Nov 0.99	Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m=	an internation factor Jan 0.99 internal to 19.58 erature do 19.76	al temperaturing heating for gains Feb No.99 0.99 0.99 0.99 20 emperaturing heating h	ture (ing positions) for line (ing positions)	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78	59 10 15 00 15 15	area from Talee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79	523 ble 9 A 0.5 7 in T 20.	.92 466.33 , Th1 (°C) ug Sep 51 0.77 Table 9c) 98 20.88 9, Th2 (°C)	394.89 Oct 0.95	Nov 0.99	323.86 Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa	an internation factor Jan 0.99 internal to 19.58 erature do 19.76 ation factor	al temperaturing heating for gains Feb Money 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.9	ture (ing positions) for line (ing positions) for respect to the control of the c	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77 est of decided in the second in	season the livings, h1,m May 0.79 ea T1 (for 20.81 or rest of 19.78 welling,	59) ng a (see) 00 01 01 01 01 01 01 01 01 01 01 01 01	area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79 m (see Table	523 ble 9 A 0.5 7 in T 20. 19. 9a)	.92 466.33 Th1 (°C) ug Sep 51 0.77 Table 9c) 98 20.88 9, Th2 (°C) 79 19.78	Oct 0.95	Nov 0.99 19.95	Dec 1 19.55	21	(84) (85) (86) (87) (88)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m=	an internation factor Jan 0.99 internal to 19.58 erature do 19.76	al temperaturing heating for gains Feb Money 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.9	ture (ing positions) for line (ing positions)	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78	59) ng a (see) 00 01 01 01 01 01 01 01 01 01 01 01 01	area from Talee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79	523 ble 9 A 0.5 7 in T 20.	.92 466.33 Th1 (°C) ug Sep 51 0.77 Table 9c) 98 20.88 9, Th2 (°C) 79 19.78	Oct 0.95	Nov 0.99	Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean	an internation factor Jan 0.99 internal to 19.76 ation factor 0.99 internal to 19.76	al temperaturing heating for gains Feb No.99 0. emperaturing heating h	ture (ing position of the form	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78 welling, 0.72 of dwelling	59 19 19 19 19 19 19 19	area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79 m (see Table 0.51 0.33 T2 (follow ste	523 ble 9 A 0.5 7 in T 20. able 9 9a) 0.3	.92 466.33 .7 Th1 (°C) ug Sep .61 0.77 .7 Table 9c) .98 20.88 .9, Th2 (°C) .79 19.78 .9 0.67 .10 Table 10 Ta	Oct 0.95 20.47 19.78 0.92 e 9c)	Nov 0.99 19.95 19.77	323.86 Dec 1 19.55 19.77	21	(84) (85) (86) (87) (88) (89)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m=	an internation factor Jan 0.99 internal to 19.76 ation factor 0.99 internal to 19.76	al temperaturing heating for gains Feb No.99 0. emperaturing heating h	ture (ing positions) for ling positions (ing positions) for regions (ing positions) fo	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77 est of do 0.88	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78 welling, 0.72	59 19 19 19 19 19 19 19	area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79 m (see Table 0.51 0.33	523 ble 9 A 0.5 7 in T 20. 4ble 9 9a) 0.5	.92 466.33 .7 Th1 (°C) ug Sep .61 0.77 .7 Table 9c) .98 20.88 .9, Th2 (°C) .79 19.78 .8	394.89 Oct 0.95 20.47 19.78 0.92 e 9c) 19.19	Nov 0.99 19.95 19.77 0.98	323.86 Dec 1 19.55 19.77 0.99		(84) (85) (86) (87) (88) (89)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean	an internation factor Jan 0.99 internal to 19.76 ation factor 0.99 internal to 19.76	al temperaturing heating for gains Feb No.99 0. emperaturing heating h	ture (ing position of the form	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78 welling, 0.72 of dwelling	59 19 19 19 19 19 19 19	area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79 m (see Table 0.51 0.33 T2 (follow ste	523 ble 9 A 0.5 7 in T 20. able 9 9a) 0.3	.92 466.33 .7 Th1 (°C) ug Sep .61 0.77 .7 Table 9c) .98 20.88 .9, Th2 (°C) .79 19.78 .8	394.89 Oct 0.95 20.47 19.78 0.92 e 9c) 19.19	Nov 0.99 19.95 19.77	323.86 Dec 1 19.55 19.77 0.99	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=	an internation factor Jan 0.99 internal to 19.76 ation factor 0.99 internal to 19.76 ation factor 17.91	al temperaturing heating for gains Feb Mo.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99	ture (ing person of the ing pe	549.84 (heating eriods in ving are Apr 0.91 iving are 20.51 eriods in 19.77 est of do 0.88 he rest 19.23	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78 welling, 0.72 of dwelling, 19.61	559 ng a 1 (see 1 (see 1)	area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79 m (see Table 0.51 0.33 T2 (follow ste	523 bole 9 A 0.5 7 in T 20. 9a) 0.3 19.	.92 466.33 .7 Th1 (°C) ug Sep .61 0.77 .7 Table 9c) .98 20.88 .9, Th2 (°C) .79 19.78 .9	394.89 Oct 0.95 20.47 19.78 0.92 e 9c) 19.19	Nov 0.99 19.95 19.77 0.98	323.86 Dec 1 19.55 19.77 0.99		(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=	an internation factor Jan 0.99 internal to 17.91 internal to 18.82	al temperaturing heating for gains Feb Mo.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99	ture (ing person of the ing pe	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest 19.23 r the wh	603.8 season the livin ea, h1,m May 0.79 ea T1 (for 20.81 n rest of 19.78 welling, 0.72 of dwelling 19.61 ole dwe 20.26	559 1	99.92 571.49 area from Tal ee Table 9a) Jun Jul 0.61 0.46 w steps 3 to 7 0.95 20.99 elling from Ta 9.79 19.79 m (see Table 0.51 0.33 T2 (follow ste 9.76 19.78	523 bole 9 A 0.5 7 in T 20. 9a) 0.3 + (1 20.	.92 466.33 .7 h1 (°C) ug Sep .61 0.77 .7 able 9c) .98 20.88 .9, Th2 (°C) .79 19.78 .9 0.67 .10 7 in Table .78 19.69 .78 19.69 .79 ft.A) × T2 .43 20.33	394.89 Oct 0.95 20.47 19.78 0.92 e 9c) 19.19 LA = Liv	Nov 0.99 19.95 19.77 0.98 18.45 ring area ÷ (4	323.86 Dec 1 19.55 19.77 0.99		(84) (85) (86) (87) (88) (89)



ı										•	•			
(93)m=	18.67	18.91	19.3	19.78	20.11	20.26	20.29	20.28	20.18	19.73	19.11	18.63		(93)
		ting requ												
				•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
tne ut				using Ta		lina	11	A	Con	0-4	Nav	Dag		
Litilias	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	tor for ga	0.95	0.88	0.74	0.55	0.39	0.44	0.71	0.92	0.98	0.99		(94)
				1 0.00 4)m x (84		0.55	0.39	0.44	0.71	0.92	0.96	0.99		(34)
(95)m=	340.09	398.69	452.29	484.34	447.6	328.47	220.41	230.19	330.12	364.24	335.04	321.2		(95)
							220.41	230.19	330.12	304.24	333.04	321.2		(00)
(96)m=	4.3	4.9	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
								x [(93)m		ļ	/.1	4.2		(50)
(97)m=	892.45	868.32	791.36	664.81	512.91	341.6	222.61	234.02	368.79	557.08	736.04	887.78		(97)
								24 x [(97)		l .	l	007.70		(01)
(98)m=	410.96	315.59	252.27	129.94	48.59	0	0.02	0	0	143.47	288.72	421.54		
(90)111=	410.30	313.39	202.21	129.94	40.59	U	0			<u> </u>	<u> </u>	<u> </u>	2014.00	7(00)
								Tota	l per year	(kvvn/year) = Sum(9	8)15,912 =	2011.08	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								45.63	(99)
9a. En	ergy rec	uiremer	its – Ind	ividual h	eating sy	ystems ii	ncluding	micro-C	CHP)					
Space	e heatir	ıg:												
Fracti	on of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =			ĺ	1	(202)
Fracti	on of to	tal heatir	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		İ	1	(204)
			_	ing syste									90.9	(206)
	•	•		ementar		n evetom	0/_					 	0	(208)
LIIICIC									_				-	
0	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space				alculate						440.47	000.70	404.54		
	410.96	315.59	252.27	129.94	48.59	0	0	0	0	143.47	288.72	421.54		
(211)m				00 ÷ (20						ı	ı			(211)
	452.1	347.19	277.52	142.95	53.46	0	0	0	0	157.84	317.62	463.74		_
								Tota	l (kWh/yea	ar) =Sum(2	211),5,1012	=	2212.41	(211)
		•		y), kWh/	month									
	<u> </u>	1)] } x 1	00 ÷ (20	r										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
	heating	•												
Output				ulated al					1	1	1	- 1		
	92.15	80.95	85.98	83.58	87.26	80.83	79.11	86.91	87.63	87.53	85.43	89.8		_
Efficier	ncy of w	ater hea	ter							•	•		80.8	(216)
(217)m=	88.87	88.64	88.1	86.66	84.14	80.8	80.8	80.8	80.8	86.79	88.38	88.95		(217)
		heating,												
		m x 100			400.7	400.00	07.04	407.50	100.45	400.00	00.07	400.00		
(219)m=	103.69	91.32	97.59	96.44	103.7	100.03	97.91	107.56	108.45	100.86	96.67	100.96	4007.0	7(0:5)
								rota	I = Sum(2				1205.2	(219)
	I totals	fuel use	d main	system	1					k'	Wh/year	[kWh/yea	,
Space	nealing	iuei use	u, maili	System	1							l	2212.41	



					_
Water heating fuel used				1205.2	
Electricity for pumps, fans and electric keep-hot					
central heating pump:			120		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)(230g) =		165	(231)
Electricity for lighting				207.61	(232)
Electricity generated by PVs				-576.34	(233)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh		Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	477.88	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
VAV = (= a la = a t' = a					
Water heating	(219) x	0.216	=	260.32	(264)
Space and water heating	(219) x (261) + (262) + (263) + (264) =	0.216	=	260.32 738.2	(264) (265)
-		0.216	=		
Space and water heating	(261) + (262) + (263) + (264) =			738.2	(265)

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

(272) ÷ (4) =

Total CO2, kg/year

El rating (section 14)

Dwelling CO2 Emission Rate

(272)

(273)

(274)

632.47

14.35

90



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Pro	perty Address: G	reen	Ground F	loor Sa	mple		
Address:							
1. Overall dwelling dimensions:							
	Area(m²)		Av. Heig	jht(m)	_	Volume(m³)	_
Ground floor	70.43 (1a	a) x	2.4	2	(2a) =	170.44	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$	70.43 (4)						
Dwelling volume	(3	a)+(3b)+(3c)+(3d)+	+(3e)+	.(3n) =	170.44	(5)
2. Ventilation rate:							
main secondary heating heating	other		total			m³ per hour	
Number of chimneys 0 + 0	+ 0	- [0	x 4	10 =	0	(6a)
Number of open flues 0 + 0	+ 0	- [0	x2	20 =	0	(6b)
Number of intermittent fans			3	x 1	10 =	30	(7a)
Number of passive vents			0	x 1	10 =	0	(7b)
Number of flueless gas fires			0	x 4	10 =	0	(7c)
		_			A 1.		
					Air cn	anges per hou	ır _
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)		tinus fr	30		÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to Number of storeys in the dwelling (ns)	to (17), otherwise con-	unue n	om (9) to (1	0)	ı	0	(9)
Additional infiltration				[(9)-	·1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0).35 for masonry o	constr	ruction	[(0)	17.0.1 -	0	(11)
if both types of wall are present, use the value corresponding to the	•					•	
deducting areas of openings); if equal user 0.35							_
If suspended wooden floor, enter 0.2 (unsealed) or 0.1	(sealed), else en	ter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0						0	(13)
Percentage of windows and doors draught stripped						0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate	(8) + (10) + (1)	11) + (1	2) + (13) +	(15) =		0	(16)
Air permeability value, q50, expressed in cubic metres	per hour per squa	are m	etre of en	velope	area	4	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$,	otherwise $(18) = (16)$					0.38	(18)
Air permeability value applies if a pressurisation test has been done	or a degree air perme	ability	is being use	ed			
Number of sides sheltered						3	(19)
Shelter factor	(20) = 1 - [0.0])75 x (1	[9)] =			0.78	(20)
Infiltration rate incorporating shelter factor	$(21) = (18) \times (21)$	(20) =				0.29	(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							

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

5

1.25

Wind Factor $(22a)m = (22)m \div 4$



Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
<i>Calculate effe</i> If mechanic		_	rate for t	he appli	cable ca	se							(23
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (N	N5)) . othe	wise (23b) = (23a)			0	(23
If balanced with									, , ,			0	(23
a) If balance		•	•	_					2b)m + (23b) x [1 – (23c)		(2
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
b) If balance	ed mech	anical ve	ntilation	without	heat red	covery (N	иV) (24b)m = (22	<u>. </u>	23b)	Į	J	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
c) If whole h	ouse ex	tract ven	tilation o	or positiv	e input v	ventilatio	n from c	utside				J	
,		(23b), t		•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural									-			-	
<u>`</u>	r	en (24d)	<u> </u>	_	·		 					1	
24d)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(2
Effective air			<u> </u>	<u> </u>	´``	``		<u> </u>	<u> </u>	ī	1	1	-
25)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(2
3. Heat losse	s and he	eat loss p	paramete	er:									
ELEMENT	Gros		Openin		Net Ar		U-valu		ΑXU		k-value		ΑXk
_	area	(m²)	m	l ²	A ,r	m²	W/m2	K ,	(W/	K)	kJ/m²-	K	kJ/K
Doors					1.89		1.6	= [3.024	_			(2
Vindows Type					3.98	x1.	/[1/(1.4)+	0.04] =	5.28				(2
Windows Type	2				5.97	х1.	/[1/(1.4)+ 	0.04] =	7.91	╝.			(2
Floor					70.43	3 X	0.12	=	8.4516	<u> </u>			(2
Nalls	40.0)3	11.8	4	28.19) X	0.16	=	4.51				(2
Total area of e	elements	, m²			110.4	6							(3
Party wall					45.23	3 x	0	= [0				(3
Party ceiling					70.43	3							(3
for windows and						ated using	formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragrapl	1 3.2	
* include the area				ls and part	titions		(26)(30)	(22) –					——, <u>,</u>
Fabric heat los		•	U)				(20)(30)		(20) . (2)	0) . (00-)	(20-)	29.18	===
Heat capacity	•	,	0	TEA\ :					.(30) + (32		(32e) =	0	(3
Thermal mass	•	`		,			o o io o ly 4h c		tive Value		oblo 1f	250	(3
For design asses: an be used inste				CONSTRUCT	ion are noi	i kriowri pr	ecisely trie	rindicative	values of	TIVIPIII	аые п		
Thermal bridg	es : S (L	x Y) cal	culated i	using Ap	pendix I	<						10.35	5 (3
f details of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
otal fabric he	at loss							(33) +	(36) =			39.53	3 (3
entilation hea	at 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= 32.01	31.85	31.71	31.01	30.88	30.28	30.28	30.17	30.51	30.88	31.15	31.42		(3
leat transfer	coefficier	nt, W/K						(39)m	= (37) + (38)m		_	
39)m= 71.53	71.38	71.23	70.54	70.41	69.8	69.8	69.69	70.04	70.41	70.67	70.95		
_									Average =	Sum(20)	/4.0	70.54	4 (3



Heat Io	ss para	meter (H	HLP), W	m²K					(40)m	= (39)m ÷	- (4)			
40)m=	1.02	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1.01		
				I- 4-\						Average =	Sum(40) ₁	12 /12=	1	(40
oumbe I	i		nth (Tab	· ·		1	11		0	0-4	Nan	Date		
44\	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(41
l1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41
4. Wa	ter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
		pancy, l		[1 - exp	(-0.0003	349 x (Ti	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		26		(42
	A £ 13.9				`	•		, ,,	`					
								(25 x N) to achieve		se target o		'.79		(43
		_			ater use, l	_	_	io acineve	a water us	se larger o	n			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
lot wate					Vd,m = fa									
14)m=	96.57	93.06	89.55	86.04	82.52	79.01	79.01	82.52	86.04	89.55	93.06	96.57		
	!		Į.		Į.		Į.	ļ.		Total = Su	ım(44) ₁₁₂ =	=	1053.51	(44
nergy o	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,ı	n x nm x D	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
l5)m=	143.21	125.25	129.25	112.68	108.12	93.3	86.46	99.21	100.4	117	127.72	138.69		_
inatant	anaaya w	ator hooti	na ot noin	of upo (no	hot woto	r otorogo)	ontor O in	boxes (46		Total = Su	ım(45) ₁₁₂ =	=	1381.32	(4
										·				/4
l6)m= Vater	21.48 storage	18.79 loss:	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.8		(4)
	_		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
comr	nunity h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)					l	
Otherw	ise if no	stored	hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage					(1.14.11	<i>,</i> , , ,						Ī	
•					or is kno	wn (kvvi	n/day):					0		(48
•			m Table					(10)				0		(49
			storage	-	ear loss fact	or is not		(48) x (49)) =			0		(50
•				-	le 2 (kW							0		(5
	-	_	ee secti	on 4.3										
		from Ta		01								0		(52
•			m Table									0		(5:
٠.			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54
	`	54) in (5	•	for oooh	month			//E6\m - /	EE\ ~ (41)			0		(5
ı			culated t				ı	((56)m = (1	1			Ī	/ E
66)m=	0	0	0	0	0 m = (56)m	0	0	0) also (5)	0 7\m = (56)	0 m whore (0	0 m Append	iv ⊔	(50
					· · ·	1		· · ·			1			
57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(5
		•	nual) fro									0		(5
					,	•	. ,	65 × (41)		(1.	-1-1			
` ı				i		i		ng and a		i	- 		1	/-
9)m=	0	0	0	0	0	0	0	0	0	0	0	0		(5



Combi loss calculated for each month (61)m = (60) - 3.05 x (41)m = (60) - 3.05 x (45)m + (46)m + (57)m + (69)m + (61)m (61)m (82)m = (8.21 x 42.83 42.83 45.83 45.83 45.81 45.81 (61) m (62)m = (9.24 x 48.83 45.83 45.83 45.84 45.81 (61) m (62)m = (9.24 x 48.83 45.83 45.84 47.81 (62) m (62)m = (9.24 x 48.83 45.84 47.81 (63) m (62) m (62)m = (9.24 x 48.83 45.84 47.81 (63) m (62) m (62)m = (9.24 x 48.83 48.84 47.81 (63) m (62)
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m = 192.42 168.09 174.88 155.11 150.18 132.27 126.72 141.27 142.83 162.64 173.61 187.91 (62) Solar PHW input calculated using Appendix Gor 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) Gayline (63)me
(62) (62) (63) (74,88 155,11 150,18 132,27 126,72 141,27 142,83 162,64 173,61 187,91 (62)
Control Cont
Companies Comp
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Common Number Common Numbe
Output from water heater (64)m= 117.3 102.13 109.09 105.96 109.02 99.33 97.47 106.92 107.75 112.17 108.69 114.29 Output from water heater (annual) 1290.12 (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 = 59.92 52.36 54.38 48.07 46.46 40.76 38.81 43.5 43.99 50.31 53.94 58.42 (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 = 135.39 13
Company 117.3 102.13 109.09 105.96 109.02 99.33 97.47 106.92 107.75 112.17 108.69 114.29 1290.12 (64)
Coulput from water heater (annual) 1290.12 (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=
(65)m= 59.92 52.36 54.38 48.07 46.46 40.76 38.81 43.5 43.99 50.31 53.94 58.42 (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
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
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
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)m=
(67) (67) (67) (67) (67) (67) (67) (67)
(67) (67) (67) (67) (67) (67) (67) (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 295.97 299.04 291.3 274.82 254.03 234.48 221.42 218.35 226.09 242.56 263.36 282.91 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(68)m= 295.97 299.04 291.3 274.82 254.03 234.48 221.42 218.35 226.09 242.56 263.36 282.91 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(70)m= 10 10 10 10 10 10 10 10 10 10 10 10 10
(70)m= 10 10 10 10 10 10 10 10 10 10 10 10 10
(71)m=
(71)m=
(72)m= 80.54 77.91 73.1 66.77 62.45 56.62 52.17 58.47 61.1 67.62 74.92 78.52 (72)
(72)m= 80.54 77.91 73.1 66.77 62.45 56.62 52.17 58.47 61.1 67.62 74.92 78.52 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
and the second s
(73)m= 528.11 523.44 503.32 472.5 441.07 412.78 396.55 404.88 422.82 453.84 488.24 514.3 (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)
North 0.9x 0.77 x 3.98 x 10.63 x 0.76 x 0.7 = 15.6 (74)
North 0.9x 0.77 x 3.98 x 20.32 x 0.76 x 0.7 = 29.82 (74)
North $0.9x$ 0.77 \times 3.98 \times 34.53 \times 0.76 \times 0.7 = 50.67 (74)



North	0.9x	0.77	X	3.9	18	X	55.46	X	0.76	X	0.7	=	81.38	(74)
North	0.9x	0.77	X	3.9	18	X	74.72	X	0.76	x	0.7	=	109.63	(74)
North	0.9x	0.77	X	3.9	8	X	79.99	X	0.76	X	0.7	=	117.36	(74)
North	0.9x	0.77	X	3.9	18	X	74.68	X	0.76	x	0.7	=	109.58	(74)
North	0.9x	0.77	X	3.9	18	X	59.25	X	0.76	x	0.7	=	86.93	(74)
North	0.9x	0.77	X	3.9	18	X	41.52	X	0.76	x	0.7	=	60.92	(74)
North	0.9x	0.77	X	3.9	18	X	24.19	X	0.76	x	0.7	=	35.49	(74)
North	0.9x	0.77	X	3.9	18	X	13.12	X	0.76	x	0.7	=	19.25	(74)
North	0.9x	0.77	X	3.9	18	X	8.86	X	0.76	x	0.7	=	13.01	(74)
East	0.9x	1	x	5.9	7	X	19.64	X	0.76	x	0.7	=	43.23	(76)
East	0.9x	1	X	5.9	7	X	38.42	X	0.76	x	0.7	=	84.56	(76)
East	0.9x	1	X	5.9	7	X	63.27	X	0.76	x	0.7	=	139.26	(76)
East	0.9x	1	x	5.9	7	X	92.28	x	0.76	x	0.7	=	203.11	(76)
East	0.9x	1	x	5.9	7	X	113.09	X	0.76	x	0.7	_ =	248.92	(76)
East	0.9x	1	X	5.9	17	X	115.77	X	0.76	x	0.7	=	254.81	(76)
East	0.9x	1	X	5.9	17	X	110.22	X	0.76	x	0.7		242.59	(76)
East	0.9x	1	X	5.9	17	X	94.68	X	0.76	x	0.7	=	208.38	(76)
East	0.9x	1	X	5.9	7	X	73.59	X	0.76	x	0.7	=	161.97	(76)
East	0.9x	1	X	5.9	7	X	45.59	X	0.76	x	0.7	=	100.34	(76)
East	0.9x	1	X	5.9	17	X	24.49	X	0.76	x	0.7	=	53.9	(76)
East	0.9x	1	X	5.9	7	X	16.15	X	0.76	X	0.7	=	35.55	(76)
Solar	gains in	watts, cal	culated	for eacl	n montl	า		(83)m	n = Sum(74)m .	(82)m				
(83)m=	58.83	114.38	189.93	284.49	358.55	3	72.18 352.17	295	.32 222.89	135.8	4 73.15	48.56		(83)
Total g	ains – i	nternal an	nd solar	(84)m =	(73)m	+ (83)m , watts						_	
(84)m=	586.94	637.82	693.25	756.99	799.62	7	84.96 748.71	700	0.2 645.71	589.6	561.39	562.86		(84)
7. Me	an inter	nal tempe	erature	(heating	seaso	n)								
Temp	erature	during he	eating p	eriods ir	the liv	ing	area from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisa	ation fac	tor for ga	ins for I	iving are	ea, h1,r	n (s	ee Table 9a)							
	Jan	Feb	Mar	Apr	May		Jun Jul	А	ug Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.96	0.89	0.75		0.56 0.41	0.4	15 0.71	0.92	0.98	0.99		(86)
Mean	interna	l tempera	ture in I	iving are	ea T1 (follo	w steps 3 to 7	7 in T	able 9c)					
(87)m=	20.16	20.29	20.5	20.76	20.93	2	20.99 21	2	1 20.96	20.74	20.41	20.13]	(87)
Temp	erature	durina he	eating p	eriods ir	rest o	f dw	elling from Ta	able 9	9. Th2 (°C)			•	_	
(88)m=	20.07	20.07	20.07	20.08	20.08	_	20.09 20.09	20.	<u> </u>	20.08	20.08	20.08]	(88)
l Itilie	ation fac	tor for as	ins for r	est of d	welling	h?	,m (see Table	۱۹۵۱	1	·	1		_	
(89)m=	0.99	0.98	0.95	0.87	0.7	_	0.48 0.33	0.3	0.63	0.9	0.97	0.99	1	(89)
		<u> </u>							<u> </u>				J	•
						Ť	T2 (follow ste	i 			10.24	10.04	1	(90)
(90)m=	18.97	19.15	19.46	19.81	20.02		20.08 20.09	20.		19.8	19.34 ving area ÷ (18.94	0.40	
									'	EA - EN	mig area + (·, –	0.42	(91)
							\ (I A T4		(I A) TO					

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



(92)m= 19.47	19.62	19.89	20.21	20.4	20.46	20.47	20.47	20.43	20.19	19.78	19.43		(92)
Apply adjustm	nent to th	ne mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m= 19.32	19.47	19.74	20.06	20.25	20.31	20.32	20.32	20.28	20.04	19.63	19.28		(93)
8. Space heat	ting requ	uirement											
Set Ti to the r			•		ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation	i												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	Ť		- I	0.74	0.5	0.05	2.00	0.05	0.0	0.07	0.00		(04)
(94)m= 0.98	0.97	0.95	0.86	0.71	0.5	0.35	0.39	0.65	0.9	0.97	0.99		(94)
Useful gains, (95)m= 577.5	620.95	655.22	654.78	+)m 566.32	394.31	259.06	272.2	417.13	527.88	544.67	555.42		(95)
(95)m= 577.5 Monthly avera						259.06	212.2	417.13	321.00	344.07	555.42		(90)
(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										7.1	4.2		(50)
(97)m= 1074.09	-	943.06	786.96	601.73	398.55	259.47	272.99	433.17	664.96	885.66	1070.04		(97)
Space heating											1070.04		(01)
(98)m= 369.46	281.74	214.15	95.17	26.34	0	0.02	0	0	101.98	245.51	382.88		
(66)							_	l per year				1717.24	(98)
0	· ·		1.14/1. / 2	1			Tota	i per year	(ICVIII) your) = Odin(o	0)15,912		╡``
Space heating	g require	ement in	kvvn/m²	/year								24.38	(99)
9a. Energy req	uiremen	its – Indi	vidual he	eating sy	ystems i	ncluding	micro-C	HP)					
Space heatin	_			, .									7 ,
Fraction of sp			_		mentary	-						0	(201)
Fraction of sp	ace hea	t from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of tot	al heatir	ng from r	main cuc										
Efficiency of r		5	nam sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency of i	nain spa		-				(204) = (204)	02) x [1 –	(203)] =			90.9	(204)
Efficiency of s	•	ice heati	ng syste	em 1	g system		(204) = (20	02) x [1 –	(203)] =				╡`
Efficiency of s	econda	ry/supple	ng syste	em 1 y heating		ı, %		, -		Nov	Dec	90.9	(206)
•	Feb	ry/supple	ng systeementary	em 1 y heating May	Jun		(204) = (2 ¹)	02) × [1 -	(203)] =	Nov	Dec	90.9	(206)
Efficiency of s	Feb	ry/supple	ng systeementary	em 1 y heating May	Jun	ı, %		, -		Nov 245.51	Dec 382.88	90.9	(206)
Efficiency of s Jan Space heating 369.46	Feb g require	Mar ement (ca	ng syste ementary Apr alculated 95.17	m 1 y heating May d above) 26.34	Jun	n, % Jul	Aug	Sep	Oct			90.9	(206) (208) ar
Efficiency of s Jan Space heating	Feb g require	Mar ement (ca	ng syste ementary Apr alculated 95.17	m 1 y heating May d above) 26.34	Jun	n, % Jul	Aug	Sep	Oct			90.9	(206)
Efficiency of s Jan Space heating 369.46 (211)m = {[(98)	Feb g require 281.74	Mar Mar (c. 214.15 4)] } x 1	ng syste ementary Apr alculated 95.17 00 ÷ (20	em 1 y heating May d above) 26.34	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51	382.88	90.9	(206) (208) ar
Jan Space heating 369.46 (211)m = {[(98) 406.45]	Feb g require 281.74 m x (20 309.95	Mar ement (called 14.15 4)] } x 1	ng systementary Apr alculated 95.17 00 ÷ (20 104.7	m 1 y heating May d above) 26.34 6) 28.98	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51	382.88	90.9 0 kWh/ye	(206) (208) ar
Space heating [211)m = {[(98)] 406.45]	Feb g require 281.74)m x (20 309.95 g fuel (se	Mar ement (c. 214.15 4)] } x 1 235.59	Apr Alculated 95.17 00 ÷ (20 104.7	m 1 y heating May d above) 26.34 6) 28.98	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51	382.88	90.9 0 kWh/ye	(206) (208) ar
Jan Space heating 369.46 (211)m = {[(98) 406.45]	Feb g require 281.74)m x (20 309.95 g fuel (se	Mar ement (c. 214.15 4)] } x 1 235.59	Apr Alculated 95.17 00 ÷ (20 104.7	m 1 y heating May d above) 26.34 6) 28.98	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51	382.88	90.9 0 kWh/ye	(206) (208) ar
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (se 11)] } x 1	Mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7	em 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar
Efficiency of s Jan Space heating 369.46 (211)m = {[(98) 406.45]} Space heating = {[(98)m x (20) (215)m=0]}	Feb g require 281.74)m x (20 309.95 g fuel (se 11)] } x 10	Mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7	em 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74)m x (20 309.95 g fuel (se 1)] } x 10 0	Mar Mar	Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/68)	m 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Jan Space heating 369.46 (211)m = {[(98)	Feb g require 281.74)m x (20 309.95 g fuel (se 1)] } x 10 0	Mar Mar	Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/68)	m 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Space heating Space heating [198] Space heating [198] Space heating [198] Space heating [198] Water heating Output from wa	Feb g require 281.74 mx (20 309.95 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] }	Mar ement (calculater (calcula	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/// 8) 0	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) = Sum(2	245.51 270.09 211) _{15,1012} 0	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 mx (20 309.95 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] }	Mar ement (calculater (calcula	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/// 8) 0	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) = Sum(2	245.51 270.09 211) _{15,1012} 0	382.88	90.9 0 kWh/ye	(206) (208) ar (211) (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (set 10)] } x 10 atter heat 87.97 heating,	mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 /), kWh/n 8) 0 ulated at 105.96 85.28 onth	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0 0 99.33	0 0 97.47	Aug 0 Tota 106.92	Sep 0 0 1 (kWh/yea 107.75	Oct 101.98 112.19 ar) =Sum(2 0 ar) =Sum(2	245.51 270.09 211) _{15,1012} 0 215) _{15,1012}	382.88 421.21 = 0 = 114.29	90.9 0 kWh/ye	(206) (208) ar (211) (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (set 11)] } x 10 0 contact heat 102.13 atter heat 87.97 heating, m x 100	mar ement (calculater (calcula	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/n 8) 0 ulated at 105.96 85.28 onth	em 1 y heating May d above) 26.34 6) 28.98 month 0 0 0000 109.02	Jun 0 0 0 99.33	0 0 97.47 80.8	0 Tota 106.92 80.8	0 0 0 (kWh/yea 107.75	Oct 101.98 112.19 ar) =Sum(2 0 ar) =Sum(2 112.17 85.31	245.51 270.09 211) _{15,1012} 0 215) _{15,1012} 108.69	382.88 421.21 = 0 = 114.29 88.36	90.9 0 kWh/ye	(206) (208) ar (211) (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (set 10)] } x 10 atter heat 87.97 heating,	mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 /), kWh/n 8) 0 ulated at 105.96 85.28 onth	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0 0 99.33	0 0 97.47	0 0 Tota 106.92 80.8	Sep 0 0 1 (kWh/yea 107.75	Oct 101.98 112.19 0 ar) =Sum(2 112.17 85.31	245.51 270.09 211) _{15,1012} 0 215) _{15,1012}	382.88 421.21 = 0 = 114.29	90.9 0 kWh/ye	(206) (208) ar (211) (211)



Annual totals Space heating fuel used, main system 1		kWh/year	kWh/year 1889.15
Water heating fuel used			1524.57
Electricity for pumps, fans and electric ke	een-hot		1324.37
central heating pump:	cop not	120	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (23)	Da)(230g) =	165 (231)
Electricity for lighting	55 5. (25		322.66 (232)
Electricity generated by PVs			-576.34 (233)
10a. Fuel costs - individual heating sys	tems:		-570.54
Tod. 1 doi ooolo maradaa nodling byo		Fuel Price	Fuel Coet
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 × 0.01 =	65.74 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	53.06 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	21.76 (249)
(if off-peak tariff, list each of (230a) to (2			
Energy for lighting	(232)	13.19 × 0.01 =	42.56 (250)
Additional standing charges (Table 12)			120 (251)
	one of (233) to (235) x)	13.19 x 0.01 =	0 (252)
Appendix Q items: repeat lines (253) and	,		(055)
Total energy cost 11a. SAP rating - individual heating sys	(245)(247) + (250)(254) =		303.12 (255)
	siei ii s		
Energy cost deflator (Table 12)	[(255) × (256)] · [(4) + 45 0] -		0.42 (256)
Energy cost factor (ECF) SAP rating (Section 12)	$[(255) \times (256)] \div [(4) + 45.0] =$		1.1 (257)
12a. CO2 emissions – Individual heatin	na systems including micro-CHP		84.61 (258)
12a. CO2 omisoiono marriada nedim		Emiliarian factor	Fortactors
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	408.06 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	329.31 (264)
Space and water heating	(261) + (262) + (263) + (264) =		737.36 (265)
Electricity for pumps, fans and electric ke	eep-hot (231) x	0.519 =	85.64 (267)
Electricity for lighting	(232) x	0.519 =	167.46 (268)



Energy saving/generation technologies Item 1

0.519

-299.12 (269)

Total CO2, kg/year

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

691.34 (272)

CO2 emissions per m²

 $(272) \div (4) =$

9.82 (273)

El rating (section 14)

92 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	2304.77 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	1859.98 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4164.74 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	506.55 (267)
Electricity for lighting	(232) x	0 =	990.56 (268)
Energy saving/generation technologies			
Item 1		3.07	-1769.38 (269)
'Total Primary Energy	sum	of (265)(271) =	3892.47 (272)
Primary energy kWh/m²/year	(272) ÷ (4) =	55.27 (273)



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Property Address: Green Ground Floor Sample

Pro	perty Address: Gre	en Ground Floo	r Sample		
Address:					
1. Overall dwelling dimensions:					
	Area(m²)	Av. Height	(m)	Volume(m³)
Ground floor	70.43 (1a)	x 2.42	(2a) =	170.44	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$	70.43 (4)				
Dwelling volume	(3a)+	-(3b)+(3c)+(3d)+(3e	e)+(3n) =	170.44	(5)
2. Ventilation rate:			_		_
main secondary	other	total		m³ per hou	r
Number of chimneys heating heating heating + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues 0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fans		3	x 10 =	30	
Number of passive vents		0	x 10 =	0	
Number of flueless gas fires		0	x 40 =	0	
			L		_
			Air ch	anges per ho	ur
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)	+(7b)+(7c) =	30	÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to	o (17), otherwise continu	ue 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 cor	nstruction		0	(11)
if both types of wall are present, use the value corresponding to the	ne greater wall area (afte	er			
deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1	(acalad) also enter	. 0	Г		740
	(Sealed), else effici	0		0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped Window infiltration	0.25 - [0.2 x (14)	\		0	(14)
		+ (12) + (13) + (15)		0	(15)
Infiltration rate	., . , , ,	. , , , , ,	Ţ	0	(16)
Air permeability value, q50, expressed in cubic metres		e metre of enve	ope area	4	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, Air permeability value applies if a pressurisation test has been done		ility is being used	L	0.38	(18)
Number of sides sheltered	,	, ,		3	(19)
Shelter factor	(20) = 1 - [0.075	x (19)] =	-	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	Ţ	0.29	(21)
Infiltration rate modified for monthly wind speed			L		 ` ′
Jan Feb Mar Apr May Jun	Jul Aug Se	ep Oct N	lov Dec		
	1 01	• 1 1			

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

Monthly average wind speed from Table 7

Wind Factor $(22a)m = (22)m \div 4$

1.25

(22)m=

(22a)m=

5.1

1.27



Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34]	
Calculate effe		_	rate for t	he appli	cable ca	se	!		!				
If mechanic			andiv N. (2	2h) _ (22c) v Emy (c	auation (N	JE)) otho	auioo (22h) - (220)			0	(23a
If exhaust air h) = (23a)			0	(23b
If balanced with		•	•	_					21.) (001) [4 (00.)	0	(230
a) If balance	·					- ` ` 	- 	<u> </u>	 	23b) × [- ` 	i ÷ 100] I	(24a
(24a)m= 0	0	0	0	0	0	0	0	0	0		0	J	(246
b) If balance	ea mecha 0	anicai ve	ntilation	without	neat red	overy (N	//V) (24b	0) m = (22)	2b)m + (2 0	23b)	Ι ,	1	(24)
(1)											0	J	(24)
c) If whole h	iouse ex n < 0.5 ×			•	-				5 x (23h))			
(24c)m = 0	0.07	0	0	0	0	0	0	0	0	0	0]	(240
d) If natural	ventilatio	n or wh	ole hous	e nositiv	/e innut	L ventilatio	n from l	oft				J	•
,	n = 1, the				•				0.5]				
(24d)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(240
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)	-	-	-		
(25)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. Heat losse	s and he	at loss r	naramete	⊃r.									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	ıe	AXU		k-value	<u> </u>	ΑΧk
	area	-	m		A ,r		W/m2		(W/I		kJ/m²-l		kJ/K
Doors					1.89	X	1.6	= [3.024				(26)
Windows Type	e 1				3.98	x1,	/[1/(1.4)+	0.04] =	5.28				(27)
Windows Type	e 2				5.97	x1,	/[1/(1.4)+	0.04] =	7.91				(27)
Floor					70.43	3 x	0.12	i	8.4516				(28)
Walls	40.0	3	11.84	4	28.19) x	0.16	= i	4.51	F i		7 F	(29)
Total area of e	elements	, m²			110.4	6							(31)
Party wall					45.23	x	0		0				(32)
Party ceiling					70.43	=						-	(32)
* for windows and	l roof wind	ows, use e	ffective wi	ndow U-va			ı formula 1	/[(1/U-valu	ıe)+0.04] a	L as given in	paragraph		(\
** include the are	as on both	sides of in	iternal wal	ls and par	titions	-							
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.18	(33)
Heat capacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design asses				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
Thermal bridg				ısina Ar	nendix k	<						10.35	(36)
if details of therm	•	,			•	`						10.33	(30)
Total fabric he			()	(-	-/			(33) +	(36) =			39.53	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 32.01	31.85	31.71	31.01	30.88	30.28	30.28	30.17	30.51	30.88	31.15	31.42]	(38)
Heat transfer	coefficier	nt, W/K					•	(39)m	= (37) + (37)	38)m	•	•	
			70.54	70.44	60.0	60.0	00.00			·	70.05	1	
(39)m= 71.53	71.38	71.23	70.54	70.41	69.8	69.8	69.69	70.04	70.41	70.67	70.95		



Heat loss para	meter (l	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.02	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1.01		
							<u>.</u>		Average =	Sum(40) ₁	12 /12=	1	(40)
Number of day		`							T	T			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	0, N = 1		[1 - exp	(-0.0003	49 x (TF	FA -13.9))2)] + 0.0	0013 x (TFA -13.		26		(42)
Annual average Reduce the annua not more that 125	e hot wa I average	hot water	usage by	5% if the a	welling is	designed t			se target o		7.79		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in								Оер	1 001	INOV	Dec		
(44)m= 96.57	93.06	89.55	86.04	82.52	79.01	79.01	82.52	86.04	89.55	93.06	96.57		
· /									Total = Su	m(44) ₁₁₂ =	=	1053.51	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		<u> </u>
(45)m= 143.21	125.25	129.25	112.68	108.12	93.3	86.46	99.21	100.4	117	127.72	138.69		_
If instantaneous w	ater heati	na at noint	of use (no	hot water	· storage)	enter∩in	hoves (46		Total = Su	m(45) ₁₁₂ =	: L	1381.32	(45)
(46)m= 21.48	18.79	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.8		(46)
Water storage		19.59	10.9	10.22	14	12.91	14.00	13.00	17.55	19.10	20.6		(40)
Storage volum	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	ind no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	ıcludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage a) If manufacto		oclared k	oss fact	or ie kno	wn (k\A/k	v/dav/):							(48)
Temperature fa				טווא פו וכ	wii (Kvvi	i/uay).					0		(49)
Energy lost fro				ar			(48) x (49)	\			0		(50)
b) If manufacti		_	-		or is not		(10) X (10)	, –			0		(30)
Hot water stora	•			e 2 (kWl	n/litre/da	ıy)					0		(51)
If community h	_		on 4.3										(=0)
Volume factor i Temperature fa			2h								0		(52) (53)
Energy lost fro				aar			(47) x (51)) v (52) v (53) -				(54)
Enter (50) or (_	, KVVII/ y (zai			(47) X (01)) X (02) X (00) =		0		(55)
Water storage	, ,	,	or each	month			((56)m = (55) × (41)	m		<u> </u>		,
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains		-						-			-	x H	(,
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	lose (ar	nual) fro	m Table	3 3	I		!				0		(58)
Primary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m			<u> </u>		(30)
(modified by				•	•	. ,	, ,		r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)



Combi loss calculated	d for each	month ((61)m –	(60) ± 3(65 v (41)m						
(61)m= 49.21 42.83	45.63	42.43	42.05	38.97	40.26	42.05	42.43	45.63	45.89	49.21	1	(61)
Total heat required for						<u> </u>					J (59)m + (61)m	(0.)
(62)m= 192.42 168.09		155.11	150.18	132.27	126.72	141.27	142.83	162.64	173.61	187.91]	(62)
Solar DHW input calculate	d using App	endix G or	r Appendix	L H (negati	ve quantity	y) (enter 'C	L)' if no sola	r contribut	ion to wate	r heating)	I	
(add additional lines i										,		
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0]	(63)
FHRS 37.61 32.69	31.68	23.69	15.09	9.73	9.24	10.45	10.53	25.73	32.5	37.28	l	(63) (G2)
WWHRS -37.65 -33.13	-33.81	-27.84	-25.86	-21.34	-18.07	-21.88	-22.51	-27.81	-32.2	-36.39		(63) (G10)
Output from water he	ater											
(64)m= 114.8 100.21	107.2	101.55	107.21	99.33	97.47	106.92	107.75	106.9	106.71	111.87		
<u> </u>						Out	put from wa	ater heater	r (annual) ₁	12	1267.93	(64)
Heat gains from water	r heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m= 59.92 52.36	54.38	48.07	46.46	40.76	38.81	43.5	43.99	50.31	53.94	58.42]	(65)
include (57)m in ca	lculation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal gains (se		` '										
Metabolic gains (Tab		<i>'</i>										
Jan Feb		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m= 112.83 112.83	+	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83		(66)
Lighting gains (calcul		ļ				Į	ļ.					•
(67)m= 18.27 16.23	13.2	9.99	7.47	6.31	6.81	8.86	11.89	15.09	17.61	18.78]	(67)
Appliances gains (cal	<u> </u>					<u> </u>						,
(68)m= 198.3 200.36		184.13	170.2	157.1	148.35	146.29	151.48	162.52	176.45	189.55]	(68)
Cooking gains (calcu			l	l .		l						(/
(69)m= 34.28 34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28]	(69)
Pumps and fans gain		ļ.	01.20	020	020	0	020	020	01.20	020		()
(70)m = 10 10	10	10	10	10	10	10	10	10	10	10	1	(70)
		<u> </u>	ļ		10	10	10	10	10	10		(10)
Losses e.g. evaporat (71)m= -90.26 -90.26	, ` 	-90.26	es) (Tab		00.26	-90.26	T 00.26	T 00.26	-90.26	-90.26	1	(71)
` '		-90.∠0	-90.∠0	-90.26	-90.26	-90.∠0	-90.26	-90.26	-90.∠0	-90.∠0		(71)
Water heating gains (` 	1		1	T -0.17	T	1 2.4	T	T = 1 20	T	1	(70)
(72)m= 80.54 77.91	73.1	66.77	62.45	56.62	52.17	58.47	61.1	67.62	74.92	78.52		(72)
Total internal gains	1	T	—				+ (69)m + (1	()
(73)m= 363.96 361.34	348.31	327.74	306.97	286.87	274.18	280.47	291.31	312.08	335.83	353.69		(73)
6. Solar gains:		Class Connection	T 51: 0:				4 = 41.	Cash				
Solar gains are calculated						ations to co		ie applicau		ion.	Caina	
Orientation: Access Table 6		Area m²		Flu Tal	ıx ble 6a	٦	g_ Fable 6b	T:	FF able 6c		Gains (W)	
North 0.9x 0.7	7 x	2.6	20	x 1	0.62] x [0.76	$\neg x \vdash$				(74)
0.1					0.63	; ⊨	0.76	≓	0.7	=	15.6	<u> </u>
Niestle					20.32]	0.76		0.7	=	29.82](74)] ₍₇₄₎
North 0.9x 0.7	7 ×	3.9	18	x 3	34.53	Х	0.76	x	0.7	=	50.67	(74)



	_																	_
North	0.9x	0.77		X	3.98	3	X	5	5.46	X	0	.76	×	0.7		=	81.38	(74)
North	0.9x	0.77		X	3.98	3	X	74	4.72	X	0	.76	x	0.7		=	109.63	(74)
North	0.9x	0.77		X	3.98	3	X	79	9.99	X	0	.76	X	0.7		=	117.36	(74)
North	0.9x	0.77		X	3.98	3	X	7-	4.68	X	0	.76	X	0.7		=	109.58	(74)
North	0.9x	0.77		X	3.98	3	X	59	9.25	X	0	.76	x	0.7		=	86.93	(74)
North	0.9x	0.77		X	3.98	3	X	4	1.52	X	0	.76	x	0.7		=	60.92	(74)
North	0.9x	0.77		X	3.98	3	x	24	4.19	x	0	.76	x	0.7		=	35.49	(74)
North	0.9x	0.77		X	3.98	3	X	1:	3.12	X	0	.76	x	0.7		=	19.25	(74)
North	0.9x	0.77		X	3.98	3	X	8	3.86	x	0	.76	x	0.7		=	13.01	(74)
East	0.9x	1		X	5.97	,	X	19	9.64	x	0	.76	x	0.7		=	43.23	(76)
East	0.9x	1		X	5.97	,	X	38	8.42	x	0	.76	x	0.7		=	84.56	(76)
East	0.9x	1		X	5.97	,	X	6:	3.27	x	0	.76	х	0.7	一	=	139.26	(76)
East	0.9x	1	一	X	5.97	,	x	9:	2.28	x	0	.76	j ×	0.7	\equiv	=	203.11	(76)
East	0.9x	1		X	5.97	,	X	11	13.09	x	0	.76	x	0.7	司	=	248.92	(76)
East	0.9x	1		X	5.97	,	X	11	15.77	x	0	.76	x	0.7		=	254.81	(76)
East	0.9x	1		X	5.97	,	x	11	10.22	x	0	.76	x	0.7	Ħ	=	242.59	(76)
East	0.9x	1		X	5.97	,	x	9,	4.68	X	0	.76	x	0.7		=	208.38	(76)
East	0.9x	1	一	X	5.97	,	x	7:	3.59	X	0	.76	X	0.7	一	=	161.97	(76)
East	0.9x	1	一	X	5.97	,	X	4:	5.59	X	0	.76] _x [0.7	一	=	100.34	(76)
East	0.9x	1	一	X	5.97	,	X	24	4.49	X	0	.76] _x [0.7	〓	=	53.9	(76)
East	0.9x	1		X	5.97		X		6.15) X		.76	_	0.7	_	=	35.55	(76)
	L	<u> </u>			0.01				01.10	J			ו נ				00.00	` ′
Solar o	aine in v	watte ca	ماديناء	tod	for each	month				(83)m	ı – Sum	(74)m	(82)m					
(83)m=	58.83	114.38	189.9	\neg		358.55	т —	72.18	352.17	295		` 	135.84	73.15	48.5	56		(83)
` ′ L					$\frac{1}{(84)m} =$		_											
	422.79	475.72	538.2		612.23	665.51	_	59.05	626.35	575	.78	514.2	447.92	408.98	402.	25		(84)
7 Mos	an intorr	nal tamp	oratu	ro (hoating	coacor	,)			<u> </u>					<u> </u>			
				•	heating seriods in			aroa f	rom Tak	مام ۵	Th1	رەر <i>ر</i>)					21	(85)
•		Ū		•	ving area		•			ی حال	, 1111 ((0)					21	(00)
	Jan	Feb	Ma	\neg	Apr	May	Ť	Jun	Jul	Ι	ug	Sep	Oct	Nov	De	20		
(86)m=	1	1	0.99	\rightarrow	0.95	0.84	-	0.65	0.49	0.5	-	0.82	0.97	1	1			(86)
` ' L														<u> </u>				()
г	-			_	ving area		$\overline{}$	i					00.50	1 00 04	100	20		(07)
(87)m=	19.94	20.08	20.3	1	20.63	20.87		20.98	21	20.	99 4	20.92	20.59	20.21	19.9	12		(87)
· -				~ `	eriods in		_	— Ť			.	` ′ 						
(88)m=	20.07	20.07	20.0	7	20.08	20.08	2	20.09	20.09	20.	09 2	20.09	20.08	20.08	20.0	8((88)
Utilisat	tion fact	tor for ga	ains f	or re	est of dw	elling,	h2	,m (se	e Table	9a)								
(89)m=	1	0.99	0.98	3	0.93	0.79		0.57	0.39	0.4	14	0.75	0.96	0.99	1			(89)
Mean	internal	tempera	ature	in t	he rest o	f dwell	ina	T2 (fc	ollow ste	eps 3	to 7 ii	n Table	9c)					
(90)m=	18.66	18.85	19.2	$\overline{}$	19.65	19.96	Ť	20.08	20.09	20.		20.02	19.61	19.06	18.6	62		(90)
L	!	Į					_	!				fL.	A = Liv	ing area ÷ (4) =		0.42	(91)

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



(92)m= 19.	19 19.36	19.66	20.05	20.34	20.45	20.47	20.46	20.39	20.02	19.54	19.16		(92)
Apply adju	stment to t	he mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m= 19.0	04 19.21	19.51	19.9	20.19	20.3	20.32	20.31	20.24	19.87	19.39	19.01		(93)
8. Space I	neating req	uirement											
	ne mean in				ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	ion factor f							1		ı	- 1		
Ja	_	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	factor for g	1						I I		I			(0.4)
(94)m= 1		0.98	0.93	0.8	0.59	0.41	0.47	0.76	0.96	0.99	1		(94)
	ns, hmGm		<u> </u>	_	200.54	250.25	070.74	202.20	400.50	405.0	404.4		(OE)
(95)m= 421		527.03	569.24	532.4	388.51	258.35	270.71	393.36	429.52	405.8	401.1		(95)
	verage exte	1				40.0	40.4	444	40.0	7.4	40		(06)
(96)m= 4.3		6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	rate for me	an intern 926.76	ai tempe 776.2	597.6	∟m , vv = 397.84	=[(39)m 2 259.37		- (96)m 430.27	652.54	868.24	1050.70		(97)
` '							272.79			<u> </u>	1050.78		(91)
(98)m= 471	ating requir	297.39	149.01	48.51	0	n = 0.02	4 X [(97])m – (95 0	165.93	332.96	483.36		
(90)111= 47 1	309.14	297.39	149.01	40.51	0	U						0047.4	(98)
							Tota	l per year	(Kvvn/year) = Sum(9	6) 15,912 =	2317.4	╡
Space hea	ating requir	ement in	kWh/m²	/year								32.9	(99)
9a. Energy	requireme	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space he	_												_
Fraction o	f space hea	at from se	econdary	y/supple	mentary	system						0	(201)
Fraction o	f space hea	at from m	ain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction o	f total heati	ng from i	main sys	stem 1			(004) (0						
Efficiency	- .						(204) = (2	02) × [1 –	(203)] =			1	(204)
	of main sp	ace heati	ng syste				(204) = (2	02) x [1 –	(203)] =			90.9	(204)
Efficiency	of main spa		0,	em 1	g system		(204) = (2	02) x [1 –	(203)] =				╡゛゛
	of seconda	ry/supple	ementar	em 1 y heating		ı, %		,	. , ,	Nov	Dec	90.9	(206)
Ja	of seconda	ry/supple Mar	ementar Apr	em 1 y heating May	Jun		(204) = (2 Aug	02) × [1 –	(203)] =	Nov	Dec	90.9	(206)
Ja	of seconda n Feb ating requir	ry/supple Mar	ementar Apr	em 1 y heating May	Jun	ı, %		,	. , ,	Nov 332.96	Dec 483.36	90.9	(206)
Ja Space hea	of secondary n Febuting requir 11 369.14	Mar Mar ement (c	Apr alculated	em 1 y heating May d above) 48.51	Jun	n, % Jul	Aug	Sep	Oct	!		90.9	(206) (208)
Ja Space hea	of secondary Febuting requir 369.14 (98)m x (20	Mar Mar ement (c	Apr alculated	em 1 y heating May d above) 48.51	Jun	n, % Jul	Aug	Sep	Oct	!		90.9	(206)
Ja Space hea 471 (211)m = {[of secondary Febuting requir 369.14 (98)m x (20	Mar ement (c 297.39 04)] } x 1	Apr alculated 149.01 00 ÷ (20	em 1 y heating May d above) 48.51	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9	(206) (208) ear (211)
Space hea 471 (211)m = {[518	of seconda n Feb ating requir 11 369.14 (98)m x (20 27 406.09	Mar ement (c 297.39 04)] } x 1 327.16	Apr alculated 149.01 00 ÷ (20 163.93	em 1 y heating May d above) 48.51 06) 53.37	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9 0 kWh/ye	(206) (208)
Space head 471. (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09	Mar ement (c 297.39)4)] } x 1 327.16	Apr alculated 149.01 00 ÷ (20 163.93	em 1 y heating May d above) 48.51 06) 53.37	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9 0 kWh/ye	(206) (208) ear (211)
Space hea 471 (211)m = {[518	of secondary of se	Mar ement (c 297.39)4)] } x 1 327.16	Apr alculated 149.01 00 ÷ (20 163.93	em 1 y heating May d above) 48.51 06) 53.37	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9 0 kWh/ye	(206) (208) ear (211)
Space head 471. (211)m = {[518] Space head 471.	of secondary of se	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8	m 1 y heating May d above) 48.51 66) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211)
Space head 471. (211)m = {[518 Space head 471. (215)m = 0	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (secondary) (201)] } x 1	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8	m 1 y heating May d above) 48.51 66) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head 471. (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20 0	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/ 8)	m 1 y heating May d above) 48.51 06) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head 471. (211)m = {[518 Space head 471. (215)m = 0	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (secondary) 0 ating fuel (secondary) 1 0 ating mater hear	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20 0	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/ 8)	m 1 y heating May d above) 48.51 06) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21	Mar ement (c 297.39)4)] } x 1 327.16 econdary 00 ÷ (20 0)	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 0	em 1 y heating May d above) 48.51 66) 53.37 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head 471. (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21 of water hea of water h	Mar ement (c 297.39)4)] } x 1 327.16 econdary 00 ÷ (20 0)	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 0	em 1 y heating May d above) 48.51 66) 53.37 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)
Space head (211)m = {[518] Space head = {[(98)m x (215)m= 0] Water head Output from 114 Efficiency contacts	of secondary of secondary required 11 369.14 (98)m x (20 27 406.09 406.09 406.09 100.21	Mar ement (c 297.39) 4)] } x 1 327.16 secondary 00 ÷ (20 0 107.2 ater 87.99	Apr alculated al 101.55	em 1 y heating May d above) 48.51 6) 53.37 month 0	Jun 0 0 0 99.33	0 0 97.47	Aug 0 Tota 106.92	Sep 0 0 I (kWh/yea 107.75	Oct 165.93 182.54 ar) =Sum(2 0 ar) =Sum(2	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0 =	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)
Space head [471] (211)m = {[518] Space head [472] Space head [472] Space head [472] (215)m = 0 Water head [472] Output from [114] Efficiency (217)m = 88.5 Fuel for was (219)m = (of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21 of water hea 73 88.54 ter heating 64)m x 100	Mar ement (c 297.39) 4)] } x 1 327.16 secondary 00 ÷ (20 0) 0 ster (calc 107.2 ater 87.99 , kWh/mc	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 0 ulated al 101.55 86.52 onth m	em 1 y heating May d above) 48.51 06) 53.37 month 0 0 0000e) 107.21	Jun 0 0 0 99.33	0 0 97.47 80.8	0 Tota 106.92 80.8	0 0 1 (kWh/yea 107.75	Oct 165.93 182.54 ar) =Sum(2 0 106.9 86.66	332.96 366.29 211) _{15,1012} 0 215) _{15,1012} 106.71	483.36 531.75 = 0 = 111.87 88.81	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)
Space head (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21 of water hea 73 88.54 ter heating 64)m x 100	Mar ement (c 297.39) 4)] } x 1 327.16 secondary 00 ÷ (20 0) 0 ster (calc 107.2 ater 87.99 , kWh/mc	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 8) 0 ulated al 101.55 86.52 onth	em 1 y heating May d above) 48.51 6) 53.37 month 0	Jun 0 0 0 99.33	0 0 97.47	0 0 Tota 106.92 80.8	Sep 0 0 I (kWh/yea 107.75	Oct 165.93 182.54 ar) = Sum(2 0 106.9 86.66	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0 =	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)



Annual totals		kWh/year	kWh/year	_
Space heating fuel used, main system 1			2549.4	
Water heating fuel used			1489.41	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		12	20	(230c)
boiler with a fan-assisted flue		4	.5	(230e)
Total electricity for the above, kWh/year	sum of (2	230a)(230g) =	165	(231)
Electricity for lighting			322.66	(232)
Electricity generated by PVs			-576.34	(233)
12a. CO2 emissions – Individual heating system	ns including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216 =	550.67	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	321.71	(264)
Space and water heating	(261) + (262) + (263) + (264)	=	872.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	85.64	(267)
Electricity for lighting	(232) x	0.519 =	167.46	(268)
Energy saving/generation technologies Item 1		0.519 =	-299.12	(269)
Total CO2, kg/year	5	sum of (265)(271) =	826.35	(272)
Dwelling CO2 Emission Rate	((272) ÷ (4) =	11.73	(273)

El rating (section 14)



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Pro	operty Address	: Lean F	irst Floor	Sample			
Address:							
1. Overall dwelling dimensions:							
	Area(m²)	_	Av. Hei	ght(m)		Volume(m³)	<u> </u>
Ground floor	44.07	(1a) x	3.	03	(2a) =	133.53	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$	44.07	(4)					
Dwelling volume		(3a)+(3b)+(3c)+(3d)	+(3e)+(3n) =	133.53	(5)
2. Ventilation rate:							
main secondary heating heating	other		total			m³ per houi	•
Number of chimneys 0 + 0	+ 0	= [0	x 40	0 =	0	(6a)
Number of open flues 0 + 0	+ 0	<u> </u>	0	x 20) =	0	(6b)
Number of intermittent fans			3	x 10) =	30	(7a)
Number of passive vents		Ī	0	x 10) =	0	(7b)
Number of flueless gas fires		Ī	0	x 40) =	0	(7c)
		_			Air ah	anges per ho	_
		_				langes per no	ui –
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a) If a pressurisation test has been carried out or is intended, proceed		continue f	30		(5) =	0.22	(8)
Number of storeys in the dwelling (ns)	to (11), otherwise	commuc n	0111 (3) 10 (10)		0	(9)
Additional infiltration				[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0	0.35 for mason	ry consti	ruction	. ,		0	(11)
if both types of wall are present, use the value corresponding to t	the greater wall ar	ea (after			'		
deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1	l (cooled) elec	ontor 0					7(40)
If no draught lobby, enter 0.05, else enter 0	(Sealed), else	enter o				0	(12)
Percentage of windows and doors draught stripped						0	
Window infiltration	0.25 - [0.	2 x (14) ÷ 1	1001 =			0	(15)
Infiltration rate			12) + (13) +	(15) =		0	(16)
Air permeability value, q50, expressed in cubic metres	, , , ,	, , ,	, , ,	, ,	area	4	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$		•				0.42	(18)
Air permeability value applies if a pressurisation test has been done			is being us	ed		02	
Number of sides sheltered						3	(19)
Shelter factor	(20) = 1 -	[0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18	3) x (20) =				0.33	(21)
Infiltration rate modified for monthly wind speed							
Jan Feb Mar Apr May Jun	Jul Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed from Table 7							

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

5

1.25

Wind Factor $(22a)m = (22)m \div 4$



Adjusted infiltration rate (allowing for	shelter an	nd wind s	peed) =	(21a) x	(22a)m					
0.42 0.41	0.4 0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39		
Calculate effective air cha	•	the appli	icable ca	se							
If mechanical ventilatio		(22h) (22	a) Fm;//a	auatian (N	VIEVV othor	muiaa (22h	\ (225\			0	(23a)
If exhaust air heat pump usir) = (23a)			0	(23b)
If balanced with heat recover		_					21.)	001) [4 (00.)	0	(23c)
a) If balanced mechani			1	- ` ` 	, ``	ŕ	<u> </u>	- 	<u> </u>	÷ 100]	(240)
(24a)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechani					É È	i `	 	- 		l	(24b)
(24b)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extra if $(22b)m < 0.5 \times (200)$		•	•				5 v (23h	,)			
$\frac{11(225)11(0.5)(25)}{(24c)m} = \frac{0.5 \times (25)}{0}$	0 0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation			<u> </u>				_				, ,
if (22b)m = 1, then							0.5]				
(24d)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effective air change rat	te - enter (24	a) or (24l	b) or (24	c) or (24	d) in box	x (25)	•		•	'	
(25)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. Heat losses and heat	loss parame	ter:									
ELEMENT Gross	Open		Net Ar	ea	U-valı	ue	AXU		k-value)	ΑΧk
area (m	1 ²)	m²	A ,r	m² 	W/m2	2Κ 	(W/I	<u>()</u>	kJ/m²-ł	<	kJ/K
Daara											
Doors			1.89	X	1.6	= [3.024				(26)
Windows Type 1			1.89	号 ,	1.6 /[1/(1.4)+	!	3.024 1.35				(26) (27)
				x1/		0.04] =					
Windows Type 1			1.02	x1/	/[1/(1.4)+	0.04] =	1.35				(27)
Windows Type 1 Windows Type 2			2.13	x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.35 2.82				(27) (27)
Windows Type 1 Windows Type 2 Windows Type 3			1.02 2.13 0.52	x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69				(27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51				(27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2			1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3	7.	45	1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728 0.728			7 6	(27) (27) (27) (27) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4	7.		1.02 2.13 0.52 1.89 0.52 0.52 0.52	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many control of the	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0	08	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04]	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many party wall Party floor * for windows and roof windows to include the areas on both sides.	2.0 5, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph	3.2	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many many many many many many many	s, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8			24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many many many many many many many	s, use effective les of internal w S (A x U) x k)	08 window U-v. alls and par	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0	2) + (32a).			(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m Party wall Party floor * for windows and roof windows ** include the areas on both side Fabric heat loss, W/K = S	s, use effective les of internal w S (A x U) x k)	one of the one of the	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12 0 a formula 1. (26)(30)	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0 ue)+0.04] a	2) + (32a). : Medium	(32e) =	24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)11.57 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =(37)36.21 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Feb Mar Jul Aug Sep Dec .lan Apr May Jun Oct Nov (38)m =25.91 25.76 25.61 24.92 24.79 24.19 24.19 24.07 24.42 24.79 25.05 25.33 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =62.12 61.97 61.82 61.13 60.4 60.4 60.28 60.63 61 61.26 61.54 61 Average = Sum(39)_{1...12} /12= (39)61.13 Heat loss parameter (HLP), W/m²K (40)m = (39)m \div (4)1.41 1.41 1.39 1.38 1.37 1.37 1.37 1.38 1.38 1.39 (40)m =1.4 (40)Average = $Sum(40)_{1...12}/12=$ 1.39 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)1.52 if TFA > 13.9, N = 1 + 1.76 x [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)70.26 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m =77.28 74.47 71.66 68.85 66.04 63.23 63.23 66.04 68.85 71.66 74.47 77.28 (44)Total = $Sum(44)_{1...12}$ = 843.09 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 =114.61 100.24 103.44 90.18 86.53 74.67 69.19 79.4 80.35 93.63 102.21 110.99 (45)Total = $Sum(45)_{1...12}$ = 1105.43 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 17.19 15.04 15.52 13.53 12.98 12.05 14.05 15.33 16.65 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 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 fro		-	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or	. , .	,									0		(55)
Water storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	n				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)r	m = (56)m	x [(50) – (l	H11)] ÷ (50	0), else (57	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	inual) fro	om Table	3							0		(58)
Primary circuit	t loss cal	culated 1	for each	month (59)m = ((58) ÷ 36	5 × (41)	m					
(modified by	/ factor fi	om Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	thermo	stat)		•	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	35 × (41)	m						
(61)m= 39.38	34.28	36.52	33.95	33.65	31.18	32.22	33.65	33.95	36.52	36.73	39.38		(61)
Total heat req	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 153.99	134.52	139.96	124.13	120.18	105.85	101.41	113.05	114.3	130.15	138.94	150.38		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity) (enter '0'	if no sola	r contributi	on to wate	er heating)	l	
(add additiona	al lines if	FGHRS	and/or V	NWHRS	applies.	, see Ap	pendix G	S)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS 31.28	26.91	26.75	16.41	11.49	7.99	7.57	8.58	8.64	17.72	27.31	30.99	'	(63) (G2)
WWHRS -27.31	-24.02	-24.52	-20.23	-18.81	-15.53	-13.18	-15.95	-16.4	-20.23	-23.39	-26.38		(63) (G10)
Output from w	ater hea	ter											
(64)m= 93.51	81.94	86.93	85.87	88.27	80.83	79.11	86.91	87.63	90.45	86.47	91.11		
				4		4 7							
				<u> </u>			Outp	ut from wa	ater heater	· (annual)₁	12	1039.04	(64)
Heat gains fro	m water	heating,	kWh/mo	 วทth 0.2	5 ′ [0.85	× (45)m	·				ļ		(64)
Heat gains fro	m water	heating,	, kWh/mo	onth 0.25	5 ´ [0.85 32.62	× (45)m	·				ļ		(64) (65)
(65)m= 47.95	41.9	43.52	38.47	37.18	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
(65)m= 47.95 include (57)	41.9 m in cald	43.52 culation	38.47 of (65)m	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
(65)m= 47.95 include (57) 5. Internal ga	41.9 m in cald ains (see	43.52 culation of	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
(65)m= 47.95 include (57)	41.9 m in cald ains (see	43.52 culation of	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75]	_
include (57) 5. Internal game	41.9 m in calc ains (see	43.52 culation of Table 5 5), Wat	38.47 of (65)m 5 and 5a)	37.18 only if c	32.62 Sylinder is	31.06 s in the c	+ (61)m 34.81 dwelling	35.2 or hot w	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h]	_
include (57) 5. Internal games Metabolic gair Jan	41.9 m in calc ains (see ns (Table Feb 91.09	43.52 culation (e Table 5), Wat Mar 91.09	38.47 of (65)m 5 and 5a) tts Apr 91.09	37.18 only if c : May 91.09	32.62 Sylinder is Jun 91.09	31.06 s in the c	+ (61)m 34.81 dwelling Aug 91.09	35.2 or hot w Sep 91.09	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h]	(65)
(65)m= 47.95 include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09	41.9 m in calc ains (see ns (Table Feb 91.09	43.52 culation (e Table 5), Wat Mar 91.09	38.47 of (65)m 5 and 5a) tts Apr 91.09	37.18 only if c : May 91.09	32.62 Sylinder is Jun 91.09	31.06 s in the c	+ (61)m 34.81 dwelling Aug 91.09	35.2 or hot w Sep 91.09	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h]	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39	m in calcains (see Feb 91.09 (calcula 26.1	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07	37.18 only if c : May 91.09 L, equati	32.62 cylinder is Jun 91.09 ion L9 or	31.06 s in the c Jul 91.09 r L9a), a	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25	35.2 or hot w Sep 91.09 Table 5	0ct 91.09	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains	m in calconnum in	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07	37.18 only if c : May 91.09 L, equati	32.62 cylinder is Jun 91.09 ion L9 or	31.06 s in the c Jul 91.09 r L9a), a	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25	35.2 or hot w Sep 91.09 Table 5	0ct 91.09	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85	m in calcains (see Feb 91.09 (calcula 26.1 198.89	43.52 culation of a Table 5 (a 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append	37.18 only if c : May 91.09 L, equati 12.01 dix L, equali 168.95	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95	31.06 s in the c Jul 91.09 r L9a), al 10.96 13 or L1: 147.27	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22	Sep 91.09 Fable 5 19.12 see Tal 150.37	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65) (66) (67)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains	m in calcains (see Feb 91.09 (calcula 26.1 198.89 (calcula calcula cal	43.52 culation of a Table 5 (a) Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ated in Ap	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Append	37.18 only if c): May 91.09 L, equati 12.01 dix L, equati 168.95 L, equat	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95	31.06 s in the c Jul 91.09 r L9a), al 10.96 13 or L1: 147.27	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se	Sep 91.09 Fable 5 19.12 see Tal 150.37	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09	+ (59)m 46.75 munity h Dec 91.09]	(65) (66) (67)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63	m in calcons (Table Feb 91.09 (calcula 26.1 198.89 c (calcula 45.63	43.52 culation of a Table 5 culation of a Ta	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Append 182.78 ppendix 45.63	37.18 only if c : May 91.09 L, equati 12.01 dix L, equali 168.95	32.62 ylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L1: 147.27 or L15a)	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22	Sep 91.09 Fable 5 19.12 see Talle te Table	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09 28.34	+ (59)m 46.75 munity h Dec 91.09 30.21]	(65) (66) (67) (68)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames	m in calcons (Table Feb 91.09 (calcula 26.1 198.89 c (calcula 45.63	43.52 culation of a Table 5 culation of a Ta	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 n Appendix 182.78 ppendix 45.63	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 ylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L1: 147.27 or L15a)	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se	Sep 91.09 Fable 5 19.12 see Talle te Table	Oct 91.09 24.28 ole 5 161.33	+ (57)m 43.17 om com Nov 91.09 28.34	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16]	(65) (66) (67) (68)
include (57) 5. Internal games and far (70)m= 47.95 include (57) 5. Internal games and far (57) Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and far (70)m= 10	m in calc ains (see as (Table Feb 91.09 (calcula 26.1 ains (calcula 198.89 c (calcula 45.63 ans gains 10	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ated in Ap 45.63 (Table 5)	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Append 182.78 ppendix 45.63 5a) 10	37.18 only if c May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63	31.06 s in the control of the contro	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 ee Table 45.63	Oct 91.09 24.28 ble 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21]	(65) (66) (67) (68) (69)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames (70)m= 10 Losses e.g. expenses Losses e.g. expenses Losses e.g. expenses Include (57) Jan Jan Jan Jan Jan Jan Jan Ja	m in calcons (See 191.09) (calcula 26.1) sins (calcula 198.89) s (calcula 45.63) ns gains 10 vaporation	43.52 culation (ce Table 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ated in Ap 45.63 (Table 5)	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Append 182.78 ppendix 45.63 5a) 10	37.18 only if c May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63	31.06 s in the control of the contro	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 ee Table 45.63	Oct 91.09 24.28 ble 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16]	(65) (66) (67) (68) (69)
include (57) 5. Internal games Metabolic gain Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and famous	m in calc ains (see as (Table Feb 91.09 (calcula 26.1 ains (calcula 198.89 a (calcula 45.63 ans gains 10 vaporatio -60.73	43.52 culation of Part Part Part Part Part Part Part Part	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 Appendix 45.63 5a) 10 tive value	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95 tion L15 45.63	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L13 147.27 or L15a) 45.63	+ (61)m 34.81 dwelling Aug 91.09 dso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63	Oct 91.09 24.28 ole 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63]	(65) (66) (67) (68) (69) (70)
include (57) 5. Internal game Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances game (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fame (70)m= 10 Losses e.g. even (71)m= -60.73 Water heating	m in calc ains (see as (Table Feb 91.09 (calcula 26.1 ains (calcula 198.89 a (calcula 45.63 ans gains 10 vaporatio -60.73	43.52 culation of Part Part Part Part Part Part Part Part	38.47 of (65)m 5 and 5a) tts Apr 91.09 opendix I 16.07 Appendix 45.63 5a) 10 tive value	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L 155.95 tion L15 45.63	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L13 147.27 or L15a) 45.63	+ (61)m 34.81 dwelling Aug 91.09 dso see 14.25 3a), also 145.22 , also se 45.63	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63	Oct 91.09 24.28 ole 5 161.33 5 45.63	+ (57)m 43.17 om com Nov 91.09 28.34 175.16	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63]	(65) (66) (67) (68) (69) (70)
include (57) 5. Internal games Metabolic gair Jan (66)m= 91.09 Lighting gains (67)m= 29.39 Appliances games (68)m= 196.85 Cooking gains (69)m= 45.63 Pumps and fames (70)m= 10 Losses e.g. even (71)m= -60.73 Water heating (72)m= 64.45	m in calcains (see hs (Table Feb 91.09) (calcula 26.1 198.89) (calcula 45.63) ns gains 10 (aporatio 60.73) gains (Table 62.35	43.52 culation of the Table 5 e 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ted in Ap 45.63 (Table 5 10 con (negation of the Table 5) 58.5	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Appendix 45.63 5a) 10 tive value -60.73	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63 10 es) (Tab	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63 10 ole 5) -60.73	31.06 s in the control of the contro	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63 10 -60.73	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63 10 -60.73	Oct 91.09 24.28 ole 5 161.33 5 45.63 10 -60.73	+ (57)m 43.17 om com Nov 91.09 28.34 175.16 45.63 10 -60.73	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63 10 -60.73]	(65) (66) (67) (68) (69) (70) (71)
include (57) 5. Internal games and far (70)m= 10 Losses e.g. ev (71)m= -60.73 include (57) 47.95 include (57) 5. Internal games and far (70)m= 10 Losses e.g. ev (71)m= -60.73 Water heating	#1.9 m in calc ains (see ns (Table Feb 91.09 (calcula 26.1 ins (calcula 45.63 ns gains 10 /aporatic -60.73 gains (T 62.35 gains =	43.52 culation of the Table 5 e 5), Wat Mar 91.09 ted in Ap 21.23 culated in 193.74 ted in Ap 45.63 (Table 5 10 con (negation of the Table 5) 58.5	38.47 of (65)m 5 and 5a tts Apr 91.09 opendix 1 16.07 n Appendix 45.63 5a) 10 tive value -60.73	37.18 only if c): May 91.09 L, equati 12.01 dix L, equ 168.95 L, equat 45.63 10 es) (Tab	32.62 Sylinder is Jun 91.09 ion L9 or 10.14 uation L' 155.95 tion L15 45.63 10 ole 5) -60.73	31.06 s in the co Jul 91.09 r L9a), a 10.96 13 or L1: 147.27 or L15a) 45.63	+ (61)m 34.81 dwelling Aug 91.09 lso see 14.25 3a), also 145.22 , also se 45.63 10 -60.73	Sep 91.09 Fable 5 19.12 see Tal 150.37 re Table 45.63 10 -60.73	Oct 91.09 24.28 ole 5 161.33 5 45.63 10 -60.73	+ (57)m 43.17 om com Nov 91.09 28.34 175.16 45.63 10 -60.73	+ (59)m 46.75 munity h Dec 91.09 30.21 188.16 45.63 10 -60.73]	(65) (66) (67) (68) (69) (70) (71)



6. Solar gains:

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

_		Access Facto Table 6d		Area m²	a anu	Flux Table 6a	uons	g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.02	x	10.63	x	0.76	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.13	X	10.63	x	0.76	x	0.7	=	8.35	(74)
North	0.9x	0.77	x	1.02	x	20.32	x	0.76	x	0.7	=	7.64	(74)
North	0.9x	0.77	x	2.13	x	20.32	x	0.76	x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.02	x	34.53	x	0.76	x	0.7	=	12.99	(74)
North	0.9x	0.77	X	2.13	X	34.53	X	0.76	X	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.02	X	55.46	x	0.76	X	0.7	=	20.86	(74)
North	0.9x	0.77	x	2.13	X	55.46	X	0.76	X	0.7	=	43.56	(74)
North	0.9x	0.77	X	1.02	X	74.72	X	0.76	X	0.7	=	28.1	(74)
North	0.9x	0.77	x	2.13	X	74.72	X	0.76	X	0.7	=	58.67	(74)
North	0.9x	0.77	X	1.02	X	79.99	X	0.76	X	0.7	=	30.08	(74)
North	0.9x	0.77	X	2.13	X	79.99	X	0.76	X	0.7	=	62.81	(74)
North	0.9x	0.77	x	1.02	X	74.68	X	0.76	X	0.7	=	28.08	(74)
North	0.9x	0.77	x	2.13	x	74.68	x	0.76	X	0.7	=	58.64	(74)
North	0.9x	0.77	X	1.02	x	59.25	x	0.76	x	0.7	=	22.28	(74)
North	0.9x	0.77	X	2.13	x	59.25	x	0.76	X	0.7	=	46.52	(74)
North	0.9x	0.77	x	1.02	x	41.52	x	0.76	X	0.7	=	15.61	(74)
North	0.9x	0.77	X	2.13	x	41.52	x	0.76	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	1.02	x	24.19	x	0.76	X	0.7	=	9.1	(74)
North	0.9x	0.77	X	2.13	x	24.19	x	0.76	X	0.7	=	19	(74)
North	0.9x	0.77	X	1.02	x	13.12	x	0.76	x	0.7	=	4.93	(74)
North	0.9x	0.77	x	2.13	x	13.12	x	0.76	X	0.7	=	10.3	(74)
North	0.9x	0.77	X	1.02	X	8.86	X	0.76	X	0.7	=	3.33	(74)
North	0.9x	0.77	X	2.13	X	8.86	X	0.76	X	0.7	=	6.96	(74)
South	0.9x	0.77	X	0.52	X	46.75	X	0.76	X	0.7	=	8.96	(78)
South	0.9x	0.77	X	1.89	X	46.75	X	0.76	X	0.7	=	32.58	(78)
	0.9x	0.77	X	0.52	X	76.57	X	0.76	X	0.7	=	14.68	(78)
	0.9x	0.77	X	1.89	X	76.57	X	0.76	X	0.7	=	53.35	(78)
South	0.9x	0.77	X	0.52	X	97.53	X	0.76	X	0.7	=	18.7	(78)
South	0.9x	0.77	X	1.89	X	97.53	X	0.76	X	0.7	=	67.96	(78)
South	0.9x	0.77	x	0.52	x	110.23	x	0.76	X	0.7	=	21.13	(78)
South	0.9x	0.77	X	1.89	X	110.23	X	0.76	X	0.7	=	76.81	(78)
	0.9x	0.77	x	0.52	x	114.87	x	0.76	x	0.7	=	22.02	(78)
	0.9x	0.77	x	1.89	x	114.87	x	0.76	X	0.7	=	80.04	(78)
	0.9x	0.77	x	0.52	X	110.55	x	0.76	X	0.7	=	21.19	(78)
South	0.9x	0.77	X	1.89	X	110.55	X	0.76	X	0.7	=	77.03	(78)



South 0.9x	0.77	X	0.52	x	108.01	x	0.76	x	0.7	=	20.71	(78)
South 0.9x	0.77	X	1.89	x	108.01	x	0.76	x	0.7	=	75.26	(78)
South 0.9x	0.77	X	0.52	x	104.89	X	0.76	x	0.7	=	20.11	(78)
South 0.9x	0.77	X	1.89	x	104.89	x	0.76	x	0.7	=	73.09	(78)
South 0.9x	0.77	X	0.52	x	101.89	x	0.76	x	0.7	=	19.53	(78)
South 0.9x	0.77	X	1.89	x	101.89	x	0.76	x	0.7	=	70.99	(78)
South 0.9x	0.77	X	0.52	x	82.59	x	0.76	X	0.7] =	15.83	(78)
South 0.9x	0.77	X	1.89	x	82.59	x	0.76	x	0.7	=	57.55	(78)
South 0.9x	0.77	X	0.52	x	55.42	x	0.76	x	0.7	=	10.62	(78)
South 0.9x	0.77	X	1.89	x	55.42	x	0.76	X	0.7	=	38.61	(78)
South 0.9x	0.77	X	0.52	X	40.4	X	0.76	X	0.7	=	7.74	(78)
South 0.9x	0.77	X	1.89	X	40.4	X	0.76	X	0.7	=	28.15	(78)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	X	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights 0.9x	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	x	0.76	x	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	157	x	0.76	x	0.7	=	39.09	(82)
_		_		-		_		•		- '		_



Rootlights 0.9s			_												
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	X	15	57	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0 av	Rooflights 0.9x	1	X	0.5	2	X	1	57	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	Rooflights 0.9x	1	X	0.5	2	X	1	57	X	0.76	X	0.7	=	39.09	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	1	15	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	1	15	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	1	15	X	0.76	х	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	1	15	X	0.76	X	0.7	=	28.63	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	6	66	x	0.76	X	0.7	=	16.43	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	×	0.5	2	х	6	66	x	0.76	X	0.7		16.43	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	6	66	x	0.76	X	0.7		16.43	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	6	66	x	0.76	x	0.7	=	16.43	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	3	33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	Rooflights 0.9x	1	×	0.5	2	х	3	33	x	0.76	X	0.7	=	8.22	(82)
Rooflights 0.9x	Rooflights 0.9x	1	x	0.5	2	х	3	33	x	0.76	x	0.7	=	8.22	(82)
Rooflights 0.9x	Rooflights 0.9x	1	X	0.5	2	х	3	33	x	0.76	x	0.7		8.22	(82)
Rooflights 0.9x	Rooflights _{0.9x}	1	X	0.5	2	x	2	21	X	0.76	x	0.7	- -	5.23	(82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m	Rooflights _{0.9x}	1	×	0.5	2	х	2	21	X	0.76	x	0.7		5.23	(82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 79.78	Rooflights 0.9x	1	×	0.5	2	х	2	21	x	0.76	X	0.7		5.23	(82)
(83)me 79.78 145.41 222.37 311.74 380.05 390.29 370.92 318.36 253.27 167.2 97.34 67.1 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)me 456.46 518.74 581.83 650.03 696.98 687.69 656.89 610.61 557.65 492.91 446.78 434.3 (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) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)me 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 0.99 0.99 0.99 0.99	Rooflights _{0.9x}	1	i x	0.5	2	x	2	21	х	0.76	x	0.7	= =	5.23	(82)
(83)me 79.78 145.41 222.37 311.74 380.05 390.29 370.92 318.36 253.27 167.2 97.34 67.1 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)me 456.46 518.74 581.83 650.03 696.98 687.69 656.89 610.61 557.65 492.91 446.78 434.3 (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) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)me 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 0.99 0.99 0.99 0.99	Solar gains in wa	atte calcu	lated	for eacl	n month	ı			(83)m	= Sum(74)m	n (82)n	1			
Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 456.46 518.74 581.83 650.03 696.98 687.69 656.89 610.61 557.65 492.91 446.78 434.3 (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) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.97 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	<u> </u>		-			$\overline{}$	90.29						67.1]	(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.4 0.45 0.68 0.9 0.97 0.99 0.97 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)		ernal and	solar	(84)m =	: (73)m	+ (8	33)m ,	watts	<u> </u>	Į	ļ				
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= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04	(84)m= 456.46 5	518.74 58	1.83	650.03	696.98	68	37.69	656.89	610	.61 557.65	492.9	91 446.78	434.3		(84)
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= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04	7 Mean interna	l tempera	ture (heating	season)	<u> </u>							_	
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= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) FLA = Living area ÷ (4) = 0.54 (91) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 – fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04						_	area fr	om Tah	ole 9	Th1 (°C)				21	(85)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	•	•	• •			_			J.O 0,	(3)					(55)
(86)m= 0.98 0.97 0.94 0.86 0.72 0.54 0.4 0.45 0.68 0.9 0.97 0.99 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 19.78 19.79 19.79 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.78 19.77 19.78 19.78 19.79 19.78 19.78 19.79 19.78 19.78 19.79 19.78 19.79 19.78 19.79 19.79 19.79 19.79			$\overline{}$			-			Aı	ua Sep	00	t Nov	Dec	1	
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.8 19.99 20.29 20.63 20.87 20.97 20.99 20.99 20.92 20.61 20.15 19.76 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)			-			+	-		 		+-	-	-	_	(86)
(87)m=					T1 /f	حال		0 2 to 7	 7 in T					_	
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.76 19.76 19.76 19.77 19.78 19.79 19.79 19.79 19.79 19.78 19.78 19.77 19.77 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)						_	— i		г —		20.6	1 20.15	19.76	7	(87)
(88)m=	` '								<u> </u>				1 .5.75	_	()
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	·					1	Ť		T			0 40.77	10.77	1	(QQ)
(89)m= 0.98 0.96 0.92 0.82 0.65 0.45 0.29 0.33 0.59 0.86 0.96 0.98 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.22 18.5 18.91 19.38 19.66 19.77 19.78 19.78 19.73 19.37 18.73 18.18 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	(88)m= 19.76	19.76	9.76	19.77	19.78	13	9.79	19.79	19.	19.78	19.7	8 19.77	19.77	_	(00)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= $\begin{bmatrix} 18.22 & 18.5 & 18.91 & 19.38 & 19.66 & 19.77 & 19.78 & 19.78 & 19.73 & 19.37 & 18.73 & 18.18 & (90) \\ & & & & & & & & & & & & & & & & & & $						_			r –		_			٦	
	(89)m= 0.98	0.96 0.	.92	0.82	0.65	C).45	0.29	0.3	0.59	0.86	0.96	0.98		(89)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	Mean internal te	emperatur	re in t	he rest	of dwell	ing	T2 (fo	llow ste	ps 3	to 7 in Tal	ble 9c)			_	
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	(90)m= 18.22	18.5	3.91	19.38	19.66	1	9.77	19.78	19.	78 19.73	19.3	7 18.73	18.18		(90)
(92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)											fLA = L	iving area ÷ (4) =	0.54	(91)
(92)m= 19.08 19.31 19.66 20.06 20.31 20.42 20.44 20.44 20.38 20.04 19.5 19.04 (92)	Mean internal to	emperatur	re (for	r the wh	ole dwe	llino	g) = fL	A × T1	+ (1	– fLA) × T2	2				<u> </u>
Apply adjustment to the mean internal temperature from Table 4e, where appropriate		.	<u> </u>			~	-		`		1	4 19.5	19.04		(92)
	Apply adjustme	nt to the r	nean	internal	temper	atu	re fron	n Table	4e,	where app	ropriat	e	•	<u>-</u>	



(93)m= 18.93	19.16	19.51	19.91	20.16	20.27	20.29	20.29	20.23	19.89	19.35	18.89		(93)
8. Space he	eating requ	uirement											
Set Ti to the			•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation	1							<u> </u>		I	I _		
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa				i -				r	 				(0.1)
(94)m= 0.97	0.96	0.92	0.83	0.68	0.49	0.34	0.38	0.62	0.86	0.95	0.98		(94)
Useful gains	1	· `	r ·	r –				i	ı				(0.7)
(95)m= 444.25		533.04	537.22	470.83	334.11	221.49	232.14	347.65	426.31	426.34	424.56		(95)
Monthly ave		T T	·					1	1				(0.0)
(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							- ` 	`					
(97)m= 908.74		804.11	672.97	516.34	342.42	222.79	234.32	371.36	566.73	750.26	903.79		(97)
Space heat	- 	ı	r each n	nonth, k\			24 x [(97)m – (95)m] x (4	r			
(98)m= 345.58	3 260.72	201.67	97.73	33.85	0	0	0	0	104.47	233.23	356.55		_
							Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1633.8	(98)
Space heat	ing require	ement in	kWh/m²	²/year								37.07	(99)
9a. Energy re	eguiremer	nts – Indi	ividual h	eating sy	vstems i	ncluding	n micro-C	CHP)					
Space heat		no ma	iviadai ii	oamig o		nora an ig	, 1111010 C	<i>,</i> , ,					
Fraction of	•	at from s	econdar	v/supple	mentary	system						0	(201)
Fraction of	•				,	,	(202) = 1	- (201) =				1	(202)
	•		-	. ,			,	, ,	(202)]				╡` ′
Fraction of t		•	-				(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency of	f main spa	ace heat	ing syste	em 1								90.9	(206)
Efficiency o	f seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	 ar
Space heat	ing require	ement (c	alculate	d above))							•	
345.58	3 260.72	201.67	97.73	33.85	0	0	0	0	104.47	233.23	356.55		
(211)m = {[(9	18)m x (20	1 <u>4</u>)1	00 - (20)6)				I.	I.				(211)
380.17		221.86	107.52	37.24	0	0	0	0	114.93	256.57	392.24		(=11)
			101.02	0				l (kWh/yea				1797.37	(211)
On and book								(a., Ga(-	- 1 15,1012	2	1191.31	(211)
Space heat	• .		• •	montn									
$= \{[(98)m \times (2000)] = (215)m = 0$	0	00 + (20	0	0	0	0	0	0	0	0	0		
(213)111= 0				0	U	U		l (kWh/yea				0	(215)
							Tota	ii (KVVII/yee	ar) =5urri(2	213) _{15,1012}	<u>-</u>	0	(213)
Water heating	_		1-1-1-1-1										
Output from 93.51		ter (caic 86.93	85.87	88.27	80.83	79.11	86.91	87.63	90.45	86.47	91.11		
Efficiency of			05.07	00.21	00.00	13.11	1 00.31	07.00	30.43	00.47	71.11	00.0	(216)
			05.55	00.00	00.0	60.5	000	60.5	05.55	07.55	00.01	80.8	
(217)m= 88.54		87.6	85.88	83.37	80.8	80.8	80.8	80.8	85.92	87.93	88.64		(217)
Fuel for wate	-												
(219)m = (64) (219)m = 105.6		99.24	m 99.99	105.89	100.03	97.91	107.56	108.45	105.27	98.35	102.78		
(= .0)	1 02.04	I ***	1 00.00	. 30.00	. 55.00	J	<u> </u>	I = Sum(2	<u> </u>	1 30.00	1 . 52.70	1223.93	(219)
Appual tat-	lo.						. 0.00	2011(2		Mb4			
Annual total Space heating		ad main	system	1					K	Wh/year		kWh/yea 1797.37	
Space ricatii	.9 .40. 430	, mani	5,5(5)11	•								1131.31	



Water heating fuel used			1223.93
Electricity for pumps, fans and electric keep-ho	ot		
central heating pump:		120	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of ((230a)(230g) =	165 (231)
Electricity for lighting			207.61 (232)
10a. Fuel costs - individual heating systems:			
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 × 0.01 :	62.55 (240)
Space heating - main system 2	(213) x	0 x 0.01 :	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 :	0 (242)
Water heating cost (other fuel)	(219)	3.48 × 0.01 :	42.59 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 :	21.76 (249)
(if off-peak tariff, list each of (230a) to (230g) s Energy for lighting	separately as applicable and (232)	apply fuel price according to	
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed		
Appendix Q items: repeat lines (253) and (254 Total energy cost (245)) as needed .(247) + (250)(254) =		274.29 (255)
	•		274.29 (255)
Total energy cost (245)	•		274.29 (255) 0.42 (256)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12)	•		
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12)	.(247) + (250)(254) =		0.42 (256)
Total energy cost (245) 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255)	x (256)] ÷ [(4) + 45.0] =		0.42 (256) 1.29 (257)
Total energy cost (245) 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12)	x (256)] ÷ [(4) + 45.0] =	Emission factor kg CO2/kWh	0.42 (256) 1.29 (257)
Total energy cost (245) 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12)	x (256)] ÷ [(4) + 45.0] = tems including micro-CHP Energy		0.42 (256) 1.29 (257) 81.96 (258) Emissions
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 12a. CO2 emissions – Individual heating systems	x (256)] ÷ [(4) + 45.0] = ems including micro-CHP Energy kWh/year	kg CO2/kWh	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) 3 SAP rating (Section 12) 12a. CO2 emissions - Individual heating systems Space heating (main system 1)	x (256)] ÷ [(4) + 45.0] = tems including micro-CHP Energy kWh/year (211) x	kg CO2/kWh 0.216 =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 12a. CO2 emissions – Individual heating systems Space heating (main system 1) Space heating (secondary)	x (256)] ÷ [(4) + 45.0] = x (256)] ÷ [(4) + 45.0] = Energy kWh/year (211) x (215) x	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261) 0 (263)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 12a. CO2 emissions – Individual heating systems Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (219) x (261) + (262) + (263) + (264)	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261) 0 (263) 264.37 (264)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 12a. CO2 emissions – Individual heating systems Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (219) x (261) + (262) + (263) + (264)	kg CO2/kWh 0.216 = 0.519 = 0.216 =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261) 0 (263) 264.37 (264) 652.6 (265)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 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-heating	Energy kWh/year (211) x (215) x (219) x (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.519 =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261) 0 (263) 264.37 (264) 652.6 (265) 85.64 (267)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 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-he Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.519 = 0.519 = 0.519 =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261) 0 (263) 264.37 (264) 652.6 (265) 85.64 (267) 107.75 (268)
Total energy cost 11a. SAP rating - individual heating systems Energy cost deflator (Table 12) Energy cost factor (ECF) [(255) SAP rating (Section 12) 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-he Electricity for lighting Total CO2, kg/year	Energy kWh/year (211) x (215) x (219) x (231) x (232) x	kg CO2/kWh 0.216 = 0.519 = 0.216 = 0.519 = 0.519 = sum of (265)(271) =	0.42 (256) 1.29 (257) 81.96 (258) Emissions kg CO2/year 388.23 (261) 0 (263) 264.37 (264) 652.6 (265) 85.64 (267) 107.75 (268) 845.98 (272)



	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2192.79	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	1493.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =		3685.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	506.55	(267)
Electricity for lighting	(232) x	0	=	637.37	(268)
'Total Primary Energy		sum of (265)(271) =		4829.89	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		109.6	(273)



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Pro	perty Address	s: Lean F	First Floo	r Sample	е		
Address:							
1. Overall dwelling dimensions:							
	Area(m²)	_	Av. He	ight(m)	_	Volume(m³)	_
Ground floor	44.07	(1a) x	3	.03	(2a) =	133.53	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$	44.07	(4)					
Dwelling volume		(3a)+(3l	o)+(3c)+(3d)+(3e)+	.(3n) =	133.53	(5)
2. Ventilation rate:							
main secondary heating heating	other		total			m³ per houi	•
Number of chimneys 0 + 0	+ 0	_ = [0	x 4	40 =	0	(6a)
Number of open flues 0 + 0	+ 0		0	x 2	20 =	0	(6b)
Number of intermittent fans			3	x -	10 =	30	(7a)
Number of passive vents		Ī	0	x -	10 =	0	(7b)
Number of flueless gas fires		Ī	0	x 4	40 =	0	(7c)
		_					_
					Air ch	anges per ho	ur
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)		aantinus t	30		÷ (5) =	0.22	(8)
If a pressurisation test has been carried out or is intended, proceed to Number of storeys in the dwelling (ns)	to (17), otnerwise	continue	rom (9) to (16)			(9)
Additional infiltration				[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0	0.35 for mason	ry const	ruction	[(0)]	1,10.1 -	0	(11)
if both types of wall are present, use the value corresponding to the		•					」 ` ′
deducting areas of openings); if equal user 0.35							_
If suspended wooden floor, enter 0.2 (unsealed) or 0.1	(sealed), else	enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0						0	(13)
Percentage of windows and doors draught stripped						0	(14)
Window infiltration	_	2 x (14) ÷	_			0	(15)
Infiltration rate			12) + (13) +			0	(16)
Air permeability value, q50, expressed in cubic metres		•	netre of e	nvelope	area	4	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$,						0.42	(18)
Air permeability value applies if a pressurisation test has been done	or a degree air p	ermeability	is being us	sed	ı		_
Number of sides sheltered	(20) – 1	· [0.075 x (10)] -			3	(19)
Shelter factor			19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (1)	8) x (20) =				0.33	(21)
Infiltration rate modified for monthly wind speed		T -	1 -			1	
Jan Feb Mar Apr May Jun	Jul Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed from Table 7							

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltration rate (allowing for	shelter an	nd wind s	peed) =	(21a) x	(22a)m					
0.42 0.41	0.4 0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39		
Calculate effective air cha	•	the appli	icable ca	se							
If mechanical ventilatio		(22h) (22	a) Fm;//a	auatian (N	VIEVV othor	muiaa (22h	\ (225\			0	(23a)
If exhaust air heat pump usir) = (23a)			0	(23b)
If balanced with heat recover		_					21.)	001) [4 (00.)	0	(23c)
a) If balanced mechani			1	- ` ` 	, ``	ŕ	<u> </u>	- 	<u> </u>	÷ 100] I	(240)
(24a)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mechani					É È	i `	 	- 		1	(24b)
(24b)m= 0 0	0 0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extra if $(22b)m < 0.5 \times (200)$		•	•				5 v (23h	,)			
$\frac{11(225)11(0.5)(25)}{(24c)m} = \frac{0.5 \times (25)}{0}$	0 0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation			<u> </u>				_				, ,
if (22b)m = 1, then							0.5]				
(24d)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effective air change rat	te - enter (24	a) or (24l	b) or (24	c) or (24	d) in box	x (25)	•		•	•	
(25)m= 0.59 0.58	0.58 0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. Heat losses and heat	loss parame	ter:									
ELEMENT Gross	Open		Net Ar	ea	U-valı	ue	AXU		k-value)	ΑΧk
area (m	1 ²)	m²	A ,r	m² 	W/m2	!Κ 	(W/I	<u>()</u>	kJ/m²-ł	<	kJ/K
Daara											
Doors			1.89	X	1.6	= [3.024				(26)
Windows Type 1			1.89	号 ,	1.6 /[1/(1.4)+	!	3.024 1.35				(26) (27)
				x1/		0.04] =					
Windows Type 1			1.02	x1/	/[1/(1.4)+	0.04] =	1.35				(27)
Windows Type 1 Windows Type 2			2.13	x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.35 2.82				(27) (27)
Windows Type 1 Windows Type 2 Windows Type 3			1.02 2.13 0.52	x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69				(27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$ = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51				(27) (27) (27) (27)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1			1.02 2.13 0.52 1.89	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2			1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728				(27) (27) (27) (27) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3	7.	45	1.02 2.13 0.52 1.89 0.52 0.52	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) +	0.04] = [0.0	1.35 2.82 0.69 2.51 0.728 0.728			7 6	(27) (27) (27) (27) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4	7.		1.02 2.13 0.52 1.89 0.52 0.52 0.52	x10 x10 x10 x10 x10 x10 x10 x10 x10 x10	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) +	0.04] = $\begin{bmatrix} 0.04 \end{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728				(27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27) (27b) (27b) (27b) (27b) (29)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many control of the	2.0		1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[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{array}{c} 0.04] = \\ 0.04] = $	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69				(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m	2.0	08	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04]	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many party wall Party floor * for windows and roof windows to include the areas on both sides.	2.0 5, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8	as given in	paragraph		(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, many many many many many many many many	s, use effective les of internal w	08 window U-va	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8			24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, management of the second of the seco	s, use effective les of internal w S (A x U) x k)	08 window U-v. alls and par	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0	2) + (32a).			(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (29) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Rooflights Type 1 Rooflights Type 2 Rooflights Type 3 Rooflights Type 4 Walls 43 Roof 50.39 Total area of elements, m Party wall Party floor * for windows and roof windows ** include the areas on both side Fabric heat loss, W/K = S	s, use effective les of internal w S (A x U) x k)	one of the one of the	1.02 2.13 0.52 1.89 0.52 0.52 0.52 35.55 48.31 93.39 40.32 44.07 alue calculatitions	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4) + /[1/(1.4) + /[1/(1.4) + 0.16 0.12 0 a formula 1. (26)(30)	0.04] = [0.04] = [0.04	1.35 2.82 0.69 2.51 0.728 0.728 0.728 5.69 5.8 0 ue)+0.04] a	2) + (32a). : Medium	(32e) =	24.6	(27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (30) (31) (32) (32a)



can be used instead of a detailed calculation Thermal bridges: S (L x Y) calculated using Appendix K (36)11.57 if details of thermal bridging are not known (36) = $0.15 \times (31)$ Total fabric heat loss (33) + (36) =(37)36.21 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Feb Mar Jul Aug Sep Dec .lan Apr May Jun Oct Nov (38)m =25.91 25.76 25.61 24.92 24.79 24.19 24.19 24.07 24.42 24.79 25.05 25.33 (38)Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m =62.12 61.97 61.82 61.13 60.4 60.4 60.28 60.63 61 61.26 61.54 61 Average = Sum(39)_{1...12} /12= (39)61.13 Heat loss parameter (HLP), W/m²K (40)m = (39)m \div (4)1.41 1.41 1.39 1.38 1.37 1.37 1.37 1.38 1.38 1.39 (40)m =1.4 (40)Average = $Sum(40)_{1...12}/12=$ 1.39 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)1.52 if TFA > 13.9, N = 1 + 1.76 x [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)70.26 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m =77.28 74.47 71.66 68.85 66.04 63.23 63.23 66.04 68.85 71.66 74.47 77.28 (44)Total = $Sum(44)_{1...12}$ = 843.09 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) 100.24 (45)m =114.61 103.44 90.18 86.53 74.67 69.19 79.4 80.35 93.63 102.21 110.99 (45)Total = $Sum(45)_{1...12}$ = 1105.43 If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 17.19 15.04 15.52 13.53 12.98 12.05 14.05 15.33 16.65 (46)Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 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		-	, kWh/ye	ar			(47) x (51)	x (52) x (53) =	(0		(54)
Enter (50) or (5	, ,	,								(0		(55)
Water storage I	oss calc	ulated f	or each	month			((56)m = (55) × (41)r	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicated	solar sto	rage, (57)r	n = (56)m	x [(50) – (I	H11)] ÷ (5	0), else (57	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit I	oss (anr	nual) fro	m Table	3						(0		(58)
Primary circuit I	oss calc	ulated f	or each	month (59)m = (58) ÷ 36	55 × (41)	m					
(modified by	factor fro	om Tabl	e H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss cald	culated fo	or each	month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 39.38	34.28	36.52	33.95	33.65	31.18	32.22	33.65	33.95	36.52	36.73	39.38		(61)
Total heat requi	ired for v	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= 153.99	134.52	139.96	124.13	120.18	105.85	101.41	113.05	114.3	130.15	138.94	150.38		(62)
Solar DHW input ca	alculated u	ising App	endix G or	Appendix	H (negativ	ve quantity	/) (enter '0	if no sola	r contributi	on to wate	r heating)		
(add additional	lines if F	GHRS	and/or V	VWHRS	applies,	see Ap	pendix C	S)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS 32.65	27.9	27.7	18.7	12.5	7.99	7.57	8.58	8.64	20.63	28.35	32.3		(63) (G2)
WWHRS -27.31	-24.02	-24.52	-20.23	-18.81	-15.53	-13.18	-15.95	-16.4	-20.23	-23.39	-26.38		(63) (G10)
Output from wa	ter heate	er											
(64)m= 92.15	80.95	85.98	83.58	87.26	80.83	79.11	86.91	87.63	87.53	85.43	89.8		
							Outp	ut from wa	ater heater	(annual) ₁	12	1027.16	(64)
Heat gains from	n water h	neating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m							(64)
Heat gains from (65)m= 47.95	n water h	neating, 43.52	kWh/mo	onth 0.25	5 ´ [0.85 32.62	× (45)m 31.06							(64) (65)
	41.9	43.52	38.47	37.18	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
(65)m= 47.95	41.9 n in calcu	43.52 ulation	38.47 of (65)m	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
include (57)m 5. Internal gai	41.9 n in calcu	43.52 ulation of	38.47 of (65)m and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
(65)m= 47.95 include (57)m	41.9 n in calcu	43.52 ulation of	38.47 of (65)m and 5a)	37.18 only if c	32.62	31.06	+ (61)m] + 0.8 x	([(46)m 40.26	+ (57)m 43.17	+ (59)m 46.75	1	
include (57)m 5. Internal gain Metabolic gains	41.9 n in calcuins (see	43.52 ulation of Table 5 5), Wat	38.47 of (65)m and 5a)	37.18 only if c	32.62 ylinder is	31.06 s in the c	+ (61)m 34.81 dwelling	35.2 or hot w	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h	1	
include (57)m 5. Internal gai Metabolic gains Jan	41.9 in calcuins (see Table : Feb 75.91	43.52 ulation of Table 5 5), Wat Mar 75.91	38.47 of (65)m 6 and 5a) ts Apr 75.91	37.18 only if c : May 75.91	32.62 ylinder is Jun 75.91	31.06 s in the c Jul 75.91	+ (61)m 34.81 dwelling Aug 75.91	35.2 or hot w Sep	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h	1	(65)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91	41.9 in calcuins (see Table : Feb 75.91	43.52 ulation of Table 5 5), Wat Mar 75.91	38.47 of (65)m 6 and 5a) ts Apr 75.91	37.18 only if c : May 75.91	32.62 ylinder is Jun 75.91	31.06 s in the c Jul 75.91	+ (61)m 34.81 dwelling Aug 75.91	35.2 or hot w Sep	40.26 ater is fr	+ (57)m 43.17 om com	+ (59)m 46.75 munity h	1	(65)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76	11.9 in calculate 10.44	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49	38.47 of (65)m and 5a) ts Apr 75.91 opendix l 6.43	37.18 only if c : May 75.91 L, equati 4.81	32.62 ylinder is Jun 75.91 ion L9 or 4.06	31.06 s in the c Jul 75.91 L9a), a 4.38	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7	35.2 or hot w Sep 75.91 Table 5	(46)m 40.26 ater is fr Oct 75.91	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain	11.9 in calculate 10.44	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49	38.47 of (65)m and 5a) ts Apr 75.91 opendix l 6.43	37.18 only if c : May 75.91 L, equati 4.81	32.62 ylinder is Jun 75.91 ion L9 or 4.06	31.06 s in the c Jul 75.91 L9a), a 4.38	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7	35.2 or hot w Sep 75.91 Table 5	(46)m 40.26 ater is fr Oct 75.91	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89	n in calculate 10.44 133.26	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81	38.47 of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 a Append	37.18 only if c May 75.91 L, equati 4.81 dix L, equali	Jun 75.91 ion L9 or 4.06 uation L' 104.49	Jul 75.91 1 L9a), a 4.38 13 or L1: 98.67	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Tal	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65) (66) (67)
include (57)m 5. Internal gai Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain	n in calculate 10.44 133.26	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81	38.47 of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 a Append	37.18 only if c May 75.91 L, equati 4.81 dix L, equali	Jun 75.91 ion L9 or 4.06 uation L' 104.49	Jul 75.91 1 L9a), a 4.38 13 or L1: 98.67	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Tal	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91	+ (59)m 46.75 munity h Dec 75.91	1	(65) (66) (67)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59	n in calculate 10.44 ns (calculate 30.59	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59	38.47 of (65)m 5 and 5a) ts Apr 75.91 opendix I 6.43 a Append 122.47 opendix 30.59	37.18 only if c May 75.91 L, equati 4.81 dix L, equati 113.2 L, equat	Jun 75.91 ion L9 or 4.06 uation L2 ion L15	Jul 75.91 - L9a), a 4.38 13 or L1 98.67 or L15a)	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Talle te Table	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91 11.33	+ (59)m 46.75 munity h Dec 75.91 12.08	1	(65) (66) (67) (68)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans	n in calculate 10.44 ns (calculate 30.59	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59	38.47 of (65)m 5 and 5a) ts Apr 75.91 opendix I 6.43 a Append 122.47 opendix 30.59	37.18 only if c May 75.91 L, equati 4.81 dix L, equati 113.2 L, equat	Jun 75.91 ion L9 or 4.06 uation L2 ion L15	Jul 75.91 - L9a), a 4.38 13 or L1 98.67 or L15a)	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3	Sep 75.91 Fable 5 7.65 see Talle te Table	Oct 75.91 9.71 ble 5 108.09	+ (57)m 43.17 om com Nov 75.91 11.33	+ (59)m 46.75 munity h Dec 75.91 12.08	1	(65) (66) (67) (68)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10	11.9 in calculate 133.26 (calculate 30.59 s gains (43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 n Append 122.47 opendix 30.59 of (65)m	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59	Jul 75.91 13 or L1: 98.67 or L15a)	+ (61)m 34.81 dwelling 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 ee Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07	1	(65) (66) (67) (68) (69)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva	n in calculate (calculate 30.59) s gains (apporation	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix L 6.43 n Append 122.47 opendix 30.59 of (65)m	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 30.59 10 lle 5)	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59	1	(65) (66) (67) (68) (69)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eval (71)m= -60.73	41.9 n in calculate 75.91 calculate 10.44 ns (calculate 30.59 s gains (10 apporation -60.73	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negatine 100.73	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix I 6.43 n Appendix 122.47 opendix 30.59 of and 5a) 10 tive value	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equati 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 30.59	Jul 75.91 13 or L1: 98.67 or L15a)	+ (61)m 34.81 dwelling 75.91 lso see 5.7 3a), also 97.3 , also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 ee Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07	1	(65) (66) (67) (68) (69) (70)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gains (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva (71)m= -60.73 Water heating gains (41.9 n in calculate 75.91 calculate 10.44 ns (calculate 30.59 s gains (10 apporation -60.73	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negatine 100.73	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix I 6.43 n Appendix 122.47 opendix 30.59 of and 5a) 10 tive value	37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 30.59 10 lle 5)	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 a, also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59	Oct 75.91 9.71 ble 5 108.09 5 30.59	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59 10	1	(65) (66) (67) (68) (69) (70) (71)
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gain (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva (71)m= -60.73 Water heating gains ((72)m= 64.45	n in calculate (calculate 30.59) s gains (10 apporation -60.73 gains (Ta 62.35	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negation of the color) able 5)	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix l 6.43 n Appendix 30.59 of (65)m of (37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equati 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59 10 le 5) -60.73	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 , also se 30.59 10 -60.73	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59 10 -60.73	Oct 75.91 9.71 ble 5 108.09 5 30.59 10 -60.73	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59 10 -60.73	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59 10 -60.73	1	(65) (66) (67) (68) (69) (70)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 75.91 Lighting gains ((67)m= 11.76 Appliances gains (68)m= 131.89 Cooking gains ((69)m= 30.59 Pumps and fans (70)m= 10 Losses e.g. eva (71)m= -60.73 Water heating c (72)m= 64.45 Total internal c	41.9 n in calculate (calculate 30.59 s gains (10 apporation -60.73 gains (Ta 62.35 gains =	43.52 ulation of Table 5 5), Wat Mar 75.91 ed in Ap 8.49 ulated in 129.81 ed in Ap 30.59 (Table 5 10 n (negation of the color) able 5)	38.47 of (65)m of (65)m of and 5a) ts Apr 75.91 opendix l 6.43 n Appendix 30.59 of (65)m of (37.18 only if c May 75.91 L, equati 4.81 dix L, equ 113.2 L, equat 30.59 10 es) (Tab	32.62 ylinder is Jun 75.91 ion L9 or 4.06 uation L' 104.49 ion L15 or 30.59 10 le 5) -60.73	31.06 S in the control of the contr	+ (61)m 34.81 dwelling Aug 75.91 lso see 5.7 3a), also 97.3 a, also se 30.59	Sep 75.91 Fable 5 7.65 see Tal 100.75 te Table 30.59 10 -60.73	Oct 75.91 9.71 ble 5 108.09 5 30.59 10 -60.73	+ (57)m 43.17 om com Nov 75.91 11.33 117.36 30.59 10 -60.73	+ (59)m 46.75 munity h Dec 75.91 12.08 126.07 30.59 10 -60.73	1	(65) (66) (67) (68) (69) (70) (71)



6. Solar gains:

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

Orienta	tion:	Access Factor Table 6d	r	Area m²	a a	Flux Table 6a		g_ Table 6b	м ри	FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.02	x	10.63	x	0.76	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.13	x	10.63	х	0.76	x	0.7	=	8.35	(74)
North	0.9x	0.77	X	1.02	х	20.32	X	0.76	x	0.7	=	7.64	(74)
North	0.9x	0.77	x	2.13	х	20.32	x	0.76	x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.02	x	34.53	x	0.76	x	0.7	=	12.99	(74)
North	0.9x	0.77	X	2.13	х	34.53	X	0.76	x	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.02	x	55.46	x	0.76	x	0.7	=	20.86	(74)
North	0.9x	0.77	X	2.13	х	55.46	X	0.76	x	0.7	=	43.56	(74)
North	0.9x	0.77	x	1.02	x	74.72	X	0.76	x	0.7	=	28.1	(74)
North	0.9x	0.77	x	2.13	x	74.72	x	0.76	x	0.7	=	58.67	(74)
North	0.9x	0.77	X	1.02	x	79.99	x	0.76	x	0.7	=	30.08	(74)
North	0.9x	0.77	X	2.13	x	79.99	x	0.76	x	0.7	=	62.81	(74)
North	0.9x	0.77	x	1.02	x	74.68	x	0.76	x	0.7	=	28.08	(74)
North	0.9x	0.77	x	2.13	x	74.68	X	0.76	x	0.7	=	58.64	(74)
North	0.9x	0.77	X	1.02	x	59.25	x	0.76	x	0.7	=	22.28	(74)
North	0.9x	0.77	X	2.13	x	59.25	x	0.76	x	0.7	=	46.52	(74)
North	0.9x	0.77	x	1.02	x	41.52	x	0.76	x	0.7	=	15.61	(74)
North	0.9x	0.77	X	2.13	x	41.52	x	0.76	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	1.02	x	24.19	x	0.76	x	0.7	=	9.1	(74)
North	0.9x	0.77	x	2.13	x	24.19	x	0.76	x	0.7	=	19	(74)
North	0.9x	0.77	X	1.02	x	13.12	x	0.76	x	0.7	=	4.93	(74)
North	0.9x	0.77	x	2.13	x	13.12	x	0.76	x	0.7	=	10.3	(74)
North	0.9x	0.77	X	1.02	x	8.86	x	0.76	x	0.7	=	3.33	(74)
North	0.9x	0.77	X	2.13	X	8.86	x	0.76	x	0.7] =	6.96	(74)
South	0.9x	0.77	X	0.52	x	46.75	x	0.76	x	0.7] =	8.96	(78)
South	0.9x	0.77	X	1.89	X	46.75	X	0.76	x	0.7] =	32.58	(78)
South	0.9x	0.77	X	0.52	X	76.57	X	0.76	X	0.7	=	14.68	(78)
South	0.9x	0.77	X	1.89	X	76.57	X	0.76	x	0.7	=	53.35	(78)
South	0.9x	0.77	X	0.52	X	97.53	X	0.76	X	0.7	=	18.7	(78)
South	0.9x	0.77	X	1.89	x	97.53	X	0.76	x	0.7	=	67.96	(78)
South	0.9x	0.77	X	0.52	X	110.23	x	0.76	x	0.7] =	21.13	(78)
South	0.9x	0.77	X	1.89	X	110.23	X	0.76	X	0.7	=	76.81	(78)
South	0.9x	0.77	X	0.52	X	114.87	X	0.76	x	0.7] =	22.02	(78)
South	0.9x	0.77	x	1.89	x	114.87	x	0.76	x	0.7] =	80.04	(78)
South	0.9x	0.77	X	0.52	x	110.55	X	0.76	x	0.7	=	21.19	(78)
South	0.9x	0.77	X	1.89	x	110.55	x	0.76	x	0.7	=	77.03	(78)



South 0.9x	0.77	X	0.52	x	108.01	x	0.76	x	0.7	=	20.71	(78)
South 0.9x	0.77	X	1.89	x	108.01	x	0.76	x	0.7	=	75.26	(78)
South 0.9x	0.77	X	0.52	x	104.89	X	0.76	x	0.7	=	20.11	(78)
South 0.9x	0.77	X	1.89	x	104.89	x	0.76	x	0.7	=	73.09	(78)
South 0.9x	0.77	X	0.52	x	101.89	x	0.76	x	0.7	=	19.53	(78)
South 0.9x	0.77	X	1.89	x	101.89	x	0.76	x	0.7	=	70.99	(78)
South 0.9x	0.77	X	0.52	x	82.59	x	0.76	X	0.7] =	15.83	(78)
South 0.9x	0.77	X	1.89	x	82.59	x	0.76	x	0.7] =	57.55	(78)
South 0.9x	0.77	X	0.52	x	55.42	x	0.76	x	0.7	=	10.62	(78)
South 0.9x	0.77	X	1.89	x	55.42	x	0.76	X	0.7	=	38.61	(78)
South 0.9x	0.77	X	0.52	X	40.4	X	0.76	X	0.7	=	7.74	(78)
South 0.9x	0.77	X	1.89	X	40.4	X	0.76	X	0.7	=	28.15	(78)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	26	x	0.76	x	0.7	=	6.47	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	x	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	x	0.76	x	0.7	=	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	54	X	0.76	X	0.7] =	13.44	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	96	x	0.76	x	0.7	=	23.9	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	X	0.76	x	0.7] =	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	x	150	x	0.76	x	0.7	=	37.35	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	192	x	0.76	X	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	x	0.76	x	0.7	=	47.8	(82)
Rooflights _{0.9x}	1	X	0.52	X	192	X	0.76	X	0.7	=	47.8	(82)
Rooflights 0.9x	1	X	0.52	x	200	x	0.76	x	0.7] =	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	X	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	200	x	0.76	x	0.7	=	49.8	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	189	x	0.76	x	0.7	=	47.06	(82)
Rooflights _{0.9x}	1	x	0.52	x	157	x	0.76	x	0.7	=	39.09	(82)
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Roofligi	<u> </u>	1	X	0.5	52	X	15	7	X	0.76	X	0.7	_ =	39.09	(82)
Roofligl		1	X	0.5	52	X	157	7	X	0.76	X	0.7	=	39.09	(82)
Roofligl	<u> </u>	1	X	0.5	52	X	157	7	X	0.76	X	0.7	=	39.09	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	115	5	X	0.76	X	0.7	=	28.63	(82)
Roofligl		1	X	0.5	52	X	11	5	X	0.76	X	0.7	=	28.63	(82)
Roofligh	nts _{0.9x}	1	X	0.5	52	X	115	5	X	0.76	X	0.7	=	28.63	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	11	5	X	0.76	X	0.7	=	28.63	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	66	6	x	0.76	x	0.7	=	16.43	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	66	3	X	0.76	X	0.7	=	16.43	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	66	3	X	0.76	X	0.7	=	16.43	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	X	66	5	x	0.76	x	0.7	_ =	16.43	(82)
Roofligl	nts _{0.9x}	1	x	0.5	52	X	33	3	x	0.76	x	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	33	3	x	0.76	x	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	33	3	x	0.76	x	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	33	3	x	0.76	x	0.7	=	8.22	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	21	1	x	0.76	x	0.7	-	5.23	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	21	1	x	0.76	x	0.7	_ =	5.23	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	21	1	x	0.76	×	0.7	=	5.23	(82)
Roofligl	nts _{0.9x}	1	X	0.5	52	X	21	1	x	0.76	= x	0.7	=	5.23	(82)
	<u> </u>		_						•						
Solar o	ains in wa	atts, calcul	ated	for eacl	h month	1		((83)m	= Sum(74)m .	(82)m				
(83)m=	79.78 1	45.41 222	2.37	311.74	380.05	39	90.29 3	370.92	318	36 253.27	167.2	97.34	67.1	1	(83)
	l I											1			()
Total g	ains – inte	ernal and s	solar	(84)m =	= (73)m	+ (8	33)m , w	vatts						_	(22)
Total g (84)m=		ernal and s		(84)m = 549.84	= (73)m 603.8	, `		vatts 571.49	523	<u> </u>	394.89	-	323.86]	(84)
(84)m=	343.65 4		1.94	549.84	603.8	59		-		<u> </u>		-	I]	
(84)m= 7. Me	343.65 4	107.23 474	1.94 ture (549.84 (heating	603.8	59 n)	99.92 5	571.49	523	92 466.33		-	I	21	
(84)m= 7. Me Temp	343.65 4 an internaterature du	107.23 474 al temperat	ture (549.84 (heating eriods in	603.8 seasor	59 ing	99.92 5	571.49 om Tab	523	92 466.33		-	I	21	(84)
(84)m= 7. Me Temp	343.65 4 an internaterature du	107.23 474 Il temperaturing heati	ture (549.84 (heating eriods in	603.8 seasor	59 ing n (se	99.92 5	571.49 om Tab	523. le 9,	92 466.33		341.76	I	21	(84)
(84)m= 7. Me Temp	an internaterature duation factor	lor.23 474 Latemperaturing heati r for gains Feb M	ture (ng pe	549.84 (heating eriods in ving are	seasor the livi	59 ing n (se	area fro ee Table	571.49 om Tab e 9a)	523. le 9,	92 466.33 Th1 (°C)	394.89	341.76	323.86	21	(84)
(84)m= 7. Me Temp Utilisa (86)m=	an internation factor Jan 0.99	l temperaturing heating for gains Feb N 0.99 0.9	ture (ng pe for li lar	549.84 (heating eriods in ving are Apr 0.91	seasor the livies, h1,m May	ing (se	area fro ee Table Jun	om Tab e 9a) Jul	523. ble 9,	92 466.33 Th1 (°C) ug Sep 1 0.77	394.89 Oct	341.76 Nov	323.86 Dec	21	(84)
(84)m= 7. Me Temp Utilisa (86)m=	an internation factor Jan 0.99 internal te	l temperaturing heating for gains Feb M 0.99 0.99	ture (ng pe for li lar	549.84 (heating eriods in ving are Apr 0.91	seasor the livies, h1,m May	ing n (so	area fro ee Tablo Jun 0.61 w steps	om Tab e 9a) Jul 0.46	523. ble 9,	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c)	394.89 Oct	Nov 0.99	323.86 Dec	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m=	an internation factor Jan 0.99 internal te	l temperaturing heating for gains Feb M 0.99 0.99 emperature 19.79 20	ture (ng pe for li far 97 e in l	549.84 (heating eriods in ving are 0.91 iving are 20.51	603.8 seasor the livies, h1,n May 0.79 ea T1 (f	55 (sollo	area fro ee Tablo Jun 0.61 w steps	om Tab e 9a) Jul 0.46 3 to 7	523 ole 9, 0.5 in T	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88	394.89 Oct 0.95	Nov 0.99	323.86 Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp	an internation factor Jan 0.99 internal te 19.58	l temperaturing heating for gains Feb No.99 0.99 emperature 19.79 20 uring heati	ture (ng po for li far 97 e in l .11	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods ir	603.8 seasor the livi ea, h1,m May 0.79 ea T1 (f 20.81	55 (state of the state of the s	area fro ee Table Jun 0.61 w steps eelling fr	om Tab e 9a) Jul 0.46 3 3 to 7 20.99	523. All 0.5 in T 20.9	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88 9, Th2 (°C)	Oct 0.95	Nov 0.99	Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m=	an internation factor Jan 0.99 internal te 19.58 erature du 19.76	l temperaturing heating for gains Feb No.99 0.99 emperature 19.79 20 uring heating hea	ture (ng pe for li far 97 e in l .11 ng pe	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77	603.8 seasor the livi ea, h1,m May 0.79 ea T1 (f 20.81 rest of 19.78	55 55 55 55 55 55 55 55 55 55 55 55 55	area fro ee Table Jun 0.61 w steps eelling fro 9.79	om Tab e 9a) Jul 0.46 3 3 to 7 20.99 om Ta	523. All 0.5 in T 20.9 ble 9	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88 9, Th2 (°C)	394.89 Oct 0.95	Nov 0.99	323.86 Dec 1	21	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa	an internation factor Jan 0.99 internal te 19.58 erature du 19.76 ation factor	l temperaturing heating for gains Feb M 0.99 0.99 emperature 19.79 20 uring heating heating heating heating heating for gains	ture (ng pe for li for li ng pe in I ng pe in I for r	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77 est of decided in the second in	603.8 seasor the livi ea, h1,n May 0.79 ea T1 (f 20.81 rest of 19.78 welling,	550 (second of the second of t	area fro ee Table Jun 0.61 w steps 0.95 relling fro 9.79 m (see	om Tabe 9a) Jul 0.46 3 to 7 20.99 om Ta 19.79 Table	523. All 0.5 in T 20.9 ble § 19.7	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88 0, Th2 (°C) 79 19.78	Oct 0.95	Nov 0.99 19.95	Dec 1 19.55	21	(84) (85) (86) (87) (88)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m=	an internation factor Jan 0.99 internal te 19.58 erature du 19.76 ation factor	l temperaturing heating for gains Feb M 0.99 0.99 emperature 19.79 20 uring heating heating heating heating heating for gains	ture (ng pe for li far 97 e in l .11 ng pe	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77	603.8 seasor the livi ea, h1,m May 0.79 ea T1 (f 20.81 rest of 19.78	550 (second of the second of t	area fro ee Table Jun 0.61 w steps 0.95 relling fro 9.79 m (see	om Tab e 9a) Jul 0.46 3 3 to 7 20.99 om Ta	523. All 0.5 in T 20.9 ble 9	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88 9, Th2 (°C) 79 19.78	Oct 0.95	Nov 0.99	Dec 1	21]	(84)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean	an internation factor Jan 0.99 internal te 19.58 erature du 19.76 ation factor 0.99 internal te	l temperaturing heating for gains Feb No.99 0.99 emperaturing heating	ture (ng po for li Mar e in l for r for r for r for r e in t	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest	603.8 seasor the livi ea, h1,m May 0.79 ea T1 (f 20.81 rest of 19.78 welling, 0.72 of dwell	550 sing sing sing sing sing sing sing sing	area fro ee Table Jun 0.61 w steps celling fro 9.79 m (see 0.51	om Table 0.33 ow ste	523. All 0.5 in T 20.9 ble 9 19.1 0.3 ps 3	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88 9, Th2 (°C) 79 19.78 9 0.67 to 7 in Tabl	Oct 0.95 20.47 19.78 0.92 e 9c)	Nov 0.99 19.95 19.77	323.86 Dec 1 19.55 19.77		(84) (85) (86) (87) (88) (89)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m=	an internation factor Jan 0.99 internal te 19.58 erature du 19.76 ation factor 0.99 internal te	l temperaturing heating for gains Feb No.99 0.99 emperaturing heating	ture (ng pe for li far 97 e in l 11 for r 96 for r	549.84 (heating eriods in Apr 0.91 iving are 20.51 eriods in 19.77 est of do 0.88	603.8 seasor the livi ea, h1,m May 0.79 ea T1 (f 20.81 rest of 19.78 welling, 0.72	550 sing sing sing sing sing sing sing sing	area fro ee Table Jun 0.61 w steps celling fro 9.79 m (see 0.51	om Tabe e 9a) Jul 0.46 3 3 to 7 20.99 om Ta 19.79 Table 0.33	523 Alle 9, 0.5 in T 20.9 ble 9 19.7 9a)	92 466.33 Th1 (°C) ug Sep 1 0.77 Table 9c) 98 20.88 0, Th2 (°C) 79 19.78 9 0.67 to 7 in Table 78 19.69	Oct 0.95 20.47 19.78 0.92 e 9c) 19.19	Nov 0.99 19.95 19.77 0.98	323.86 Dec 1 19.55 19.77 0.99		(84) (85) (86) (87) (88) (89)
(84)m= 7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean	an internation factor Jan 0.99 internal te 19.58 erature du 19.76 ation factor 0.99 internal te	l temperaturing heating for gains Feb No.99 0.99 emperaturing heating	ture (ng po for li Mar e in l for r for r for r for r e in t	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest	603.8 seasor the livi ea, h1,m May 0.79 ea T1 (f 20.81 rest of 19.78 welling, 0.72 of dwell	550 sing sing sing sing sing sing sing sing	area fro ee Table Jun 0.61 w steps celling fro 9.79 m (see 0.51	om Table 0.33 ow ste	523. All 0.5 in T 20.9 ble 9 19.1 0.3 ps 3	92 466.33 Th1 (°C) ug Sep 1 0.77 Table 9c) 98 20.88 0, Th2 (°C) 79 19.78 9 0.67 to 7 in Table 78 19.69	Oct 0.95 20.47 19.78 0.92 e 9c) 19.19	Nov 0.99 19.95 19.77	323.86 Dec 1 19.55 19.77 0.99	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=	an internation factor Jan 0.99 internal terrature du 19.58 erature du 19.76 ation factor 0.99 internal terrature du 17.91	l temperaturing heating from gains Feb Money 0.99 0.99 emperaturing heating heating heating heating from gains 0.98 0.99 emperature from gains 0.98 0.99 emperature from gains 0.98 0.99 emperature from gains 0.98 0.99	ture (ng po for li far lar for r for r ge e in t 667	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest 19.23	603.8 seasor the livities, h1,m May 0.79 ea T1 (ff 20.81 n rest of 19.78 welling, 0.72 of dwell 19.61	550 sing (Single Single	area from the second se	om Table 0.33 ow ste 19.78	523. All 0.5 in T 20.9 19.1 0.3 ps 3 19.1	92 466.33 Th1 (°C) ug Sep 1 0.77 Table 9c) 98 20.88 0, Th2 (°C) 79 19.78 9 0.67 to 7 in Table 78 19.69	Oct 0.95 20.47 19.78 0.92 e 9c) 19.19	Nov 0.99 19.95 19.77 0.98	323.86 Dec 1 19.55 19.77 0.99		(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=	an internation factor Jan 0.99 internal te 19.58 erature du 19.76 ation factor 0.99 internal te 17.91 internal te 18.82	1 temperaturing heating from gains 1 temperature 19.79	ture (ng po for li for li 11 ng po 76 for r 96 for r 96 e in t 67	549.84 (heating eriods in ving are 20.51 eriods in 19.77 est of do 0.88 he rest 19.23 r the wh 19.93	603.8 seasor the livities, h1,m May 0.79 ea T1 (ff 20.81 n rest of 19.78 welling, 0.72 of dwell 19.61	550 sing (Single Single	99.92 5 area fro ee Table Jun 0.61 w steps 0.95 2 relling fr 9.79 m (see 0.51 T2 (follo 9.76 g) = fLA	om Table 0.33 ow ste 19.78	523 Alle 9, 0.5 in T 20.9 9a) 0.3 ps 3 19.7 + (1 - 20.4	92 466.33 Th1 (°C) ug Sep 1 0.77 able 9c) 98 20.88 0, Th2 (°C) 79 19.78 9 0.67 to 7 in Table 78 19.69 f fLA) × T2	394.88 Oct 0.95 20.47 19.78 0.92 e 9c) 19.19 LA = Liv	Nov 0.99 19.95 19.77 0.98 18.45 ring area ÷ (4	323.86 Dec 1 19.55 19.77 0.99		(84) (85) (86) (87) (88) (89)



ı										•	•			
(93)m=	18.67	18.91	19.3	19.78	20.11	20.26	20.29	20.28	20.18	19.73	19.11	18.63		(93)
		ting requ												
						ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
tne ut				using Ta		lina	11	A	Con	0-4	Nav	Dag		
Litilias	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	tor for ga	0.95	0.88	0.74	0.55	0.39	0.44	0.71	0.92	0.98	0.99		(94)
				1 0.00 4)m x (84		0.55	0.39	0.44	0.71	0.92	0.96	0.99		(34)
(95)m=	340.09	398.69	452.29	484.34	447.6	328.47	220.41	230.19	330.12	364.24	335.04	321.2		(95)
							220.41	230.19	330.12	304.24	333.04	321.2		(00)
(96)m=	4.3	4.9	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
								x [(93)m		ļ	/.1	4.2		(50)
(97)m=	892.45	868.32	791.36	664.81	512.91	341.6	222.61	234.02	368.79	557.08	736.04	887.78		(97)
								24 x [(97)		l .	l	007.70		(01)
(98)m=	410.96	315.59	252.27	129.94	48.59	0	0.02	0	0	143.47	288.72	421.54		
(90)111=	410.30	313.39	202.21	129.94	40.59	U	0			<u> </u>	<u> </u>	<u> </u>	2014.00	7(00)
								Tota	l per year	(kvvn/year) = Sum(9	8)15,912 =	2011.08	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								45.63	(99)
9a. En	ergy rec	uiremer	its – Ind	ividual h	eating sy	ystems ii	ncluding	micro-C	CHP)					
Space	e heatir	ıg:												
Fracti	on of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =			ĺ	1	(202)
Fracti	on of to	tal heatir	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		İ	1	(204)
			_	ing syste									90.9	(206)
	•	•		ementar		n evetom	0/_					 	0	(208)
LIIICIC									_				-	
0	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space				alculate						440.47	000.70	404.54		
	410.96	315.59	252.27	129.94	48.59	0	0	0	0	143.47	288.72	421.54		
(211)m		<u> </u>		00 ÷ (20						ı	ı			(211)
	452.1	347.19	277.52	142.95	53.46	0	0	0	0	157.84	317.62	463.74		_
								Tota	l (kWh/yea	ar) =Sum(2	211),5,1012	=	2212.41	(211)
		•		y), kWh/	month									
	<u> </u>	1)] } x 1	00 ÷ (20	r										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
	heating	•												
Output				ulated al					1	1	1	- 1		
	92.15	80.95	85.98	83.58	87.26	80.83	79.11	86.91	87.63	87.53	85.43	89.8		_
Efficier	ncy of w	ater hea	ter							•	•		80.8	(216)
(217)m=	88.87	88.64	88.1	86.66	84.14	80.8	80.8	80.8	80.8	86.79	88.38	88.95		(217)
		heating,												
		m x 100			400.7	400.00	07.04	407.50	100.45	400.00	00.07	400.00		
(219)m=	103.69	91.32	97.59	96.44	103.7	100.03	97.91	107.56	108.45	100.86	96.67	100.96	4007.0	7(0:5)
								rota	I = Sum(2				1205.2	(219)
	I totals	fuel use	d main	system	1					k'	Wh/year	[kWh/yea	,
Space	nealing	iuei use	u, maili	System	1							l	2212.41	



Water heating fuel used 1205.2 Electricity for pumps, fans and electric keep-hot central heating pump: (230c)120 boiler with a fan-assisted flue (230e)45 sum of (230a)...(230g) = Total electricity for the above, kWh/year 165 (231)Electricity for lighting (232)207.61 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)0.216 477.88 (215) x Space heating (secondary) (263)0.519 0 (219) x Water heating (264)0.216 260.32 (261) + (262) + (263) + (264) =Space and water heating 738.2 (265)(231) x Electricity for pumps, fans and electric keep-hot (267)0.519 85.64 (232) x Electricity for lighting (268)0.519 107.75 sum of (265)...(271) =Total CO2, kg/year (272)931.59

 $(272) \div (4) =$

Dwelling CO2 Emission Rate

El rating (section 14)

(273)

(274)

21.14

86



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Ground floor Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ Dwelling volume $ \begin{array}{cccccccccccccccccccccccccccccccccc$				Prope	rty Addres	s: Lean	Ground F	loor Sar	mple		
Area(m²)	Area(m²)										
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Total floor area TFA = (1a)+(1b)+(1c)+(1c)+(1d)+(1d)+(1d)+(1d)+(1d)+(1d)+(1d)+(1d	1. Overall dwelling dimension	ons:									
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)				1	Area(m²)		Av. He	ight(m)		Volume(m	3)
Dwelling volume Saa+(3b)+(3c)+(3d)+(3e)+(3n) = 170.44	Ground floor				70.43	(1a) x	2	2.42	(2a) =	170.44	(3a
2. Ventilation rate: main heating Number of chimneys 0	Total floor area TFA = (1a)+((1b)+(1c)+(1d)+(1e)+	.(1n)	70.43	(4)					
Mumber of chimneys	Dwelling volume			_		(3a)+(3	b)+(3c)+(3c	d)+(3e)+	(3n) =	170.44	(5)
Number of chimneys Number of open flues	2. Ventilation rate:										_
Number of chimneys					other		total			m³ per hou	ır
Number of intermittent fans Number of passive vents Number of flueless gas fires O x40 = 0 Air changes per ho Air changes per ho Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of chimneys				0	=	0	X	40 =	0	(6a
Number of passive vents \[0 \] \times 10 = 0 \] Number of flueless gas fires \[0 \] \times 10 = 0 \] Air changes per ho Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 \dots (5) = 0.18 If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 \times (14) \div 100] = 0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) \div 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 \times (19)] = 0.29 Infiltration rate incorporating shelter factor (21) = (18) \times (20) = 0.29	Number of open flues	0	+ 0	- +	0	=	0	x	20 =	0	(6b
Number of flueless gas fires Air changes per hor Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of intermittent fans						3	X	10 =	30	 (7a
Air changes per hor Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of passive vents						0	X	10 =	0	(7b
Air changes per ho Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of flueless gas fires						0	x	40 =	0	(7c
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	· ·									-	`
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.29									Air ch	anges per ho	our
Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = 0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0 0.29 Infiltration rate incorporating shelter factor	Infiltration due to chimneys,	flues and fans	s = (6a) + (6b)	o)+(7a)+(7	'b)+(7c) =		30		÷ (5) =	0.18	(8)
Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0 Infiltration rate incorporating shelter factor	If a pressurisation test has been	carried out or is i	ntended, pro	ceed to (17), otherwis	ا e continue	from (9) to		` '		`
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = 0.25 - [0.2 × (14) ÷ 100] = 0.25 - [Number of storeys in the o	lwelling (ns)								0	(9)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) ÷ 100] = Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = Infiltration rate incorporating shelter factor (21) = (18) × (20) = 0 Infiltration rate incorporating shelter factor	Additional infiltration							[(9)	-1]x0.1 =	0	(10
deducting areas of openings); if equal user 0.35If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00If no draught lobby, enter 0.05, else enter 00Percentage of windows and doors draught stripped0Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area4If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being usedNumber of sides sheltered3Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	Structural infiltration: 0.25	for steel or tin	nber frame	e or 0.3	of for maso	nry cons	truction			0	(11
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.29				ng to the g	greater wall a	rea (after					
If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - $[0.2 \times (14) \div 100] = 0$ Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = $[(17) \div 20] + (8)$, otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] = 0.78$ Infiltration rate incorporating shelter factor (21) = (18) × (20) = 0.29				or ∩ 1 (c.	oalod) ole	o ontor (١				7/40
Percentage of windows and doors draught stripped Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) $\div 20$]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 \times (19)] = 0.78 Infiltration rate incorporating shelter factor (21) = (18) \times (20) = 0.29	•	•	,	0.1 (3	calcu), cis	e enter c	,				=
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.29$	•			νd							= '
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0 0.38 0.38 13 14 15 15 16 17 17 18 18 18 19 19 10 10 10 10 10 10 10 10	-	id doors drad	giit strippe	u	0.25 - [0).2 x (14) ÷	1001 =		-		=
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.29								+ (15) =			=
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.38 0.38) ovproceed i	n cubic m	otroc po		, , ,	. , . ,	, ,	oroo		(16
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.29		•		•	•	•	nene or e	rivelope	alea		(17
Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(22) = (18) \times (20) =$ $(23) = (21) $,	ŕ					v is beina u	sed		0.38	(18
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78 $ Infiltration rate incorporating shelter factor $ (21) = (18) \times (20) = 0.29 $, proceding all or the		40.10 01 0	a aog. oo a j		, 10 20g u	-		3	(19
0.20					(20) = 1	- [0.075 x	(19)] =				(20
	Infiltration rate incorporating	shelter factor			(21) = (18) x (20) =	=			0.29	(21
•	Infiltration rate modified for n	nonthly wind s	speed								_
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec			` 	ın Jı	ul Aud	Sep	Oct	Nov	Dec		
Monthly average wind speed from Table 7	l l		-	1	1	, 1	1	1		I	

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34]	
Calculate effe		_	rate for t	he appli	cable ca	se	!		!				
If mechanic			andiv N. (2	2h) _ (22c) v Emy (c	auation (N	JE)) otho	auioo (22h) - (220)			0	(23a
If exhaust air h) = (23a)			0	(23b
If balanced with		•	•	_					21.) (001) [4 (00.)	0	(230
a) If balance	·					- ` ` 	- 	<u> </u>	 	23b) × [- ` 	i ÷ 100] I	(24a
(24a)m= 0	0	0	0	0	0	0	0	0	0		0	J	(246
b) If balance	ea mecha 0	anicai ve	ntilation	without	neat red	overy (N	//V) (24b	0 m = (22)	2b)m + (2 0	23b)	Ι ,	1	(241
(1)											0	J	(24)
c) If whole h	iouse ex n < 0.5 ×			•	-				5 x (23h))			
(24c)m = 0	0.07	0	0	0	0	0	0	0	0	0	0]	(240
d) If natural	ventilatio	n or wh	ole hous	e nositiv	/e innut	L ventilatio	n from l	oft				J	•
,	n = 1, the				•				0.5]				
(24d)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(240
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)	-	-	-		
(25)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. Heat losse	s and he	at loss r	naramete	⊃r.									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	ıe	AXU		k-value	<u> </u>	ΑΧk
	area	-	m		A ,r		W/m2		(W/I		kJ/m²-l		kJ/K
Doors					1.89	X	1.6	= [3.024				(26)
Windows Type	e 1				3.98	x1,	/[1/(1.4)+	0.04] =	5.28				(27)
Windows Type	e 2				5.97	x1,	/[1/(1.4)+	0.04] =	7.91				(27)
Floor					70.43	3 x	0.12	i	8.4516				(28)
Walls	40.0	3	11.84	4	28.19) x	0.16	= i	4.51	= i		7 F	(29)
Total area of e	elements	, m²			110.4	6							(31)
Party wall					45.23	x	0		0				(32)
Party ceiling					70.43	=						-	(32)
* for windows and	l roof wind	ows, use e	ffective wi	ndow U-va			ı formula 1	/[(1/U-valu	ıe)+0.04] a	L as given in	paragraph		(\
** include the are	as on both	sides of in	iternal wal	ls and par	titions	-							
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.18	(33)
Heat capacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design asses				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
Thermal bridg				ısina Ar	nendix k	<						10.35	(36)
if details of therm	•	,			•	`						10.33	(30)
Total fabric he			()	(-	-/			(33) +	(36) =			39.53	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 32.01	31.85	31.71	31.01	30.88	30.28	30.28	30.17	30.51	30.88	31.15	31.42]	(38)
Heat transfer	coefficier	nt, W/K					•	(39)m	= (37) + (37)	38)m	•	•	
			70.54	70.44	60.0	60.0	00.00			·	70.05	1	
(39)m= 71.53	71.38	71.23	70.54	70.41	69.8	69.8	69.69	70.04	70.41	70.67	70.95		



Heat Io	ss para	meter (H	HLP), W	m²K					(40)m	= (39)m ÷	- (4)			
40)m=	1.02	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1.01		
				I- 4-\						Average =	Sum(40) ₁	12 /12=	1	(40
oumbe I	i		nth (Tab	· ·		1	11		0	0-4	Nan	Date		
44\~	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(41
l1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41
4. Wa	ter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
		pancy, l		[1 - exp	(-0.0003	349 x (Ti	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		26		(42
	A £ 13.9				`	•		, ,,	`					
								(25 x N) to achieve		se target o		'.79		(43
		_			ater use, l	_	_	io acineve	a water us	se larger o	n			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
lot wate					Vd,m = fa									
14)m=	96.57	93.06	89.55	86.04	82.52	79.01	79.01	82.52	86.04	89.55	93.06	96.57		
	!		Į.		Į.		Į.	ļ.		Total = Su	ım(44) ₁₁₂ =	=	1053.51	(44
nergy o	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,ı	n x nm x D	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
l5)m=	143.21	125.25	129.25	112.68	108.12	93.3	86.46	99.21	100.4	117	127.72	138.69		_
inatant	anaaya w	ator hooti	na ot noin	of upo (no	hot woto	r otorogo)	ontor O in	boxes (46		Total = Su	ım(45) ₁₁₂ =	=	1381.32	(4
										·				/4
l6)m= Vater	21.48 storage	18.79 loss:	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.8		(4)
	_		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
comr	nunity h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)					l	
Otherw	ise if no	stored	hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage					(1.14.11	<i>,</i> , , ,						Ī	
•					or is kno	wn (kvvi	n/day):					0		(48
•			m Table					(10)				0		(49
			storage	-	ear loss fact	or is not		(48) x (49)) =			0		(50
•				-	le 2 (kW							0		(5
	-	_	ee secti	on 4.3										
		from Ta		01								0		(52
•			m Table									0		(5:
٠.			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54
	`	54) in (5	•	for oach	month			//E6\m - /	EE\ ~ (41)			0		(5
ı			culated t				ı	((56)m = (1	1			Ī	/ E
66)m=	0	0	0	0	0 m = (56)m	0	0	0) also (5)	0 7\m = (56)	0 m whore (0	0 m Append	iv ⊔	(50
					· · ·	1		· · ·			1			
57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(5
		•	nual) fro									0		(5
					,	•	. ,	65 × (41)		(1.	-1-1			
` ı				i		i		ng and a		i	- 		1	/-
9)m=	0	0	0	0	0	0	0	0	0	0	0	0		(5



Combi loss calculated for each month (61)m = (60) - 3.05 x (41)m = (60) - 3.05 x (45)m + (46)m + (57)m + (69)m + (61)m (61)m (82)m = (8.21 x 42.83 42.83 45.83 45.83 45.81 45.81 (61) m (62)m = (9.24 x 48.83 45.83 45.83 45.81 45.81 (62) m (62)m = (9.24 x 48.83 45.83 45.83 45.83 45.84 (73.61 187.91) (62)m = (9.24 x 48.83 48
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m = 192.42 168.09 174.88 155.11 150.18 132.27 126.72 141.27 142.83 162.64 173.61 187.91 (62) Solar PHW input calculated using Appendix Gor 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) Gayline (63)
(62) (62) (63) (74,88 155,11 150,18 132,27 126,72 141,27 142,83 162,64 173,61 187,91 (62)
Control Cont
Companies Comp
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Common Number Common Numbe
Output from water heater (64)m= 117.3 102.13 109.09 105.96 109.02 99.33 97.47 106.92 107.75 112.17 108.69 114.29 Output from water heater (annual) 1290.12 (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 = 59.92 52.36 54.38 48.07 46.46 40.76 38.81 43.5 43.99 50.31 53.94 58.42 (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 = 135.39 13
Company 117.3 102.13 109.09 105.96 109.02 99.33 97.47 106.92 107.75 112.17 108.69 114.29 1290.12 (64)
Coulput from water heater (annual) 1290.12 (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=
(65)m= 59.92 52.36 54.38 48.07 46.46 40.76 38.81 43.5 43.99 50.31 53.94 58.42 (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
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
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
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)m=
(67) (67) (67) (67) (67) (67) (67) (67)
(67) (67) (67) (67) (67) (67) (67) (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 295.97 299.04 291.3 274.82 254.03 234.48 221.42 218.35 226.09 242.56 263.36 282.91 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(68)m= 295.97 299.04 291.3 274.82 254.03 234.48 221.42 218.35 226.09 242.56 263.36 282.91 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(69)m= 50.8 50.8 50.8 50.8 50.8 50.8 50.8 50.8
(70)m= 10 10 10 10 10 10 10 10 10 10 10 10 10
(70)m= 10 10 10 10 10 10 10 10 10 10 10 10 10
(71)m=
(71)m=
(72)m= 80.54 77.91 73.1 66.77 62.45 56.62 52.17 58.47 61.1 67.62 74.92 78.52 (72)
(72)m= 80.54 77.91 73.1 66.77 62.45 56.62 52.17 58.47 61.1 67.62 74.92 78.52 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
and the second s
(73)m= 528.11 523.44 503.32 472.5 441.07 412.78 396.55 404.88 422.82 453.84 488.24 514.3 (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)
North 0.9x 0.77 x 3.98 x 10.63 x 0.76 x 0.7 = 15.6 (74)
North 0.9x 0.77 x 3.98 x 20.32 x 0.76 x 0.7 = 29.82 (74)
North $0.9x$ 0.77 \times 3.98 \times 34.53 \times 0.76 \times 0.7 = 50.67 (74)



N 1 41	_							,		_				_
North	0.9x	0.77	X	3.9	8	X	55.46	X	0.76	X	0.7	=	81.38	(74)
North	0.9x	0.77	X	3.9	8	X	74.72	X	0.76	X	0.7	=	109.63	(74)
North	0.9x	0.77	X	3.9	8	X	79.99	X	0.76	X	0.7	=	117.36	(74)
North	0.9x	0.77	X	3.9	8	X	74.68	X	0.76	X	0.7	=	109.58	(74)
North	0.9x	0.77	X	3.9	8	X	59.25	X	0.76	X	0.7	=	86.93	(74)
North	0.9x	0.77	X	3.9	8	X	41.52	X	0.76	X	0.7	=	60.92	(74)
North	0.9x	0.77	X	3.9	8	X	24.19	x	0.76	X	0.7	=	35.49	(74)
North	0.9x	0.77	X	3.9	8	X	13.12	X	0.76	X	0.7	=	19.25	(74)
North	0.9x	0.77	X	3.9	8	X	8.86	x	0.76	x	0.7	=	13.01	(74)
East	0.9x	1	X	5.9	7	X	19.64	x	0.76	X	0.7	=	43.23	(76)
East	0.9x	1	X	5.9	7	X	38.42	x	0.76	X	0.7	=	84.56	(76)
East	0.9x	1	x	5.9	7	X	63.27	x	0.76	x	0.7		139.26	(76)
East	0.9x	1	x	5.9	7	X	92.28	x	0.76	x	0.7	=	203.11	(76)
East	0.9x	1	x	5.9	7	X	113.09	х	0.76	x	0.7	=	248.92	(76)
East	0.9x	1	x	5.9	7	X	115.77	x	0.76	x	0.7	=	254.81	(76)
East	0.9x	1	x	5.9	7	X	110.22	x	0.76	×	0.7		242.59	(76)
East	0.9x	1	x	5.9	7	X	94.68	x	0.76	×	0.7		208.38	(76)
East	0.9x	1	x	5.9	7	X	73.59	x	0.76	x	0.7	=	161.97	(76)
East	0.9x	1	×	5.9	7	X	45.59	x	0.76	X	0.7	=	100.34	(76)
East	0.9x	1	x	5.9	7	X	24.49	x	0.76	x	0.7	=	53.9	(76)
East	0.9x	1	x	5.9	7	X	16.15	X	0.76	×	0.7	= =	35.55	(76)
	L							,						
Solar o	ains in	watts, cald	culated	for each	n montl	า		(83)m	n = Sum(74)m .	(82)m				
(83)m=	58.83		189.93	284.49	358.55	$\overline{}$	72.18 352.17	295	.32 222.89	135.84	73.15	48.56]	(83)
Total g	ains – i	nternal an	d solar	(84)m =	: (73)m	+ (83)m , watts	•	•		•	•	•	
(84)m=	586.94	637.82	693.25	756.99	799.62	7	84.96 748.71	700	0.2 645.71	589.68	3 561.39	562.86		(84)
7. Me	an inter	nal tempe	rature	(heating	seaso	n)						-		
				`			area from Tal	ole 9	, Th1 (°C)				21	(85)
Utilisa	ation fac	tor for gai	ns for li	iving are	a, h1,r	n (s	ee Table 9a)		, ,					
	Jan	Feb	Mar	Apr	May	<u> </u>	Jun Jul	Α	ug Sep	Oct	Nov	Dec]	
(86)m=	0.99	0.98	0.96	0.89	0.75		0.56 0.41	0.4	5 0.71	0.92	0.98	0.99		(86)
Mean	interna	l temnerat	ture in I	iving are	ea T1 (- follo	w steps 3 to 7	7 in T	able 9c)				1	
(87)m=	20.16	20.29	20.5	20.76	20.93	$\overline{}$	20.99 21	2		20.74	20.41	20.13]	(87)
		<u> </u>	!				!	ماماد (J	
(88)m=	20.07		20.07	20.08	20.08	$\overline{}$	velling from Ta	20.	<u> </u>	20.08	20.08	20.08	1	(88)
		<u> </u>	!					l	20.03	20.00	20.00	20.00		(00)
						_	m (see Table	T _					1	(00)
(89)m=	0.99	0.98	0.95	0.87	0.7		0.48 0.33	0.3	0.63	0.9	0.97	0.99	J	(89)
Mean	interna	l temperat	ture in t	he rest	of dwel	ling	T2 (follow ste	eps 3	to 7 in Tabl	e 9c)			1	
(90)m=	18.97	19.15	19.46	19.81	20.02	2	20.09	20.		19.8	19.34	18.94		(90)
									f	LA = Liv	ring area ÷ (4) =	0.42	(91)
									41 A) TO					

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



(92)m= 19.47	19.62	19.89	20.21	20.4	20.46	20.47	20.47	20.43	20.19	19.78	19.43		(92)
Apply adjustm	nent to th	ne mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m= 19.32	19.47	19.74	20.06	20.25	20.31	20.32	20.32	20.28	20.04	19.63	19.28		(93)
8. Space heat	ting requ	uirement											
Set Ti to the r			•		ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation	i												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	Ť		- I	0.74	0.5	0.05	2.00	0.05	0.0	0.07	0.00		(04)
(94)m= 0.98	0.97	0.95	0.86	0.71	0.5	0.35	0.39	0.65	0.9	0.97	0.99		(94)
Useful gains, (95)m= 577.5	620.95	655.22	654.78	+)m 566.32	394.31	259.06	272.2	417.13	527.88	544.67	555.42		(95)
(95)m= 577.5 Monthly avera						259.06	212.2	417.13	321.00	344.07	555.42		(90)
(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										7.1	4.2		(00)
(97)m= 1074.09	-	943.06	786.96	601.73	398.55	259.47	272.99	433.17	664.96	885.66	1070.04		(97)
Space heating											1070.04		(01)
(98)m= 369.46	281.74	214.15	95.17	26.34	0	0.02	0	0	101.98	245.51	382.88		
(66)							_	l per year				1717.24	(98)
0	· ·		1.14/1. / 2	1			Tota	i per year	(ICVIII) your) = Odin(o	0)15,912		╡``
Space heating	g require	ement in	kvvn/m²	/year								24.38	(99)
9a. Energy req	uiremen	its – Indi	vidual he	eating sy	ystems i	ncluding	micro-C	HP)					
Space heatin	_			, .									7 ,,,,
Fraction of sp			_		mentary	-						0	(201)
Fraction of sp	ace hea	t from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of tot	al heatir	ng from r	main cuc										
Efficiency of r		5	nam sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficiency of i	nain spa		-				(204) = (204)	02) x [1 –	(203)] =			90.9	(204)
Efficiency of s	•	ice heati	ng syste	em 1	g system		(204) = (20	02) x [1 –	(203)] =				╡`
Efficiency of s	econda	ry/supple	ng syste	em 1 y heating		ı, %		, -		Nov	Dec	90.9	(206)
•	Feb	ry/supple	ng systeementary	em 1 y heating May	Jun		(204) = (2 ¹)	02) × [1 -	(203)] =	Nov	Dec	90.9	(206)
Efficiency of s	Feb	ry/supple	ng systeementary	em 1 y heating May	Jun	ı, %		, -		Nov 245.51	Dec 382.88	90.9	(206)
Efficiency of s Jan Space heating 369.46	Feb g require	mar Mar 214.15	ng syste ementary Apr alculated 95.17	em 1 y heating May d above) 26.34	Jun	n, % Jul	Aug	Sep	Oct			90.9	(206) (208) ar
Efficiency of s Jan Space heating	Feb g require	mar Mar 214.15	ng syste ementary Apr alculated 95.17	em 1 y heating May d above) 26.34	Jun	n, % Jul	Aug	Sep	Oct			90.9	(206)
Efficiency of s Jan Space heating 369.46 (211)m = {[(98)	Feb g require 281.74	Mar Mar (c. 214.15 4)] } x 1	ng syste ementary Apr alculated 95.17 00 ÷ (20	em 1 y heating May d above) 26.34	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51 270.09	382.88	90.9	(206) (208) ar
Jan Space heating 369.46 (211)m = {[(98) 406.45]	Feb g require 281.74 m x (20 309.95	Mar ement (called 14.15 4)] } x 1	ng systementary Apr alculated 95.17 00 ÷ (20 104.7	m 1 y heating May d above) 26.34 6) 28.98	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51 270.09	382.88	90.9 0 kWh/ye	(206) (208) ar
Space heating [211)m = {[(98)] 406.45	Feb g require 281.74)m x (20 309.95 g fuel (se	Mar ement (c. 214.15 4)] } x 1 235.59	Apr Alculated 95.17 00 ÷ (20 104.7	m 1 y heating May d above) 26.34 6) 28.98	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51 270.09	382.88	90.9 0 kWh/ye	(206) (208) ar
Jan Space heating 369.46 (211)m = {[(98) 406.45]	Feb g require 281.74)m x (20 309.95 g fuel (se	Mar ement (c. 214.15 4)] } x 1 235.59	Apr Alculated 95.17 00 ÷ (20 104.7	m 1 y heating May d above) 26.34 6) 28.98	Jun) 0	n, % Jul 0	Aug 0	Sep 0	Oct 101.98	245.51 270.09	382.88	90.9 0 kWh/ye	(206) (208) ar
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (se 11)] } x 1	Mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7	em 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar
Efficiency of s Jan Space heating 369.46 (211)m = {[(98)] 406.45 Space heating = {[(98)m x (20) (215)m=0	Feb g require 281.74)m x (20 309.95 g fuel (se 11)] } x 10	Mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7	em 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74)m x (20 309.95 g fuel (se 1)] } x 10 0	Mar Mar	Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/68)	m 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Jan Space heating 369.46 (211)m = {[(98)	Feb g require 281.74)m x (20 309.95 g fuel (se 1)] } x 10 0	Mar Mar	Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/68)	m 1 y heating May d above) 26.34 6) 28.98 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) =Sum(2	245.51 270.09 211) _{15,1012}	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Space heating Space heating [198] Space heating [198] Space heating [198] Space heating [198] Water heating Output from wa	Feb g require 281.74 mx (20 309.95 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] }	Mar ement (calculater (calcula	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/// 8) 0	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) = Sum(2	245.51 270.09 211) _{15,1012} 0	382.88	90.9 0 kWh/ye	(206) (208) ar (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 mx (20 309.95 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] } x 10 0 mx (20 1)] }	Mar ement (calculater (calcula	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/// 8) 0	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 101.98 112.19 ar) = Sum(2	245.51 270.09 211) _{15,1012} 0	382.88	90.9 0 kWh/ye	(206) (208) ar (211) (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (set 10)] } x 10 atter heat 87.97 heating,	mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 /), kWh/n 8) 0 ulated at 105.96 85.28 onth	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0 0 99.33	0 0 97.47	Aug 0 Tota 106.92	Sep 0 0 1 (kWh/yea 107.75	Oct 101.98 112.19 ar) =Sum(2 0 ar) =Sum(2	245.51 270.09 211) _{15,1012} 0 215) _{15,1012}	382.88 421.21 = 0 = 114.29	90.9 0 kWh/ye	(206) (208) ar (211) (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (set 11)] } x 10 0 contact heat 102.13 atter heat 87.97 heating, m x 100	mar ement (calculater (calcula	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 //), kWh/n 8) 0 ulated at 105.96 85.28 onth	em 1 y heating May d above) 26.34 6) 28.98 month 0 0 0000 109.02	Jun 0 0 0 99.33	0 0 97.47 80.8	0 Tota 106.92 80.8	0 0 1 (kWh/yea 107.75	Oct 101.98 112.19 ar) =Sum(2 0 ar) =Sum(2 112.17 85.31	245.51 270.09 211) _{15,1012} 0 215) _{15,1012} 108.69	382.88 421.21 = 0 = 114.29 88.36	90.9 0 kWh/ye	(206) (208) ar (211) (211)
Jan Space heating 369.46 (211)m = {[(98) 406.45	Feb g require 281.74 m x (20 309.95 g fuel (set 10)] } x 10 atter heat 87.97 heating,	mar Mar	ng systementary Apr alculated 95.17 00 ÷ (20 104.7 /), kWh/n 8) 0 ulated at 105.96 85.28 onth	em 1 y heating May d above) 26.34 6) 28.98 month 0	Jun 0 0 0 99.33	0 0 97.47	0 0 Tota 106.92 80.8	Sep 0 0 1 (kWh/yea 107.75	Oct 101.98 112.19 0 ar) =Sum(2 112.17 85.31	245.51 270.09 211) _{15,1012} 0 215) _{15,1012}	382.88 421.21 = 0 = 114.29	90.9 0 kWh/ye	(206) (208) ar (211) (211)



Annual totals Space heating fuel used, main system 1		kWh/year	•	kWh/year 1889.15	1
Water heating fuel used				1524.57]]
Electricity for pumps, fans and electric keep-	hot				J
central heating pump:			120	1	(230c)
boiler with a fan-assisted flue			45	,]	(230e)
Total electricity for the above, kWh/year		sum of (230a)(230g) =		165	(231)
Electricity for lighting				322.66	(232)
10a. Fuel costs - individual heating systems	s:				_
	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	65.74	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	53.06	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	21.76	(249)
(if off-peak tariff, list each of (230a) to (230g) Energy for lighting	separately as applica	· · · · · 	ding to x 0.01 =	Table 12a 42.56	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (25	54) as needed				
)(247) + (250)(254) =			303.12	(255)
11a. SAP rating - individual heating systems	S				
Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF) [(255	5) x (256)] ÷ [(4) + 45.0] =			1.1	(257)
SAP rating (Section 12)				84.61	(258)
12a. CO2 emissions – Individual heating sy	stems including micro	-CHP			
	Energy kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.216	=	408.06	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	329.31	(264)
Space and water heating	(261) + (262) + (2	63) + (264) =		737.36	(265)
Electricity for pumps, fans and electric keep-	hot (231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	167.46	(268)
Total CO2, kg/year		sum of (265)(271) =		990.46	(272)
CO2 emissions per m ²		(272) ÷ (4) =		14.06	(273)



El rating (section 14)

13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	2304.77 (261)
Space heating (secondary)	(215) x	3.07	0 (263)
Energy for water heating	(219) x	1.22	1859.98 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4164.74 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	506.55 (267)
Electricity for lighting	(232) x	0 =	990.56 (268)
'Total Primary Energy	sum	of (265)(271) =	5661.85 (272)
Primary energy kWh/m²/year	(272	2) ÷ (4) =	80.39 (273)



Assessor Name: Peter Mitchell **Stroma Number:** STRO007945 **Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.3.6

Р	roperty Addres	s: Lean C	Fround F	loor Sar	nple		
Address:							
1. Overall dwelling dimensions:							
	Area(m²)	_	Av. He	ight(m)	_	Volume(m³))
Ground floor	70.43	(1a) x	2	.42	(2a) =	170.44	(3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1r)$	70.43	(4)					
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+	.(3n) =	170.44	(5)
2. Ventilation rate:							
main secondar heating heating	y other		total			m³ per hou	٢
Number of chimneys 0 + 0	+ 0	= [0	X (40 =	0	(6a)
Number of open flues 0 + 0	+ 0	<u> </u>	0	x :	20 =	0	(6b)
Number of intermittent fans			3	X.	10 =	30	(7a)
Number of passive vents		Ī	0	x	10 =	0	(7b)
Number of flueless gas fires		Ī	0	X (40 =	0	(7c)
		_				_	
					Air ch	nanges per ho	ur
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7		[30		÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed	d to (17), otherwise	e continue f	rom (9) to (16)		_	٦,
Number of storeys in the dwelling (ns) Additional infiltration				[(0)	-1]x0.1 =	0	(9)
Structural infiltration: 0.25 for steel or timber frame or	0.35 for maso	nrv const	ruction	[(9)]	-1]XU.1 =	0	(10)
if both types of wall are present, use the value corresponding to		•	dollon			0	(''')
deducting areas of openings); if equal user 0.35	J	`					_
If suspended wooden floor, enter 0.2 (unsealed) or 0.	1 (sealed), els	e enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0						0	(13)
Percentage of windows and doors draught stripped						0	(14)
Window infiltration	0.25 - [0	.2 x (14) ÷	100] =			0	(15)
Infiltration rate	(8) + (10	0) + (11) + (12) + (13) -	+ (15) =		0	(16)
Air permeability value, q50, expressed in cubic metre	s per hour per	square m	etre of e	nvelope	area	4	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$	3), otherwise (18) =	= (16)				0.38	(18)
Air permeability value applies if a pressurisation test has been don	e or a degree air p	ermeability	is being us	sed			_
Number of sides sheltered	(00)	fo 075 /	40)1			3	(19)
Shelter factor		- [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (1	8) x (20) =				0.29	(21)
Infiltration rate modified for monthly wind speed	, <u>, , , , , , , , , , , , , , , , , , </u>					1	
Jan Feb Mar Apr May Jun	Jul Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed from Table 7					•	,	

4.9

1.23

4.4

1.1

4.3

1.08

3.8

0.95

3.8

0.95

3.7

0.92

4

4.3

1.08

4.5

1.12

4.7

1.18

(22)m=

(22a)m=

5.1

1.27

Wind Factor $(22a)m = (22)m \div 4$

1.25



Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34]	
Calculate effe		_	rate for t	he appli	cable ca	se	!		!				
If mechanic			andiv N. (2	2h) _ (22c) v Emy (c	auation (N	JE)) otho	auioo (22h) - (220)			0	(23a
If exhaust air h) = (23a)			0	(23b
If balanced with		•	•	_					21.) (001) [4 (00.)	0	(230
a) If balance	·					- ` ` 	- 	<u> </u>	 	23b) × [- ` 	i ÷ 100] I	(24a
(24a)m= 0	0	0	0	0	0	0	0	0	0		0	J	(246
b) If balance	ea mecha 0	anicai ve	ntilation	without	neat red	overy (N	//V) (24b	0) m = (22)	2b)m + (2 0	23b)	Ι ,	1	(24)
(1)											0	J	(24)
c) If whole h	iouse ex n < 0.5 ×			•	-				5 x (23h))			
(24c)m = 0	0.07	0	0	0	0	0	0	0	0	0	0]	(240
d) If natural	ventilatio	n or wh	ole hous	e nositiv	/e innut	L ventilatio	n from l	oft				J	•
,	n = 1, the				•				0.5]				
(24d)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(240
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)	-	-	-		
(25)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. Heat losse	s and he	at loss r	naramete	⊃r.									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	ıe	AXU		k-value	<u> </u>	ΑΧk
	area	-	m		A ,r		W/m2		(W/I		kJ/m²-l		kJ/K
Doors					1.89	X	1.6	= [3.024				(26)
Windows Type	e 1				3.98	x1,	/[1/(1.4)+	0.04] =	5.28				(27)
Windows Type	e 2				5.97	x1,	/[1/(1.4)+	0.04] =	7.91				(27)
Floor					70.43	3 x	0.12	i	8.4516				(28)
Walls	40.0	3	11.84	4	28.19) x	0.16	= i	4.51	= i		7 F	(29)
Total area of e	elements	, m²			110.4	6							(31)
Party wall					45.23	x	0		0				(32)
Party ceiling					70.43	=						-	(32)
* for windows and	l roof wind	ows, use e	ffective wi	ndow U-va			ı formula 1	/[(1/U-valu	ıe)+0.04] a	L as given in	paragraph		(\
** include the are	as on both	sides of in	iternal wal	ls and par	titions	-							
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				29.18	(33)
Heat capacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design asses				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
Thermal bridg				ısina Ar	nendix k	<						10.35	(36)
if details of therm	•	,			•	`						10.33	(30)
Total fabric he			()	(-	-/			(33) +	(36) =			39.53	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 32.01	31.85	31.71	31.01	30.88	30.28	30.28	30.17	30.51	30.88	31.15	31.42]	(38)
Heat transfer	coefficier	nt, W/K					•	(39)m	= (37) + (37)	38)m	•	•	
			70.54	70.44	60.0	60.0	00.00			·	70.05	1	
(39)m= 71.53	71.38	71.23	70.54	70.41	69.8	69.8	69.69	70.04	70.41	70.67	70.95		



Heat Id	ss para	meter (l	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.02	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1.01		
									,	Average =	Sum(40) ₁ .	12 /12=	1	(40
Numbe			nth (Tab						0		NI.	D		
(44)m-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(41
41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41
4. Wa	iter heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
if TF	ed occu A > 13.9 A £ 13.9	9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		26		(42
nnua Reduce	l averag	e hot wa al average	ater usaç hot water	usage by	5% if the a	lwelling is	designed t			se target o		.79		(43
ot more	e that 125	litres per	person pei	<i>day (all</i> w	ater use, l	hot and co	ld)			1				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			r day for ea						1	1				
44)m=	96.57	93.06	89.55	86.04	82.52	79.01	79.01	82.52	86.04	89.55	93.06	96.57		–
nergy (content of	hot water	used - cal	culated m	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1053.51	(44
45)m=	143.21	125.25	129.25	112.68	108.12	93.3	86.46	99.21	100.4	117	127.72	138.69		
,			<u> </u>	l	<u> </u>	l	<u> </u>	l		I Total = Su	m(45) ₁₁₂ =		1381.32	(45
instan	taneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)			L		
46)m=	21.48	18.79	19.39	16.9	16.22	14	12.97	14.88	15.06	17.55	19.16	20.8		(46
	storage		الماليطان		olor or M	WHDC	otoro ao	within o		aal				
Ū		` ′) includir				Ū		allie ves	SEI		0		(47
	•	-	and no ta hot wate		_			, ,	ers) ente	er '0' in <i>(</i>	(47)			
	storage			. (o. o, o		,			
a) If m	anufact	urer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48
empe	rature fa	actor fro	m Table	2b								0		(49
			storage	-				(48) x (49)) =			0		(50
			eclared of	-										(E
		-	factor free section		e z (KVV	n/nue/ua	iy <i>)</i>					0		(51
	e factor	_										0		(52
empe	rature fa	actor fro	m Table	2b								0		(53
ergy	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		(55
Vater	storage	loss cal	culated t	for each	month			((56)m = (55) × (41)	m				
56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56
cylinde	er contains	dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	x H	
57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57
Primar	v circuit	loss (ar	nnual) fro	m Tabla	·	•				•		0		(58
	-	•	culated			59)m = ((58) ÷ 36	65 × (41)	m					
	•		rom Tab		,	•	` '	, ,		r thermo	stat)			
59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(5



Combi	loss ca	lculated	for each	month (61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	49.21	42.83	45.63	42.43	42.05	38.97	40.26	42.05	42.43	45.63	45.89	49.21]	(61)
Total h	eat reg	uired for	water h	eating ca	alculated	l for eacl	n month	(62)m	= 0.85 × ((45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m=	192.42	168.09	174.88	155.11	150.18	132.27	126.72	141.27		162.64	173.61	187.91]	(62)
Solar Di		calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '	0' if no sola	r contributi	on to wate	er heating)	ı	
(add a	dditiona	l lines if	FGHRS	and/or V	VWHRS	applies	see Ap	pendix	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	37.61	32.69	31.68	23.69	15.09	9.73	9.24	10.45	10.53	25.73	32.5	37.28	•	(63) (G2)
WWHR	37.65	-33.13	-33.81	-27.84	-25.86	-21.34	-18.07	-21.88	-22.51	-27.81	-32.2	-36.39		(63) (G10)
Output	from w	ater hea	ter											
(64)m=	114.8	100.21	107.2	101.55	107.21	99.33	97.47	106.92	107.75	106.9	106.71	111.87		
			•	•		•		Ou	tput from w	ater heate	r (annual) ₁	12	1267.93	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	59.92	52.36	54.38	48.07	46.46	40.76	38.81	43.5	43.99	50.31	53.94	58.42		(65)
inclu	ide (57)	m in cal	culation	of (65)m	only if o	ylinder is	s in the o	dwelling	g or hot w	ater is fr	om com	munity h	neating	
5. Int	ternal ga	ains (see	Table 5	and 5a):									
Metab	olic gain	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83	112.83		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	^r L9a), a	lso see	Table 5				_	
(67)m=	18.27	16.23	13.2	9.99	7.47	6.31	6.81	8.86	11.89	15.09	17.61	18.78		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5		-		
(68)m=	198.3	200.36	195.17	184.13	170.2	157.1	148.35	146.29	151.48	162.52	176.45	189.55		(68)
Cookir	ng gains	(calcula	ited in A	ppendix	L, equat	tion L15	or L15a)), also s	see Table	5			_	
(69)m=	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28	34.28		(69)
Pumps	and fai	ns gains	(Table 5	5a)									_	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)							_	
(71)m=	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26	-90.26		(71)
Water	heating	gains (T	able 5)										_	
(72)m=	80.54	77.91	73.1	66.77	62.45	56.62	52.17	58.47	61.1	67.62	74.92	78.52		(72)
Total i	nternal	gains =	•			(66)	m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	1)m + (72))m	_	
(73)m=	363.96	361.34	348.31	327.74	306.97	286.87	274.18	280.47	291.31	312.08	335.83	353.69		(73)
	lar gains													
_			_		Table 6a			itions to d	convert to th	ne applicab		tion.		
Orienta		Access F Γable 6d		Area m²		Flu Tak	x ole 6a		g_ Table 6b	т.	FF able 6c		Gains (W)	
N 1 (1	_						ole oa	. –					` '	1
North	0.9x	0.77	×	3.9			0.63	x	0.76		0.7	=	15.6	<u> </u> (74)
North	0.9x	0.77	×	3.9		-	0.32	x	0.76	x	0.7	=	29.82	<u> </u> (74)
North	0.9x	0.77	X	3.9	8	x 3	4.53	x	0.76	x	0.7	=	50.67	(74)



North	0.9x	0.77		x	3.98		x	55.46	X	0.76	X	0.7	=	81.38	(74)
North	0.9x	0.77		x	3.98		x	74.72	x	0.76	X	0.7	=	109.63	(74)
North	0.9x	0.77		x	3.98		x	79.99	x	0.76	X	0.7	=	117.36	(74)
North	0.9x	0.77		X	3.98		x	74.68	X	0.76	X	0.7	=	109.58	(74)
North	0.9x	0.77		x	3.98		x	59.25	x	0.76	X	0.7	=	86.93	(74)
North	0.9x	0.77		x	3.98		x	41.52	x	0.76	X	0.7	=	60.92	(74)
North	0.9x	0.77		x	3.98		x	24.19	X	0.76	x	0.7	=	35.49	(74)
North	0.9x	0.77		x	3.98		x	13.12	x	0.76	X	0.7	=	19.25	(74)
North	0.9x	0.77		x	3.98		x	8.86	X	0.76	X	0.7	=	13.01	(74)
East	0.9x	1		X	5.97		x	19.64	X	0.76	X	0.7	=	43.23	(76)
East	0.9x	1		X	5.97		x	38.42	X	0.76	X	0.7	=	84.56	(76)
East	0.9x	1		X	5.97		x	63.27	X	0.76	X	0.7	=	139.26	(76)
East	0.9x	1		x	5.97		x	92.28	X	0.76	X	0.7	=	203.11	(76)
East	0.9x	1		X	5.97		x	113.09	X	0.76	X	0.7	=	248.92	(76)
East	0.9x	1		X	5.97		x	115.77	X	0.76	X	0.7	=	254.81	(76)
East	0.9x	1		X	5.97		x	110.22	X	0.76	X	0.7	=	242.59	(76)
East	0.9x	1		X	5.97		x	94.68	X	0.76	X	0.7	=	208.38	(76)
East	0.9x	1		X	5.97		X	73.59	X	0.76	X	0.7	=	161.97	(76)
East	0.9x	1		X	5.97		x	45.59	X	0.76	X	0.7	=	100.34	(76)
East	0.9x	1		X	5.97		x	24.49	X	0.76	X	0.7	=	53.9	(76)
East	0.9x	1		X	5.97		X	16.15	X	0.76	X	0.7	=	35.55	(76)
Solar g		watts, ca	alculat	ed	for each n		$\overline{}$		(83)m	n = Sum(74)m	(82)m			Ī	
(83)m=	58.83	114.38	189.9	_		58.55		72.18 352.17	295	.32 222.89	135.8	73.15	48.56		(83)
j				_	` 		·	33)m , watts	T ===	70 5440	1 447 0	1 400 00	1,00,05	1	(84)
(84)m=	422.79	475.72	538.2	_	!_	65.51		59.05 626.35	575	.78 514.2	447.9	408.98	402.25		(04)
					heating se										_
•		•		•			-	area from Tal	ole 9	, Th1 (°C)				21	(85)
Utilisa				\neg			Ť	ee Table 9a)	1	1				1	
	Jan	Feb	Ma	\rightarrow		May	-	Jun Jul	_	ug Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99		0.95	0.84	(0.65 0.49	0.5	0.82	0.97	1	1		(86)
Mean	internal	temper	ature	in li	ving area	T1 (f	ollo	w steps 3 to 7	7 in T	able 9c)	,		,	•	
(87)m=	19.94	20.08	20.3	1	20.63 2	20.87	2	0.98 21	20.	99 20.92	20.59	20.21	19.92		(87)
Temp	erature	during h	eating	у ре	eriods in re	est of	dw	elling from Ta	able 9	9, Th2 (°C)					
(88)m=	20.07	20.07	20.07	7	20.08 2	20.08	2	0.09 20.09	20.	09 20.09	20.08	20.08	20.08		(88)
Utilisa	ation fac	tor for g	ains fo	or re	est of dwe	lling,	h2,	m (see Table	9a)						
(89)m=	1	0.99	0.98		0.93	0.79		0.39	0.4	0.75	0.96	0.99	1		(89)
Mean	internal	temper	ature	in t	he rest of	dwell	ina	T2 (follow ste	eps 3	to 7 in Tab	le 9c)	-		-	
(90)m=	18.66	18.85	19.2	_		9.96	Ť	0.08 20.09	20.		19.61	19.06	18.62		(90)
	·!						-				fLA = Liv	ring area ÷ (4) =	0.42	(91)
														·	

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



(92)m= 19.	19 19.36	19.66	20.05	20.34	20.45	20.47	20.46	20.39	20.02	19.54	19.16		(92)
Apply adju	stment to t	he mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m= 19.0	04 19.21	19.51	19.9	20.19	20.3	20.32	20.31	20.24	19.87	19.39	19.01		(93)
8. Space I	neating req	uirement											
	ne mean in				ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	ion factor f							1		ı	- 1		
Ja	_	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	factor for g	1						I I		I			(0.4)
(94)m= 1		0.98	0.93	0.8	0.59	0.41	0.47	0.76	0.96	0.99	1		(94)
	ns, hmGm		<u> </u>	_	200.54	250.25	070.74	202.20	400.50	405.0	404.4		(OE)
(95)m= 421		527.03	569.24	532.4	388.51	258.35	270.71	393.36	429.52	405.8	401.1		(95)
	verage exte	1				40.0	40.4	444	40.0	7.4	40		(06)
(96)m= 4.3		6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	rate for me	an intern 926.76	ai tempe 776.2	597.6	∟m , vv = 397.84	=[(39)m 2 259.37		- (96)m 430.27	652.54	868.24	1050.70		(97)
` '							272.79			<u> </u>	1050.78		(91)
(98)m= 471	ating requir	297.39	149.01	48.51	0	n = 0.02	4 X [(97])m – (95 0	165.93	332.96	483.36		
(90)111= 47 1	309.14	297.39	149.01	40.51	0	U						0047.4	(98)
							Tota	l per year	(Kvvn/year) = Sum(9	6) 15,912 =	2317.4	╡
Space hea	ating requir	ement in	kWh/m²	/year								32.9	(99)
9a. Energy	requireme	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space he	_												_
Fraction o	f space hea	at from se	econdary	y/supple	mentary	system						0	(201)
Fraction o	f space hea	at from m	ain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction o	f total heati	ng from i	main sys	stem 1			(004) (0						
Efficiency	- .						(204) = (2	02) × [1 –	(203)] =			1	(204)
	of main sp	ace heati	ng syste				(204) = (2	02) x [1 –	(203)] =			90.9	(204)
Efficiency	of main spa		0,	em 1	g system		(204) = (2	02) x [1 –	(203)] =				╡゛゛
	of seconda	ry/supple	ementar	em 1 y heating		ı, %		,	. , ,	Nov	Dec	90.9	(206)
Ja	of seconda	ry/supple Mar	ementar Apr	em 1 y heating May	Jun		(204) = (2 Aug	02) × [1 –	(203)] =	Nov	Dec	90.9	(206)
Ja	of seconda n Feb ating requir	ry/supple Mar	ementar Apr	em 1 y heating May	Jun	ı, %		,	. , ,	Nov 332.96	Dec 483.36	90.9	(206)
Ja Space hea	of secondary n Febuting requir 11 369.14	Mar Mar ement (c	Apr alculated	em 1 y heating May d above) 48.51	Jun	n, % Jul	Aug	Sep	Oct	!		90.9	(206) (208)
Ja Space hea	of secondary Febuting requir 369.14 (98)m x (20	Mar Mar ement (c	Apr alculated	em 1 y heating May d above) 48.51	Jun	n, % Jul	Aug	Sep	Oct	!		90.9	(206)
Ja Space hea 471 (211)m = {[of secondary Febuting requir 369.14 (98)m x (20	Mar ement (c 297.39 04)] } x 1	Apr alculated 149.01 00 ÷ (20	em 1 y heating May d above) 48.51	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9	(206) (208) ear (211)
Space hea 471 (211)m = {[518	of seconda n Feb ating requir 11 369.14 (98)m x (20 27 406.09	Mar ement (c 297.39 04)] } x 1 327.16	Apr alculated 149.01 00 ÷ (20 163.93	em 1 y heating May d above) 48.51 06) 53.37	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9 0 kWh/ye	(206) (208)
Space head 471. (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09	Mar ement (c 297.39)4)] } x 1 327.16	Apr alculated 149.01 00 ÷ (20 163.93	em 1 y heating May d above) 48.51 06) 53.37	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9 0 kWh/ye	(206) (208) ear (211)
Space hea 471 (211)m = {[518	of secondary of se	Mar ement (c 297.39)4)] } x 1 327.16	Apr alculated 149.01 00 ÷ (20 163.93	em 1 y heating May d above) 48.51 06) 53.37	Jun 0	n, % Jul 0	Aug 0	Sep 0	Oct 165.93	332.96 366.29	483.36 531.75	90.9 0 kWh/ye	(206) (208) ear (211)
Space head 471. (211)m = {[518] Space head 471.	of secondary of se	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8	m 1 y heating May d above) 48.51 66) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211)
Space head 471. (211)m = {[518 Space head 471. (215)m = 0	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8	m 1 y heating May d above) 48.51 66) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head 471. (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20 0	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/ 8)	m 1 y heating May d above) 48.51 06) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head 471. (211)m = {[518 Space head 471. (215)m = 0	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (secondary) 0 ating fuel (secondary) 1 0 ating mater hear	Mar ement (c 297.39) 4)] } x 1 327.16 econdary 00 ÷ (20 0	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/ 8)	m 1 y heating May d above) 48.51 06) 53.37 month	Jun 0 0	o 0	Aug 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012}	483.36 531.75 =	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21	Mar ement (c 297.39)4)] } x 1 327.16 econdary 00 ÷ (20 0)	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 0	em 1 y heating May d above) 48.51 66) 53.37 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0	90.9 0 kWh/ye	(206) (208) ear (211) (211)
Space head 471. (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21 of water hea of water h	Mar ement (c 297.39)4)] } x 1 327.16 econdary 00 ÷ (20 0)	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 0	em 1 y heating May d above) 48.51 66) 53.37 month 0	Jun 0 0	o 0	Aug 0 Tota 0 Tota	Sep 0 0 I (kWh/yea	Oct 165.93 182.54 ar) =Sum(2	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)
Space head (211)m = {[518] Space head = {[(98)m x (215)m= 0] Water head Output from 114 Efficiency contacts	of secondary of secondary required 11 369.14 (98)m x (20 27 406.09 406.09 406.09 100.21	Mar ement (c 297.39) 4)] } x 1 327.16 secondary 00 ÷ (20 0 107.2 ater 87.99	Apr alculated al 101.55	em 1 y heating May d above) 48.51 6) 53.37 month 0	Jun 0 0 0 99.33	0 0 97.47	Aug 0 Tota 106.92	Sep 0 0 I (kWh/yea 107.75	Oct 165.93 182.54 ar) =Sum(2 0 ar) =Sum(2	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0 =	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)
Space head [471] (211)m = {[518] Space head [472] Space head [472] Space head [472] (215)m = 0 Water head [472] Output from [114] Efficiency (217)m = 88.5 Fuel for was (219)m = (of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21 of water hea 73 88.54 ter heating 64)m x 100	Mar ement (c 297.39) 4)] } x 1 327.16 secondary 00 ÷ (20 0) 0 ster (calc 107.2 ater 87.99 , kWh/mc	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 0 ulated al 101.55 86.52 onth m	em 1 y heating May d above) 48.51 06) 53.37 month 0 0 0000e) 107.21	Jun 0 0 0 99.33	0 0 97.47 80.8	0 Tota 106.92 80.8	0 0 0 1 (kWh/yea 107.75	Oct 165.93 182.54 ar) =Sum(2 0 106.9 86.66	332.96 366.29 211) _{15,1012} 0 215) _{15,1012} 106.71	483.36 531.75 = 0 = 111.87 88.81	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)
Space head (211)m = {[518	of secondary n Feb ating requir 11 369.14 (98)m x (20 27 406.09 ating fuel (s (201)] } x 1 0 ating n water hea 8 100.21 of water hea 73 88.54 ter heating 64)m x 100	Mar ement (c 297.39) 4)] } x 1 327.16 secondary 00 ÷ (20 0) 0 ster (calc 107.2 ater 87.99 , kWh/mc	Apr alculated 149.01 00 ÷ (20 163.93 y), kWh/8 8) 0 ulated al 101.55 86.52 onth	em 1 y heating May d above) 48.51 6) 53.37 month 0	Jun 0 0 0 99.33	0 0 97.47	0 0 Tota 106.92 80.8	Sep 0 0 I (kWh/yea 107.75	Oct 165.93 182.54 ar) = Sum(2 0 106.9 86.66	332.96 366.29 211) _{15,1012} 0 215) _{15,1012}	483.36 531.75 = 0 =	90.9 0 kWh/ye 2549.4	(206) (208) (211) (211) (215)



Annual totals		14Mb/400		ls\A/b/ssor	
Space heating fuel used, main system 1		kWh/yea		kWh/year 2549.4	7
Water heating fuel used				1489.41	ĺ
Electricity for pumps, fans and electric keep-hot					_
central heating pump:			120		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of	(230a)(230g) =		165	(231)
Electricity for lighting				322.66	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/yea	ır
Space heating (main system 1)	•		etor =		ır](261)
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh		kg CO2/yea	,
	kWh/year (211) x	kg CO2/kWh	=	kg CO2/yea	(261)
Space heating (secondary)	kWh/year (211) x (215) x	0.216 0.519 0.216	=	kg CO2/yea	(261)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	0.216 0.519 0.216	=	kg CO2/yea 550.67 0 321.71	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (263)	kg CO2/kWh 0.216 0.519 0.216	= = =	kg CO2/yea 550.67 0 321.71 872.38	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (263) (261) x	kg CO2/kWh 0.216 0.519 0.216 0.519	= = =	kg CO2/yea 550.67 0 321.71 872.38 85.64	(261) (263) (264) (265) (267)

El rating (section 14)

Appendix C - Non- Domestic Results Tables



Cumulative Emissions & Savings

The following tables are presented in accordance with the advice presented within 'Energy Planning - Greater London Authority guidance on preparing energy assessments'.

	Carbon dioxide emissi buildings (Tonnes	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building		
Regulations Compliant Development	2.90	3.02
After energy demand reduction	2.41	3.02
After heat network / CHP	2.41	3.02
After renewable energy	1.87	3.02

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

	Regulated Carbon dioxide savings		
	(Tonnes CO ₂ / annum)	(%)	
Savings from energy demand reduction	0.50	17.09	
Savings from heat network / CHP	0.00	0.00	
Savings from renewable energy	0.54	18.59	
Total Cumulative Savings	1.04	35.68	
Total Target Savings	1.02	35.00	
Annual Surplus	0.02		

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

Results by Plot

Baseline

Baseline: Part L 2013 of the Building	Non-Domestic Total (Sum)	Commercial
Regulations Compliant Development	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	2.904	2.904

Be Lean

After energy demand reduction	Non-Domestic Total (Sum)	Commercial
	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	2.904	2.904
Be Lean	2.408	2.408
% Improvement	17.09	17.09

Be Lean & Clean

After heat network / CHP	Non-Domestic Total (Sum)	Commercial
	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	2.904	2.904
Be Lean & Clean	2.408	2.408
% Improvement	17.09	17.09

Be Lean, Clean & Green

After renewable energy	Non-Domestic Total (Sum)	Commercial
	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)	Cumulative CO ₂ Emissions (tonnes CO ₂ per annum)
Baseline	2.904	2.904
Be Lean, Clean & Green	1.868	1.868
% Improvement	35.68	35.68

Unregulated Emissions

Emissions from Sources not Regulated under	Non-Domestic Total (Sum)	Commercial
Part L of the Building Regulations (Tonnes CO2 / annum)	3.02	3.02

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

74 Church Road

As designed

Date: Thu Jul 28 11:20:01 2016

Administrative information

Building Details

Address: Barnes, London, SW13 0DQ

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3.3

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.5
Target CO₂ emission rate (TER), kgCO₂/m².annum	19.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	12.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _{a-Limit}	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.16	0.16	External Wall
Floor	0.25	0.12	0.12	Ground Floor
Roof	0.25	0.12	0.12	Roof/Internal Ceiling
Windows***, roof windows, and rooflights	2.2	1.4	1.4	W01 Lower
Personnel doors	2.2	1.5	1.5	W01 Lower - DOOR
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	4

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

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

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

Building services

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

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

1- New HVAC System (5 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	4	4.5	-	1.4	0.8
Standard value	2.5*	2.6	N/A	1.1^	0.65
Automatic moni	itoring & targeting w	ith alarms for out-of	-range values for th	is HVAC syster	n NO

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

1- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name		SFP [W/(I/s)]									UD officionou	
ID of system type	Α	В	С	D	E	F	G	Н	I	HR efficiency		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Commercial Unit 1	-	-	-	1.4	-	-	-	-	-	-	N/A	
Commercial Unit 2	-	-	-	1.4	-	-	-	-	-	-	N/A	
Commercial Unit 3	-	-	-	1.4	-	-	-	-	-	-	N/A	
Commercial Unit 4	-	-	-	1.4	-	-	-	-	-	-	N/A	
Commercial Unit 5	-	-	_	1.4	_	_	_	_	_	-	N/A	

General lighting and display lighting	Lumino	us effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial Unit 1	90	-	-	208
Commercial Unit 2	90	-	-	210
Commercial Unit 3	90	-	-	207
Commercial Unit 4	90	-	-	211

[^] Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

General lighting and display lighting	Lumino	us effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	21 3 22 2
Commercial Unit 5	90	41	-	208

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial Unit 1	NO (-47%)	NO
Commercial Unit 2	NO (-48%)	NO
Commercial Unit 3	NO (-47%)	NO
Commercial Unit 4	NO (-49%)	NO
Commercial Unit 5	NO (-66%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	139	139
External area [m²]	283	283
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	4	5
Average conductance [W/K]	93	140
Average U-value [W/m²K]	0.33	0.49
Alpha value* [%]	14.95	14.95

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

Building Use

% Area Building Type A1/A2 Retail/Financial and Professional services A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways

100 **B1 Offices and Workshop businesses**

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Inst.: Hospitals and Care Homes

C2 Residential Inst.: Residential schools

C2 Residential Inst.: Universities and colleges

C2A Secure Residential Inst.

Residential spaces

D1 Non-residential Inst.: Community/Day Centre

D1 Non-residential Inst.: Libraries, Museums, and Galleries

D1 Non-residential Inst.: Education

D1 Non-residential Inst.: Primary Health Care Building D1 Non-residential Inst.: Crown and County Courts

D2 General Assembly and Leisure, Night Clubs and Theatres

Others: Passenger terminals Others: Emergency services

Others: Miscellaneous 24hr activities

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.93	2.94
Cooling	8.03	6.57
Auxiliary	3.63	3.47
Lighting	14.59	23.48
Hot water	2.89	3.17
Equipment*	41.87	41.87
TOTAL**	30.07	39.64

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

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	5.42	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	129.1	116.71
Primary energy* [kWh/m²]	92.31	112.64
Total emissions [kg/m²]	12.8	19.5

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

۱	HVAC Systems Performance									
Sy	System Type Heat dem MJ/m2 MJ/m2 Heat con									
[S1	[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	12	117.1	0.9	8	3.6	3.6	4.05	4	4.5
	Notional	27	89.6	3.1	6.9	3.7	2.43	3.6		Andrews,

Key to terms

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

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

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

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

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs'
Wall	0.23	0.16	External Wall
Floor	0.2	0.12	Ground Floor
Roof	0.15	0.12	Roof/Internal Ceiling
Windows, roof windows, and rooflights	1.5	1.4	Rooflights
Personnel doors	1.5	1.5	W01 Lower - DOOR
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²k	()]	1	U _{i-Min} = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	4

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

74 Church Road

As designed

Date: Thu Jul 28 12:04:27 2016

Administrative information

Building Details

Address: Barnes, London, SW13 0DQ

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3.3

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	16.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _{a-Limit}	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.16	0.16	External Wall
Floor	0.25	0.12	0.12	Ground Floor
Roof	0.25	0.12	0.12	Roof/Internal Ceiling
Windows***, roof windows, and rooflights	2.2	1.4	1.4	W01 Lower
Personnel doors	2.2	1.5	1.5	W01 Lower - DOOR
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	4

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

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

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

Building services

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

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

1- New HVAC System (5 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	0.91	4		1.4	0.8
Standard value	0.91*	2.6 N/A 1.1^ 0.65			
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO					

^{*} Standard shown is for gas single boiler systems <= 2 MW output. For single boiler systems > 2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name				SF	P [W/	(l/s)]				up -	cc : _:
ID of system type	Α	В	С	D	E	F	G	Н	I	HKE	fficiency
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Commercial Unit 1	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial Unit 2	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial Unit 3	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial Unit 4	-	-	-	1.4	-	-	-	-	-	-	N/A
Commercial Unit 5	-	-	_	1.4	_	_	_	_	_	-	N/A

General lighting and display lighting	Lumino	us effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Commercial Unit 1	90	-	-	208
Commercial Unit 2	90	-	-	210
Commercial Unit 3	90	-	-	207
Commercial Unit 4	90	-	-	211

[^] Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

General lighting and display lighting	Lumino	us effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	21 3 22 2
Commercial Unit 5	90	41	-	208

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial Unit 1	NO (-47%)	NO
Commercial Unit 2	NO (-48%)	NO
Commercial Unit 3	NO (-47%)	NO
Commercial Unit 4	NO (-49%)	NO
Commercial Unit 5	NO (-66%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	139	139
External area [m²]	283	283
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	4	5
Average conductance [W/K]	93	140
Average U-value [W/m²K]	0.33	0.49
Alpha value* [%]	14.95	14.95

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

Building Use

% Area Building Type A1/A2 Retail/Financial and Professional services A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways

100 B1 Offices and Workshop businesses

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Inst.: Hospitals and Care Homes

C2 Residential Inst.: Residential schools

C2 Residential Inst.: Universities and colleges

C2A Secure Residential Inst.

Residential spaces

D1 Non-residential Inst.: Community/Day Centre

D1 Non-residential Inst.: Libraries, Museums, and Galleries

D1 Non-residential Inst.: Education

D1 Non-residential Inst.: Primary Health Care Building D1 Non-residential Inst.: Crown and County Courts

D2 General Assembly and Leisure, Night Clubs and Theatres

Others: Passenger terminals
Others: Emergency services

Others: Miscellaneous 24hr activities

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.07	8.73
Cooling	9.04	6.57
Auxiliary	3.63	3.47
Lighting	14.59	23.48
Hot water	2.89	3.17
Equipment*	41.87	41.87
TOTAL**	34.21	45.43

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

Energy Production by Technology [kWh/m²]

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

Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	129.1	116.71
Primary energy* [kWh/m²]	97.51	114.48
Total emissions [kg/m²]	16.5	19.9

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

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

۱	IVAC Sys	stems Per	formanc	е						
Sy	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[S1	Central he	eating using	air distrib	ution, [HS]	LTHW boile	er, [HFT] Na	tural Gas, [CFT] Electr	icity	
	Actual	12	117.1	4.1	9	3.6	0.82	3.6	0.91	4
	Notional	27	89.6	9.1	6.9	3.7	0.82	3.6		And the first

Key to terms

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

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

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

 ST
 = System type

 HS
 = Heat source

 HFT
 = Heating fuel type

 CFT
 = Cooling fuel type

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs'
Wall	0.23	0.16	External Wall
Floor	0.2	0.12	Ground Floor
Roof	0.15	0.12	Roof/Internal Ceiling
Windows, roof windows, and rooflights	1.5	1.4	Rooflights
Personnel doors	1.5	1.5	W01 Lower - DOOR
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²k	()]	1	U _{i-Min} = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	4



SBEM Input Parameters Summary

The following section gives details of various SBEM model parameters under relevant sub-headings used for the non-domestic elements of the proposed development at 74 Church Road, Barnes.

General

Calendar: NCM Standard

Weather: London TRY

Fabric Performance

Air Permeability: 4m³/hr.m²

Thermal Transmittance

Table 1 below gives details of the fabric performance of the building elements assumed in the model:

Building Element	g-value/ light transmittance	U-value (W/m2.K)	Construction
External Walls	n/a	0.16	Plasterboard lined inner blockwork, insulated cavity and brickwork outer skin.
Ground Floor	n/a	0.12	Screed over solid insulation and concrete floor slab.
Roof	n/a	0.12	Insulated concrete slab with plastered soffit internally.
Glazing / Rooflights	0.50 / 0.65	1.4	Triple glazed unit
External Doors	0.50 / 0.65	1.5	Pedestrian access doors
Internal Floors	n/a	1.4	False ceiling below concrete floor to above.
Party Walls	n/a	0.37	Insulated cavity wall, plasterboard lined on both sides.

Table 1



System Efficiencies

Electrical Power Factor: <0.90

Lighting

Control strategy typically follows the principles in Table 2 below:

Zone	Lighting Efficacy (LL/CW)	Auto Presence Switching	Daylight Control
Commercial Areas	90	Manual on, auto off	Photocell dimming

Table 2

As noted, the commercial spaces are to have photocell sensors throughout, with lighting dimmed automatically depending on levels of natural light in the space at any given time.

Assumed design illuminance of 400lux to commercial areas.

No time clock controls assumed to photocells. Parasitic power assumed as default 0.3 W/m².

Light metering with alarms warning of out-of-range values not included.

Ventilation

Zone	Ventilation Type	Extract Rate	Specific Fan Power (W/l.s)	Heat Recovery Efficiency (%)
Commercial Areas	VRF with Mechanical Supply and Extract	n/a	1.4	80

Table 3

Ventilation is assumed to have demand control, with fan speed varying automatically with occupancy.

Heat recovery assumed to be 80% using a thermal wheel heat exchanger.

Metering with alarms warning of out-of-range values <u>not</u> included.

Heating & Cooling

Heating and cooling is provided by an air source heat pump with a heating COP of 4.0 and cooling ESEER of 4.5.

Distribution efficiency for the heating system and cooling systems assumed to be as 90%.



Variable speed pumping is assumed, with multiple differential pressure sensors in the system.

Heat metering with alarms warning of out-of-range values <u>not</u> included.

Hot Water

Assumed to be point of use instantaneous electric water heating, without storage volumes.

Generation and distribution efficiency assumed to be 100%.

Renewables

 $\mbox{8m}^{2}$ of photovoltaic array is proposed on the south-east facing pitched roof.

The array has an inclination of 15° from the horizontal.

Panels are assumed to have an efficiency of 15% and a solar conversion factor of 0.8.

Appendix F -Site Wide Results Tables



Cumulative Emissions & Savings

The following tables are presented in accordance with the advice presented within 'Energy Planning - Greater London Authority guidance on preparing energy assessments'.

	Carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013 of the Building Regulations Compliant			
Development	8.28	2.98	
After energy demand reduction	7.60	2.98	
After heat network / CHP	7.60	2.98	
After renewable energy	5.30	2.98	

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

	Regulated Carbon die	oxide savings
	(Tonnes CO ₂ / annum)	(%)
Savings from energy demand reduction	0.68	8.25
Savings from heat network / CHP	0.00	0.00
Savings from renewable energy	2.29	27.70
Cumulative on site Savings	2.98	35.96
Total Target Savings	2.90	35.00
Annual Surplus	0.08	

Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO ₂ per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013 of the Building Regulations Compliant			
Development	2.90	3.02	
After energy demand reduction	2.41	3.02	
After heat network / CHP	2.41	3.02	
After renewable energy	1.87	3.02	

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

	Regulated Carbon di	oxide savings
	(Tonnes CO ₂ / annum)	(%)
Savings from energy demand reduction	0.50	17.09
Savings from heat network / CHP	0.00	0.00
Savings from renewable energy	0.54	18.59
Total Cumulative Savings	1.04	35.68
Total Target Savings	1.02	35.00
Annual Surplus	0.02	

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

Part L 2013 Baseline	Total regulated emissions (Tonnes CO ₂ /year) 11.18	CO2 savings (Tonnes CO ₂ /year)	Percentage Saving (%)
Be lean	10.00	1.18	10.55
Be clean	10.00	0.00	0.00
Be green	7.17	2.83	25.34

Table 6: Site wide regulated carbon dioxide emissions and savings

F	Total Savings	4.01	35.88

Appendix G - Possible PV Locations





Appendix H – BREEAM Pre Assessment





GREEN BUILDING RATINGS ONLINE

Criteria Summary

Project:	52388 - 74 Church Road Barnes London SW13 0DQ
Report:	Pre-Assessment Stage
Design	Excellent - 72.42%
Target:	
Potential	Outstanding - 91.32%
Rating:	-

Man 01.1: Project brief and design: 2 1.14% 1 0.57% 0 0%	Management	Availabl	е	Targete	d	Potential	
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Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016: Contractor to demonstrate adherence to relevant environmental standard (EMS) eg. ISO14001 or equivalent. Man 03.2: Responsible construction practices: Construction stage Sustainability Champion Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016: Appointment of Sustainability Professional (AP) to monitor construction phase and oversee BREEAM certification optimisation. Man 03.3: Responsible construction Practices: Considerate construction Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016: Contractor must be considerate constructors (CC) registered, and in addition exceed CC requirements. Man 03.4: Responsible construction Practices: Monitoring of construction Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016: Construction monitoring will be required to provide robust reporting information, by a specified individual. An exemplary credit is available if the contractor demonstrates excellence relating to Considerate Constructors performance. Man 04.1: Commissioning and handover : Commissioning and testing schedule and responsibilities Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016: Contractor to formally identify commissioning schedule Man 04.2: Commissioning and handover : Commissioning building services		1	0.57%	1	0.57%	U	0%
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Man 04.3: Commissioning and handover	1	0.57%	1	0.57%	0	0%			
: Testing and inspecting building fabric									
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consu	ltant) on 8	Aug 2016	5:					
A thermography survey will be carried out by a suitably qualified expert and any fabric defects will be rectified.									
Man 04.4: Commissioning and handover	1	0.57%	1	0.57%	0	0%			
: Handover									
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:									
A building user guide will be prepared and distr	ibuted to d	occupants a	nd building	managers.					
Man 05.1: Aftercare : Aftercare support	1	0.57%	1	0.57%	0	0%			
Man 05.2: Aftercare : Seasonal	1	0.57%	1	0.57%	0	0%			
commissioning									
Man 05.3: Aftercare : Post occupancy	1	0.57%	1	0.57%	0	0%			
evaluation									
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consu	ltant) on 8	Aug 2016	5:					
Commitment to complete Post Occupancy Eval	uation afte	r completion	1 ⁻						
Management Totals	21	12.00%	18	10.28%	1	0.57%			

Health and Wellbeing	Available		Targete	d	Potential	
	Credits	Percent	Credits	Percent	Credits	Percent
Hea 01.1: Visual comfort : Glare control	1	0.79%	1	0.79%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consu	ltant) on 8	Aug 2016	5:		
In order to award many of these credits in this	section ful	II Dynamic S	Simulation	modelling is	required.	This
model will assist in all						
aspects of the energy calculation and also allow	v for therm	nal comfort i	reports to I	oe run. Usir	ng CIBSE f	uture
weather data files,						
predictions may be made to assist in demonstr	ating the i	mpact with	regard to f	uture climat	e change,	as
required under The London						
Plan.						
Glare has been considered and designed out w	here possil	ble with the	strategy to	maximise	daylight wi	niist
reducing energy consumption.		1 500/		0.700/		0.700/
Hea 01.2: Visual comfort : Daylighting	2	1.58%	1 2014	0.79%	1	0.79%
Steve Bickell (Malcolm Hollis - Sustainabil					_ #.:	
Average daylight factors have been calculated						0.700/
Hea 01.3: Visual comfort : View out	2	1.58%	1 2014	0.79%	1	0.79%
Steve Bickell (Malcolm Hollis - Sustainabil					indow one	ططنين سمنم
The design team confirm 95% of floor area is valview out.	vicnin 7m c	or a wan win	ch has a p	ermanent w	indow ope	ning with
Hea 01.4: Visual comfort : Internal and	1	0.79%	1	0.79%	0	0%
external lighting, Zoning and control	1	0.79%	1	0.7970	0	0.70
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consu	ltant) on 8	Aug 2016			
Internal and external lighting will be designed					umption ar	nd to
provide appropriate lighting levels for occupant						iu to
Hea 02.1: Indoor air quality : Minimising	4	3.16%	2	1.58%	2	1.58%
sources of air pollution	7	3.10 /0	_	1.50 /0	_	1.50 /0
Steve Bickell (Malcolm Hollis - Sustainabil	itv Consu	ltant) on 8	Aug 2016	5:		
The design team will produce an indoor air qua					ources etc	
All VOCs will be designed out from products.	-, ,					
Hea 02.2: Indoor air quality:	1	0.79%	0	0%	1	0.79%
Adaptability - potential for natural						
ventilation						
Steve Bickell (Malcolm Hollis - Sustainabil						
The building has been designed with an approp						e in a
number of different climate scenarios. The str	ategy prov	<u>ides at least</u>	tow levels	of user cor	trols.	
Hea 04: Thermal comfort	3	2.37%	3	2.37%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabil						
See earlier comments in HEA01 about thermal				or optimum	design	
temperatures, a range of climate change scena						
Hea 05.1: Acoustic performance :	3	2.37%	3	2.37%	0	0%
Education, Healthcare, Office and Law						
Courts building types						
Steve Bickell (Malcolm Hollis - Sustainabil						1. 12.
A suitable qualified acoustician will be asked to	comment	and assist o	on the proj	ect and his	recommen	dations
taken forward on the project.	1.0	1 500/	1 4	0.700/		0.700/
Hea 06: Safety and security	2	1.58%	1	0.79%	1	0.79%
Steve Bickell (Malcolm Hollis - Sustainabil					la ta	
A suitably qualified Security Expert will be asked		nent and ass	sist on the	project and	nıs	
recommendations taken forward on the project						

Health and Wellbeing Totals	19	15.00%	13	10.26%	6	4.73%
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Energy	Availabl	е	Targeted	i t	Potential			
	Credits	Percent	Credits	Percent	Credits	Percent		
Ene 01: Reduction of energy use and	12	8.57%	7	5%	2	1.43%		
carbon emissions								
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consu	ltant) on 8	Aug 2016	5:				
Through the use of low energy, high efficiency	ASHP, and	low energy	lighting ac	chieved thro	ugh a full l	lighting		
design and sealing air leakage point/controlling	thermal b	ridges, the	project will	demonstra	te a signifi	cant		
improvement over the benchmark notional building.								
Ene 02: Energy monitoring	2	1.43%	2	1.43%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:								
Smart energy metering and sub metering will be	<u>e installed</u>							
Ene 03: External lighting	1	0.71%	1	0.71%	0	0%		
Ene 04.1: Low carbon design : Passive	2	1.43%	1	0.71%	1	0.71%		
design								
Steve Bickell (Malcolm Hollis - Sustainabil								
The project team has carried out passive desig	n analysis	in complian	ce with HE	A01 at conc	ept design	stage		
and has reviewed all passive design measures	to reduce t	the energy l	oads, desig	ning these	into the sc	heme		
where possible.								
Ene 04.2: Low carbon design : Low or	1	0.71%	1	0.71%	0	0%		
zero carbon technologies								
Steve Bickell (Malcolm Hollis - Sustainabil								
A feasibility study has been carried out by Build	d Energy a	nd LZC tech	nologies ha	ave been ind	cluded in th	ne		
scheme where possible.								
Ene 08: Energy efficient equipment	2	1.43%	1	0.71%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consul	ltant) on 8	Aug 2016	5:				
High performance unregulated appliances will be	e specified	d						
Ene 09: Drying space	1	0.71%	1	0.71%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainabil	ity Consu	ltant) on 8	Aug 2016	5:				
Adequate drying space will be provided.								
Energy Totals	21	15.00%	14	10.00%	3	2.14%		

Transport	Available		Targeted		Potential	
	Credits	Percent	Credits	Percent	Credits	Percent
Tra 01.1: Public transport accessibility:	5	3.75%	4	3%	0	0%
Accessibility Index						
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	i:		
PTAL AI score of 14 equating to 4 credits			_			
Tra 02: Proximity to amenities	2	1.5%	2	1.5%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	i:		
A review on Google maps indicates that sufficie	nt qualifyir	ng amenities	s are availa	ble close to	the site.	This will
need to be confirmed.						
Tra 03: Cyclist facilities	2	1.5%	1	0.75%	1	0.75%
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	i:		
These credits will be targeted, final amendment	ts to desigr	n may be ne	ecessary			
Tra 04: Maximum car parking capacity	2	1.5%	2	1.5%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	:		
Confirmation of residential parking is required t	o make fin	al calculatio	n			
Tra 05: Travel plan	1	0.75%	0	0%	1	0.75%
Transport Totals	12	9.00%	9	6.75%	2	1.50%

Water	Available		Targeted		Potential			
	Credits	Percent	Credits	Percent	Credits	Percent		
Wat 01: Water consumption	5	3.89%	4	3.11%	1	0.77%		
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:								
The scheme aims to ensure a 50% saving over BREEAM benchmark performance, which would significantly								
improve on compliance with Part G building reg	ulations.							
Wat 02: Water monitoring	1	0.78%	1	0.78%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consult	tant) on 8	Aug 2016	:				
A water meter will be supplied with sub-meters	where nec	essary.						
Wat 03: Water leak detection	2	1.56%	2	1.56%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:								
Leak detection and flow control devices will be provided.								

Wat 04: Water efficient equipment	1	0.78%	1	0.78%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:								
The scheme will undertake a commitment to installation of unregulated water consuming appliances.								
Water Totals	9	7.00%	8	6.22%	1	0.77%		

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Materials	Availabl	e	Targete	<u>d</u>	Potential			
	Credits	Percent	Credits	Percent	Credits	Percent		
Mat 01: Life cycle impacts	6	5.79%	4	3.85%	2	1.93%		
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	:				
Use of low environmental impact (including em	bodied carl	bon) materi	als in the r	nain buildin	g fabric ov	er the full		
life cycle of the building.								
An exemplary credit is available for specification of materials from the Green Guide.								
Mat 02: Hard landscaping and boundary	1	0.96%	0	0%	1	0.96%		
protection								
Mat 03: Responsible sourcing of	4	3.86%	3	2.89%	1	0.96%		
materials								
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	i:				
All timber and timber based products will be leg	gally harve	sted. A sus	tainable pr	ocurement	plan will be	е		
submitted by the main contractor. Compliance	with BREE	AM method	ology for re	esponsible s	sourcing of	materials		
- 2 credits.								
Mat 04: Insulation	1	0.96%	1	0.96%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	i:				
New insulation will be assessed for performance	e against tl	ne BREEAM	insulation	index.				
Mat 05: Designing for durability and	1	0.96%	1	0.96%	0	0%		
resilience								
Steve Bickell (Malcolm Hollis - Sustainabili	ity Consul	tant) on 8	Aug 2016	i:		•		
Suitable protection measures and resistance to	degradatio	on will be co	nsidered a	nd impleme	ented.			
Mat 06: Material efficiency	1	0.96%	0	0%	0	0%		
Materials Totals	14	13.50%	9	8.67%	4	3.85%		

Waste	Availabl	е	Targeted		Potential	
	Credits	Percent	Credits	Percent	Credits	Percent
Wst 01.1: Construction waste	3	2.83%	3	2.83%	0	0%
management : Construction resource						
efficiency						
Steve Bickell (Malcolm Hollis - Sustainabili			Aug 2016	:		
Assumption of <3.4m3 waste generated per 10	0m2 (GIFA	.)				
Wst 01.2: Construction waste	1	0.94%	1	0.94%	0	0%
management : Diversion of resources						
from landfill						
Steve Bickell (Malcolm Hollis - Sustainabili						
Non demolition waste of 70% and Demolition w	aste of 80°	% by volum	e will be di	iverted fron	n landfill. '	Waste will
be segregated on site.						
Wst 02: Recycled aggregates	1	0.94%	1	0.94%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabili						
The percentage of high grade aggregate that is	recycled w		uired limit		e per elem	
Wst 03: Operational waste	1	0.94%	1	0.94%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabili			Aug 2016	:		
Space will be provided on site for segregation of	f waste str	eams.				
Wst 04: Speculative floor and ceiling	1	0.94%	1	0.94%	0	0%
finishes						
Steve Bickell (Malcolm Hollis - Sustainabili						
Fit out work for tenants will take place to less the	nan 25% o	f the net let	table floor	area, to av	oid unnece	essary
refurbishment on tenancy.						
Wst 05: Adaptation to climate change	1	0.94%	1	0.94%	0	0%
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consul	tant) on 8	Aug 2016	:		
The scheme has been reviewed for potential add	aptation to	different cl	imate char	<u>ige scenario</u>	os.	
Wst 06: Functional adaptability	1	0.94%	0	0%	0	0%
Waste Totals	9	8.50%	8	7.55%	0	0.00%

Land Use and Ecology	Available		Targeted		Potential		
	Credits	Percent	Credits	Percent	Credits	Percent	
LE 01.1: Site selection : Previously	1	1%	1	1%	0	0%	
occupied land							
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:							

This is a brownfield development with at least 75% of the proposed development's footprint having been developed before. A contaminated land site investigation carried out by a suitably qualified professional will be									
· ·	estigation/	carried out	by a suital	oly qualified	l profession	nal will be			
carried out.									
LE 01.2: Site selection : Contaminated	1	1%	1	1%	0	0%			
land									
LE 02: Ecological value of site and	2	2%	2	2%	0	0%			
protection of ecological features									
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:									
The site has been evalued as low ecological value according to BREEAM checklist. A suitably qualified ecologist									
will review any ecological elements that require	retention	or protectio	n.						
LE 03: Minimising impact on existing site	2	2%	1	1%	0	0%			
ecology									
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consul	tant) on 8	Aug 2016	i:					
A suitably qualified ecologist will outline measure	res to enha	ance the site	e's ecologic	al value.					
LE 04: Enhancing site ecology	2	2%	0	0%	1	1%			
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consul	tant) on 8	Aug 2016	i:					
A Suitably Qualified Ecologist (SQE) will advise	on appropi	riate measu	res to enha	ance ecolog	ical value.				
LE 05: Long term impact on biodiversity	2	2%	0	0%	2	2%			
Land Use and Ecology Totals	10	10.00%	5	5.00%	3	3.00%			

ollution Available Targeted					Potential			
	Credits	Percent	Credits	Percent	Credits	Percent		
Pol 01: Impact of refrigerants	3	2.31%	2	1.54%	1	0.77%		
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consul	tant) on 8	Aug 2016	:				
Refrigerants will comply with BS EN 378:2008 a	and have a	GWP <10.	Systems v	vill have lov	v refrigerai	nt		
impacts and be fitted with leak detection.								
Pol 02: NOx emissions	3	2.31%	3	2.31%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016: The scheme will use plant with NOx emission levels of <40mg/kWh.								
Pol 03.1: Surface water run-off : Flood	2	1.54%	1	0.77%	1	0.77%		
risk	_	2.5 . 70	_	017770	_	0.77.70		
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consul	tant) on 8	Aug 2016	:		•		
The site will be assessed against flood risk and					sk assessn	nent will		
be carried out.			J					
Pol 03.2: Surface water run-off : Surface	2	1.54%	1	0.77%	1	0.77%		
water run-off								
Steve Bickell (Malcolm Hollis - Sustainabili	ty Consul	tant) on 8	Aug 2016	:				
An appropriate consultant will be engaged to ev	/aluate dra	inage meas	ures are in	corporated	to minimis	e surface		
water run off from the scheme.								
Pol 03.3: Surface water run-off:	1	0.77%	1	0.77%	0	0%		
Minimising water course pollution								
Steve Bickell (Malcolm Hollis - Sustainabili		tant) on 8	Aug 2016	:				
Assessment will be made of discharge to water								
Pol 04: Reduction of night time light	1	0.77%	1	0.77%	0	0%		
pollution								
Steve Bickell (Malcolm Hollis - Sustainabili								
An external lighting strategy will be drawn up to								
Pol 05: Reduction of noise pollution	1	0.77%	1	0.77%	0	0%		
Steve Bickell (Malcolm Hollis - Sustainabili		,						
There are/will be no noise sensitive buildings w								
Pollution Totals	13	10.00%	10	7.69%	3	2.30%		

Innovation	Available		Targeted		Potential				
	Credits	Percent	Credits	Percent	Credits	Percent			
Inn 01: Innovation	10	10%	0	0%	0	0%			
Steve Bickell (Malcolm Hollis - Sustainability Consultant) on 8 Aug 2016:									
No innovation credits have been sought. However, several would be achievable if required including; Man 03,									
Man 05, Wat 01, Wst 01, 02.									
Man 03: Responsible construction	1	1%	0	0%	0	0%			
practices									
Man 05: Aftercare	1	1%	0	0%	0	0%			
Hea 01: Visual comfort	1	1%	0	0%	0	0%			
Hea 02: Indoor air quality	2	2%	0	0%	0	0%			
Ene 01: Reduction of energy use and	1	1%	0	0%	0	0%			
carbon emissions									
Wat 01: Water consumption	1	1%	0	0%	0	0%			

Mat 01: Life cycle impacts	1	1%	0	0%	0	0%
Mat 03: Responsible sourcing of	1	1%	0	0%	0	0%
materials						
Wst 01: Construction site waste	1	1%	0	0%	0	0%
management						
Wst 02: Recycled aggregates	1	1%	0	0%	0	0%
Wst 05: Adaptation to climate change	1	1%	0	0%	0	0%
Innovation Totals (Up to a maximum of	10	10.00%	0	0.00%	0	0.00%
10 credits)						
Overall Totals	138	110.00%	94	72.42%	23	18.86%