



CLIENT: Sudaj Ltd

Sustainability and Energy Statement

FOR THE PROPOSED

Residential Units

at

82 Guildford Street Bloomsbury London WC1N 1DF

01 August 2014

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1. EXECUTIVE SUMMARY

This report has been prepared on behalf of Sudaj Ltd to present and summarise the work of the design team exploring the energy options and strategies for the proposed development of 4 residential units on the site currently known as 82 Guildford Street, Bloomsbury, London WC1N 1DF.

The proposed scheme is a reconfiguration of the existing building within the constraints of an existing listed building and whilst the target is to strive to achieve a BREEAM Domestic Refurbishment rating of Very Good, the team need to consider the building fabric and associated services and use best endeavours to achieve the best practical overall rating. Very Good may prove unachievable due to the limitations of the listed building.

The pre-assessment carried out for the development predicts a score of 51.55 credits, which does not quite achieve the required 55 credits for BREEAM Domestic Refurbishment 'Very Good'.

The chart on the following page provides a summary of the CO2 savings achieved by the proposed change of use over the development with existing building fabric and systems. The 19.72% reduction in CO2 emissions reflects regulated energy use only, in accordance with Part L Building Regulations. Unregulated energy use is not taken into account in the calculation of BREEAM credits (e.g. plug-in load and appliances).

The number of credits obtained in the BREEAM pre- assessment reflects the client and design team's aspirations in incorporating as many sustainability measures as possible.

ENERGY STATEMENT

The figures below are based on SAP calculations carried out on the basement, ground floor and third floor. These calculations are provided in the appendix to this document.

	CO2 Emissions/m2	% reduction over baseline
Baseline scenario	1.01	
Baseline + energy efficiency	0.99	1.76
Baseline + energy efficiency +	0.79	19.72
efficient services		

The total 19.72% improvement over the baseline for the improved envelope is calculated using the methods given in BREEAM Domestic Refurbishment. The actual reduction in carbon emissions is much greater than this. (see page 13 section 2.2 for an explanation of this)

Measures suggested by Camden Council for listed buildings and how they have been incorporated.

A range of thermal efficiency measures can be implemented, which avoid harm to the historic environment. Ranked according to their impact on heritage and the technical risks, these include:

1. Ensure that the building is in a good state of repair.



The building will be thoroughly refurbished with a new roof, windows and doors. Approximately 35% of the project cost will be spent on improvements to energy efficiency.

2. Minor interventions - upgrade the easier and non-contentious elements:

• Insulate roof spaces and suspended floors;

This is to be carried out to achieve a u-value of 0.15W/m2K for both roof and floor.

• Provide flue dampers - (close in winter, open in summer);

All existing chimneys are to be sealed.

• Use curtains, blinds and window shutters;

Curtains and blinds to be fitted.

• Provide energy efficient lighting and appliances;

Energy efficient lighting and appliances will be provided.

• Draught-seal doors and windows;

New windows and doors to be provided with full draught stripping.

• Provide hot water tank and pipe insulation.

There will be no hot water tanks. Pipes will be insulated.

3. Moderate interventions - upgrade vulnerable elements:

• install secondary (or double) glazing (if practicable);

Secondary glazing to be fitted to the front elevation (subject to permission being given) and highly efficient double glazing to the rear.

4. Upgrade building services and give advice to building users on managing them efficiently:

• Install high-efficiency boiler and heating controls;

Gas boilers of 90% efficiency to be installed with weather compensation boiler interlock and TRV's.

• Install smart metering;

Smart metering to water, gas and electricity will be installed.

• Install solar panels, where not visible from the street or public spaces.

In this case there is no suitable position for solar technologies. There is only a very small inward sloping roof. Roof windows have been chosen over solar technologies to provide natural daylight to the top floor flat.



5. Major interventions - upgrade more difficult and contentious elements (where impact on heritage values and level of technical risk shown to be acceptable) provide solid wall insulation.

Solid wall insulation is to be provided. 200mm of fibreboard is to be used to the front and rear of the existing solid walls with lime plaster to maintain 'breathability. The new walls to the rear will be blockwork with external wall insulation. All external walls to achieve a u-value of 0.17W/m2K.

2. INTRODUCTION

2.1 Proposed development

82 Guilford Street is located along Guilford Street, in a close proximity to Russell Square underground station, within the London Borough of Camden. The proposed development includes the refurbishment of an existing Grade II Listed Building. The site lies within walking distance of shops and services in town centre.

The approximate site location is shown in the figure below.



2.2 Camden Council Sustainability Requirements and Policies

2.2.1 Camden Council – Planning Guidance Existing Buildings

The Camden Planning Guidance support the policies set out in the Local Development Framework (LDF). While the Camden LDF contains policies relating to sustainability in their Core Strategy and Development Policies documents, the Council also has a separate planning guidance specific to sustainability.

According to the Camden Council,



- All buildings, whether being updated or refurbished, are expected to reduce their carbon emissions by making improvements to the existing building. Work involving a change of use or an extension to an existing property is included. As a guide, at least 10% of the project cost should be spent on the improvements.
- Where retro-fitting measures are not identified at application stage we will most likely secure the implementation of environmental improvements by way of condition. Appendix 1 sets out a checklist of retro fit improvements for applicants.
- Development involving a change of use or a conversion of 5 or more dwellings or 500sq m of any floor space, will be expected to achieve 60% of the un-weighted credits in the Energy category in their EcoHomes or BREEAM assessment, whichever is applicable. (See the section on Sustainability assessment tools for more details).
- Special consideration will be given to buildings that are protected e.g. listed buildings to ensure that their historic and architectural features are preserved.



The sections that will be covered the Sustainability Statement listed below:

- The energy hierarchy
- Energy efficiency: new buildings
- Decentralised energy networks and combined
- heat and power
- Renewable Energy
- Water Efficiency
- Sustainable use of materials
- Sustainability assessment tools
- Brown roofs, green roofs and green walls
- Flooding
- Adapting to climate change
- Biodiversity



2.2.2 The London Plan

The London Plan 2011 requires compliance with the following policies relating to climate change:

- Policy 5.2 Minimising Carbon Dioxide Emissions (refer to the supplementary Energy Report)
- Policy 5.3 Sustainable Design and Construction
- Policy 5.5 Decentralised Energy Networks (refer to the supplementary Energy Report)
- Policy 5.6 Decentralised Energy in Development Proposals (refer to the supplementary Energy Report)
- Policy 5.7 Renewable Energy (refer to the supplementary Energy Report for more details)
- Policy 5.9 Overheating and Cooling
- Policy 5.10 Urban Greening
- Policy 5.11 Green Roofs
- Policy 5.12 Flood Risk Management
- Policy 5.13 Sustainable Drainage
- Policy 5.15 Water use and Supplies
- Policy 5.16 Waste Self-Sufficiency
- Policy 5.18 Construction. Excavation and Demolition Waste
- Policy 5.19 Hazardous Waste
- Policy 5.20 Aggregates

Where possible, the London Plan policies have been met through the implementation of the BREEAM Domestic Refurbishment.

2.2.3 Historic and Listed Buildings

The refurbishment of this building has been planned according to the guidance given on Camden Councils website:

A range of thermal efficiency measures can then be implemented, which avoid harm to the historic environment. Ranked according to their impact on heritage and the technical risks, these include:

1. Ensure that the building is in a good state of repair

- 2. Minor interventions upgrade the easier and non-contentious elements:
 - insulate roof spaces and suspended floors;
 - provide flue dampers (close in winter, open in summer);
 - use curtains, blinds and window shutters;
 - provide energy efficient lighting and appliances
 - draught-seal doors and windows;
 - provide hot water tank and pipe insulation.

3. Moderate interventions - upgrade vulnerable elements:

• install secondary (or double) glazing (if practicable);

4. Upgrade building services and give advice to building users on managing them efficiently:

- install high-efficiency boiler and heating controls;
- install smart metering;



• install solar panels, where not visible from the street or public spaces.

5. Major interventions - upgrade more difficult and contentious elements (where impact on heritage values and level of technical risk shown to be acceptable)

• provide solid wall insulation.

2.2.4 BREEAM Domestic Refurbishment Pre- Assessment

BREEAM Domestic Refurbishment is a performance based assessment method and certification scheme for domestic buildings undergoing refurbishment, providing an authoritative rating for refurbished homes, covering houses, flats and apartments. It also recognises limitations of existing buildings including their inherent built form and location. Since June 2012, BREEAM Domestic Refurbishment has superseded the EcoHomes assessment method.

BREEAM Domestic Refurbishment measures the sustainability of a development against design categories, rating the entire development as a complete package. Each standard requires developments to gain credits by meeting sustainable design principles over seven key areas:

- 1. Management
- 2. Health and Wellbeing
- 3. Energy
- 4. Water
- 5. Materials
- 6. Waste
- 7. Pollution

Camden Council sets Ecohomes 'Excellent' rating for refurbishments and conversions as a requirement from 2013. However, since Ecohomes was superseded by BREEAM Domestic Refurbishment in 2012, the development at 82 Guilford Street aims to reach BREEAM Domestic Refurbishment 'Excellent', reflecting the design team's aspirations in incorporating appropriate sustainability measures. The following section outlines the measures to be adopted at 82 Guilford Street to achieve BREEAM Domestic Refurbishment 'Excellent'.





3. PASSIVE AND ENERGY EFFICIENT DESIGN STRATEGIES

3.1 Building form and design

The building is listed and therefore there are restrictions on what changes can be made. The building form and front elevation must remain unchanged.

3.2 Building Fabric Performance

U-values are to be improved where this is permitted.

- Existing walls will be improved to 0.17W/m2K (from approximately 2.1w/m2K). Internal wall insulation is permitted within the restriction of the listed building to existing walls. This must be a natural insulation to maintain the 'breathability of the solid walls'. 200mm of fibreboard will be used in this case together with lime plaster to prevent any problems with condensation and mould growth. New walls to the rear will achieve a u-value of 0.17W/m2K using externally insulated blockwork.
- **Windows** to the front elevation will be retained, refurbished and draught stripped, with secondary glazing added. Windows to the rear will have new high efficiency double glazing of u-value 1.2W/m2K.
- Roof and external floors are to be improved to u-value 0.15W/m2K

	U-value	U-value
Fabric Element	Part L1B 2010	Proposed Refurbished Building
External Wall	0.28	0.17
Exposed Floor	0.22	0.15
Exposed Roof	0.18	0.15
External Glazing	1.6	Secondary glazing 2.4, new windows to rear 1.2

Table 1 Building Fabric Standards in Guildford Street Development

The u-values which inform the BREEAM Domestic Refurbishment assessment prior to development are the backstop values given in Part L 2013 which are in fact much greater than those of the existing building. For example the wall u-value that needs to be used prior to development in the SAP calculation is 0.28, whereas in actual fact it was 2.1W/m2K this means that the actual energy and carbon savings of the refurbishment of this building will be much greater than those shown.

3.2.1 Air permeability and Thermal Bridging

The building refurbishment has been carefully designed to improve airtightness and thermal bridge-free detailing is also given priority. The calculations are based on an airtightness of 10m3/m2/hr.

It is expected that a better value than this can be achieved in practice.

3.2.2 Limiting solar gain in summer

Blinds will be fitted to the front elevation of this building to limit solar gain.



3.3 Efficient Building Services

3.3.1 Principles

The policies on energy have been considered thoroughly throughout the pre-planning design. The approach to achieving the planning policy energy objectives has been to adopt the Mayor's Energy and Heating Hierarchies, and to consider strategies and technologies to achieve a low energy and carbon footprint for the scheme.

The energy strategy for the scheme follows the energy hierarchy:

- Using less energy by passive design and energy efficiency measures
- Supplying energy efficiently by means of highly efficient gas combi boilers
- In this case renewable energy is not appropriate

3.3.2 Heating, Ventilation and Cooling

A simple low carbon heating strategy has been designed.

- Natural ventilation with fans to bathrooms and kitchens
- High efficiency individual gas combi boilers
- Radiators
- Local, efficient, simple but effective controls are provided for the units. Local controls will be provided to connect to the room temperature sensors. A weather compensated system will be provided for the heating system.

Each dwelling will be provided with their own gas, water and electricity meters for individual metering and billing.

3.3.3 Domestic Hot & Cold Water

This will be provided by gas combi boilers.

3.3.4 Lighting

The lighting to each of the apartments will be provided by at least 80% low energy fittings. In addition external lighting will be energy efficient with daylight cut-off

3.3.5 Enhanced User Understanding and Controls

Ensuring that building users understand how the building works is crucial to limiting energy consumption. Engineering the building to operate autonomously and making it simple to use and operate further helps reduce consumption. The team will work closely to ensure the final building solution is understandable and manageable by the users.

3.3.6 Smart Metering

Smart meters will be provided to each flat to show consumption data for electricity, water and gas. This is required to achieve credits in the BREEAM Domestic Refurbishment assessment and aims to assist the occupants in minimising their consumption.



4. LOW AND ZERO CARBON TECHNOLOGIES

To reduce the carbon emission of the buildings, the first step has been to adopt a passive design whereby the architectural design of the building, including fabric specification and engineering services help in minimising the energy demand of the building.

To further help reduce the carbon emissions from the building we can look to the installation of Low and Zero Carbon technologies. Careful consideration and calculation of these options can help in reducing energy consumption and carbon emission of the buildings over time to realise an economical benefit for the building owner / occupier.

Therefore this part of the report investigates the feasibility of installing different low/zero carbon technologies that could be considered appropriate for the area. The technologies considered in this report include:

- Air source heat pumps
- Solar thermal energy capture
- Photovoltaic Panels

It is important to consider the use of renewable technologies however in this case it is thought to be inappropriate to include any for the reasons outlined below.

5. AIR SOURCE HEAT PUMPS

5.1 Technology explained:

Air source heat pumps use similar principles as ground source heat pumps. The principle of the heat pump, is to take low-grade energy from the surrounding air by means of a fan pulling the outside air through a heat exchanger at a lower temperature to pick up heat in the refrigerant cycle. The compressor within the refrigerant cycle then compresses the refrigerant gas increasing the temperature concurrently. The heat is then removed for heating and the whole process continues.

Unlike the ground source heat pumps where the temperature of ground is relatively stable throughout the year, in air source heat pumps the temperature can be highly variable in accordance with the weather. In the past, to run the system most efficiently, it is sometimes best to combine the system with another system such as conventional boilers or a CHP machine to run when the air temperature is very low and the coefficient of performance (COP) of ASHP is lower. However, more efficient machines and refrigerants are now available that mean higher COP's during colder ambient temperatures thus removing the necessity for combining with traditional boilers to further save infrastructure charges.





Figure 13 - Air Source Heat Pump principles

5.2 Potentials for Guildford Street Development

5.2.1 Natural Resources

System uses ambient air as the renewable energy source and using electricity –converts low grade heat to higher grade heat.

5.2.2 Technical feasibility

This technology cannot be easily installed to this building as there is not a suitable position which would be acceptable to the occupants and noise from the compressors, pumps and fans would be unacceptable in such a tight site.

6. SOLAR THERMAL ENERGY

6.1 Technology explained:

Solar collectors absorb the solar radiation and sun's energy and provide heating and hot water. There are two basic types of solar heating systems, liquid based system or air based system. Liquid based systems are usually used with storage which makes the solar thermal system more viable, matching the demand with the availability of hot water. The circulation of heat can be passive (relying on water pressure) or active (using pumps). The two most common types of solar collectors are flat plate and evacuated tube collectors. Evacuated tubes are more sophisticated, more efficient and also more expensive than flat panels.

6.2 Potential for Guilford Street Development

6.2.1 Natural Resources





The peak solar radiation in London is just less than 1 kW/m². The best location for solar thermal panels are on building roofs or walls, facing south (within 15°).

6.2.2 Technical feasibility



1:50

The roof plan provided shows how roof windows have been incorporated into the top floor flat to improve the daylighting and thus the need for electric lighting. This does not leave sufficient space for the installation of solar technologies on this small inward sloping roof.

7. PHOTOVOLTAIC (PV) PANELS

7.1 Technology explained:

Photovoltaic systems use solar cells to convert sunlight into electricity. The PV cell consists of semi-conducting material usually silicon. It creates an electric field when light shines on the cell which causes electricity to flow. There are different kinds of PV panels on the market today, thin films, polycrystalline and monocrystalline. These have different efficiencies normally ranging from 12-28%.

PV panels can be integrated with the fabric of the building. In ideal circumstances the modules replace building components such as curtain walls, roof tiles, atria and structural glazing and vertical walls. Framed PV modules can either be roof mounted or free standing.



7.2 Potentials for Guilford Street Development

7.2.1 Natural Resources

The annual isolation is reasonably good in this area.

7.2.2 Technical feasibility

As outlined previously for solar water heating there is not sufficient roof space to install solar photovoltaics.

8. BREEAM DOMESTIC REFURBISHMENT

8.1 Management

MAN 1 Home User Guide

A 'Home User Guide' will be made available to the dwelling providing occupants with an understanding of the energy associated with the operation of their home. This nontechnical guide will include operational instructions, recommendations on improving energy use and information on the surrounding area (local amenities) to obtain full credits in this section.

MAN 2 Responsible Construction Practices

The tender specification will require contractors to be compliant with the Considerate Constructors Scheme (CCS). It is expected that formal certification will be achieved and that contractors will operate beyond compliance level (CCS Code of Considerate Practice score between 35 and 40 with score 7 in each section).

MAN 3 Construction Site Impacts

To minimise the construction impacts of the site, contractors will be required to monitor, report and set targets for the production of CO2 arising from site activities in respect to energy use and water consumption.

MAN 4 Security

All external doors and accessible windows will meet minimum BREEAM standards and be appropriately fitted.

An Architectural Liaison Officer will be consulted and their advice will be incorporated into the design of the development in accordance with 'Secured By Design' standards.

The requirement is for putty (where present) to be on the inside of windows for security. However this is not possible in the case of the existing windows. In this case negotiation with the ALO is required to ensure security is achieved within the restrictions of the list building status.





MAN 5 Protection and Enhancement of Ecological Features

The development is currently located on a site with low ecological value as there are no existing features of ecological value at the site. Therefore, this credit can be awarded by default.

MAN 6 Project Management

A project implementation plan will be compiled by the project manager; individual and shared responsibilities will be assigned amongst the project team during an initiation meeting.

8.2 Health and Wellbeing

HEA 1 Daylighting

These credits are unlikely to be achievable as the size of the windows cannot be changed.

HEA 2 Sound Insulation

Building elements will be designed to meet Building Regulations Part E.

HEA 5 Ventilation

A minimum level of background ventilation will be provided (e.g. trickle ventilators) for all habitable rooms, kitchens, utility rooms and bathrooms compliant with section 7, Part F, 2010. Extract ventilation will be provided in all wet rooms (e.g. kitchen, utility and bathrooms), and will be compliant with section 5, Building Regulations Approved Document Part F 2010. In addition, purge ventilation will be provided in all habitable rooms and wet rooms in compliance with section 7, Building Regulations Approved Document Part F, 2010.

The refurbishment will be designed to meet the requirements of Building Regulations Part F section 3.11–3.16.

HEA 6 Safety

Smoke and carbon monoxide detection systems will be installed as part of the refurbishment. A compliant fire detection and alarm system will also be provided Energy

8.3 Energy

ENE 1 Improvement in Energy Efficiency Rating (EER)

The Energy Efficiency Rating (EER) is a measure of the overall efficiency of a dwelling. It accounts for regulated energy use in terms of heating, hot water, equipment, lighting and auxiliary energy use.

The methodology set out by the Department of Energy and Climate Change (DECC) for assessing the energy use of dwellings is the Standard Assessment Procedure (SAP). The version of SAP used for BREEAM Domestic Refurbishment is SAP 2009.

Preliminary SAP calculations have been carried out to assess the potential CO2 savings achieved through

- energy efficiency measures
- the efficient supply of energy

The average reduction in the EER for this development is calculated to be 4.33. This is not sufficient to achieve credits.



ENE 2 Energy Efficiency Rating (EER) Post Refurbishment

The reduction in energy demand of the proposed development has been outlined previously in this report. The SAP calculations show that and average of 3 credits can be achieved here.

ENE 3 Primary Energy Demand

An average primary energy demand of 153.94 kWh/m2/year will be achieved by the building post refurbishment. This achieves 6 credits.

ENE 5 Energy Labelled White Goods

All residential units in 82 Guilford Street will be supplied with an EU Energy Efficiency Labelling Scheme Leaflet, which provides guidance on the purchase of energy efficient white goods.

The dwellings will also be supplied with energy efficient white goods which meet the following standard:

- Fridges and freezers or fridge freezers, washing machines and dishwashers Energy Saving Trust recommended appliances
- Tumble dryers or washer dryers B rating under EU Energy Efficiency

ENE 6 Drying Space

The proposed development will include provisions for internal clothes drying, thereby reducing the amount of electricity consumed through the use of tumble dryers. Each 1-2 bedroom dwelling will include at least 4m of retractable drying lines, while a minimum of 6m will be provided in dwellings of 3 bedrooms, all within well-ventilated bathrooms.

ENE7 Lighting

Internal - When daylight is inadequate, lighting will be designed to give occupants flexibility in achieving desired illuminance levels without excessive energy use. The design will aim to achieve a maximum average wattage of 9 watts/m2 across the total floor area of the dwelling.

External - Energy efficient light fittings will be installed in the external spaces. In addition, external lights will be fitted with controls to reduce the energy consumption of the building during periods of infrequent use:





ENE 8 Energy Display Devices

Energy display devices will be installed in all flats to enable the occupants to gain an understanding of their energy consumption and to enable them to reduce their energy use in the future. The display devices will provide information on current electricity and primary heating consumption data.

ENE 8 Cycle Storage

Cycle spaces will be provided within the development to reduce the frequency of short car journeys. The cycle storage will be adequately sized, secure and accessible to all occupants, thereby achieving a credit in this category.

The provision of bicycle storage will be at a rate of 1 space for every flat.

8.4 Water

WAT 1 Internal Water Use

The water category aims to reduce the consumption of potable water in the home from all sources. These are mandatory credits within BREEAM Domestic Refurbishment, with BREEAM 'Excellent' setting an upper limit of 117 litres per person per day.

The development at 82 Guilford Street aims to reduce water consumption through the use of water efficient fittings, including dual flush toilet, water efficient shower heads and taps. The average capacity and maximum flow rates of the water fittings are listed below.

It is estimated that the proposed development will achieve a water consumption rate of 104.6 litres/ person/day.

WAT 2 External Water Use

Flat with a private garden will be equipped with a compliant rainwater collection system for external/ internal irrigation use. The volume of a rainwater butt for a 1-2 bedroom home with a private garden should be 150 litres.

Flats without garden space, as well as flats that only have balconies provided, achieve this credit by default.

WAT 3 Water meter

Water meters providing visual display of mains potable water consumption installed at a secure and visible location within all flats. The water meters will be capable of recording and displaying historical water consumption, and allowing occupants to monitor their water consumption over time. The meter will also be able to display current consumption either instantaneously or at half hourly intervals.



	ResidentialUnits									
Fitting	Average capacity/Flow rate	Consumption (I/person/day)								
WC (full flush)	6 litres per flush	17.64								
WC (half flush)	3 litres per flush	17.04								
Kitchen and utility sink taps	6 litres per min	13								
Wash basin tap	4 litres per min	7.9								
Bath	180L capacity to overflow	19.8								
Shower	8 litres per min	34.96								
Washingmachine	8.17L per kg (dry load)	17.16								
Dishwasher	1.25L per place setting	4.5								
Net internal water		114.96								
consumption										
Normalisation factor		0.91								
Total Water Use		104.6								

Estimated Water Consumption

8.5 Materials

MAT 1 Environmental Impact of Materials

Embodied energy is the energy that is used in the manufacture, processing and the transportation of the materials to site.

The construction build-ups for each of the main building elements are rated from A+ to E. Each element to be used in the building has been rated according to the BRE Green Guide to Specification whereby:

A+ rated elements are least likely to affect the environment

E rated elements are most likely to affect the environment

It is assumed that most of the main building elements within this development will achieve between an A+ to C rating.

MAT 2 & MAT 3 Responsible Sourcing of Materials and Insulation

At least 80% of the materials specified will be obtained from legally and responsible sources. This includes all basic building elements, comprising the building frame, floors, roof, external walls, foundations and internal walls and all finishing elements.

In addition, 100% of all timber used on site will be legally sourced, thereby satisfying the mandatory requirements set out in this category. Any timber used in the structural and finishing elements will be specified from certified sustainable sources such as FSC or PEFC.

Where possible, on-site materials will be reused and recycled to lower transport CO2 emissions associated with off-site recycling. Where practicable, materials with a high recycled or waste content will be specified.



The insulation index for all new insulation used in external walls, ground floor, roof and building services will be less than 2 when calculated using the BREEAM Mat3 Insulation Calculator..

8.6 Waste

WAS 1 Household Waste

Non-recyclable: External space will be allocated for non-recyclable household waste, this will be collected by the Local Authority

Recyclable: A Local Authority Collection Scheme is in operation for the collection of recyclable household waste. Each dwelling will be provided with a bin, with a total capacity of 30 litres and to be located in a dedicated position in the kitchen.

WAS 2 Construction Site Waste Management

The development will minimise the impact of construction waste on the environment through a Site Waste Management Plan (SWMP). This plan will include:

- benchmarks for resource efficiency
- procedures and commitments to reduce hazardous and non-hazardous waste
- monitoring hazardous and non-hazardous waste

All waste generated through the refurbishment process will be managed in accordance with BREEAM recommendations.

A pre-refurbishment audit of the existing building, which covers demolition materials, will be completed. Non-hazardous demolition waste generated by the dwellings refurbishment will meet or exceed the refurbishment and demolition waste diversion benchmarks.



8.7 Pollution

POL1 NOx Emissions

This section aims to reduce the release of nitrogen oxide (NOx) into the atmosphere. Space heating and hot water requirements will be met by high efficiency gas combi boilers with low inherent NOx emissions. Gas boilers with NOx emissions of less than 70 mg/kWh will be specified.

POL3 Flooding

The Environment Agency flood map (as below) shows the site to be at low risk of flooding, however this credit is not achievable without a full flood risk assessment.





Flooding from rivers or sea without defences Extent of Extreme flood Areas benefiting from flood defences

Approximate Site Location

9. CONCLUSION

A number of steps have been considered and will continue to be considered to reduce the energy consumption and to provide a percentage of renewable energy for the proposed refurbishment.

9.1 BREEAM Domestic Refurbishment Pre- Assessment Results

A BREEAM Domestic Refurbishment pre- assessment was carried out for the 82 Guilford Street refurbishment, using the targets set by the client and project team. This reflects the client's and project team's commitment in adopting a range of sustainability measures over the life-cycle of the development.

The table below summarises the number of credits achieved in each of the BREEAM categories, using the BRE Pre-Assessment Estimator.



The proposed development achieves a total of 51.55 credits, which exceeds the requirement for BREEAM 'Good'.

			Score Assessment					
		Credit Score	Credits Available	Sub Total	Weighting Factor	Points Score		
Management	MAN 1 Home User Guide	3	3					
	MAN 2 Responsible Construction Practices	0	2					
	MAN 3 Construction Site Impacts	1	1					
	MAN 4 Security	0	2	6	12%	6.00		
	MAN 5 Protection & Enhancement of Ecological Features	1	1					
	MAN 6 Project Management	1	2					
Health &	HEA 1 Daylighting	0	2					
Wellbeing	HEA 2 Sound Insulation	2	4					
	HEA 3 Volatile Organic Compounds	1	1	_	4 = 0 (
	HEA 4 Inclusive Design	0	2	5	17%	7.08		
	HEA 5 Ventilation	1	2					
	HEA 6 Safety	1	1					
Energy	ENE 1 Improvement in Energy Efficiency Rating	0	6					
	ENE 2 Energy Efficiency Rating Post Refurbishment	3	4					
	ENE 3 Primary Energy Demand	6	7					
	ENE 4 Renewable Technologies	0	2					
	ENE 5 Energy Labelled White Goods	1	2	4.6	420/	22.72		
	ENE 6 Drying Space	1	1	16	43%	23.72		
	ENE 7 Lighting	2	2					
	ENE 8 Display Energy Devices	2	2					
	ENE 9 Cycle Storage	1	2					
	ENE 10 Home Office	0	1					
Water	WAT 1 Internal Water Use	1	3					
	WAT 2 External Water Use	1	1	3	11%	6.60		
	WAT 3 Water Meter	1	1					
Materials	MAT 1 Environmental Impact of Materials	6	25					
	MAT 2 Responsible Sourcing	4	12	14	8%	2.49		
	MAT 3 Insulation	4	8					
Waste	WAS 1 Household Waste	2	2	Л	2%	2.40		
	WAS 2 Refurbishment Site Waste Management	2	3	+	578	2.40		
Pollution	POL 1 NOx Emissions	2	3					
	POL 2 Surface Water Runoff	1	3	3	6%	2.25		
	POL 3 Flooding	0	2					
Innovation	MAN 6 Early Design Input	1	1	1	10%	1.00		
		Corr		Total P	o int Soored	E1 EE 97		
	Level Achieved:	6000		Total P	om scored:	51.55%		



Appendix A

Outline Design Drawings











Appendix B

SAP calculations

Predicted Energy Assessment

82 Guilford Street London WC1N 1DF Dwelling type: Date of assessment: Produced by: Total floor area: Top floor Flat 15 July 2014 Stroma Certification 34.6 m²

Environmental Impact (CO₂) Rating

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be. The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.



User Details:													
Assessor Name:	Test User		Strom	STRO	000000								
Software Name:	Stroma FSAP 200	9	Softwa	are Ver	sion:		Versio	on: 1.5.0.74					
		Prope	rty Address:	Third flo	oor flat								
Address :	82 Guilford Street, L	ondon, WC1	N 1DF										
1. Overall dwelling dimer	nsions:		(A)										
Basement			Area(m²) 34.6	(1a) x	Ave He 2.6	6 ight(m) 693	(2a) =	93.18	(3a)				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e))+(1n)	34.6	(4)									
Dwelling volume				(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	93.18	(5)				
2. Ventilation rate:	·							<u>, , , , , , , , , , , , , , , , , , , </u>					
	main Se heating h	econdary eating	other		total			m ³ per hour					
Number of chimneys	0 +	0 +	0	=	0	x 4	40 =	0	(6a)				
Number of open flues	0 +	0 +	0] = [0	x 2	20 =	0	(6b)				
Number of intermittent far	is			- E	2	x 1	0 =	20	(7a)				
Number of passive vents				Ē	0	x 1	0 =	0	(7b)				
Number of flueless gas fir	es				0	x 4	40 =	0	(7c)				
							I		_				
							Air ch	anges per ho	ur				
Infiltration due to chimney	s, flues and fans = $(6a)$	a)+(6b)+(7a)+(7	b)+(7c) =		20	-	÷ (5) =	0.21	(8)				
If a pressurisation test has be	en carried out or is intende	d, proceed to (1	7), otherwise o	continue fro	om (9) to (16)	I						
Additional infiltration	e aweiling (ns)					[(9)-	11x0 1 =	0	(9)				
Structural infiltration: 0.2	25 for steel or timber f	rame or 0.35	o for masonr	v constru	uction	[(0)	17.0.1 -	0	(10)				
if both types of wall are pre deducting areas of opening	esent, use the value corresp gs); if equal user 0.35	oonding to the g	reater wall are	a (after			I	Ū], ,				
If suspended wooden fle	oor, enter 0.2 (unseale	ed) or 0.1 (se	ealed), else	enter 0				0	(12)				
If no draught lobby, ente	er 0.05, else enter 0							0	(13)				
Percentage of windows	and doors draught sti	ripped						0	(14)				
Window infiltration			0.25 - [0.2	x (14) ÷ 10	= [00			0	(15)				
Infiltration rate	50	• • • • • • • • • • • •	(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)				
Air permeability value, o	150, expressed in cub	IC metres pe	r nour per so	quare me	etre of e	nvelope	area	10					
Air permeability value applies	if a pressurisation test has	$r \rightarrow 20 + (0), 0$	a degree air pei	rmeabilitv i	s heina us	sed		0.71	(18)				
Number of sides on which	sheltered		l dogi oo dii poi	incusiinty i	o bonng uc	,ou	I	2	(19)				
Shelter factor			(20) = 1 -	0.075 x (1	9)] =			0.85	(20)				
Infiltration rate incorporation	ng shelter factor		(21) = (18)	x (20) =				0.61	(21)				
Infiltration rate modified for	r monthly wind speed						-		_				
Jan Feb I	Mar Apr May	Jun Ju	ıl Aug	Sep	Oct	Nov	Dec						
Monthly average wind spe	ed from Table 7												
(22)m= 5.4 5.1 §	5.1 4.5 4.1	3.9 3.	7 3.7	4.2	4.5	4.8	5.1						
Wind Factor $(22a)m = (22a)m $)m ÷ 4												
(22a)m= 1.35 1.27 1	.27 1.12 1.02	0.98 0.9	0.92	1.05	1.12	1.2	1.27						
		I											

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m	-	-	-	_	
~ ' '	0.82	0.77	0.77	0.68	0.62	0.59	0.56	0.56	0.64	0.68	0.73	0.77		
Calcul If me	ate ette	<i>ctive air (</i> al ventila	change i ition:	rate for t	he appli	cable ca	Se						0	(23a)
lf exh	naust air h	eat pump (using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)), othei	wise (23b) = (23a)			0	(23b)
If bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =	, , ,			0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	m = (22)	2b)m + (23b) x [′	1 – (23c)	 - 100]	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	ed mecha	anical ve	ntilation	without	heat rec	coverv (N	MV) (24b)m = (22	1 2b)m + (;	23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	iouse ex	tract ver	tilation o	or positiv	ve input v	ventilatio	on from c	outside				1	
í	if (22b)r	n < 0.5 ×	: (23b), t	hen (240	c) = (23b); otherv	wise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilatio	on from I	oft	_				
(if (22b)r	n = 1, the	en (24d)	m = (22t	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0.84	0.8	0.8	0.73	0.69	0.68	0.66	0.66	0.7	0.73	0.77	0.8]	(240)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in boy	(25)	0.70	0.77	0.0	1	(25)
(25)m=	0.84	0.8	0.8	0.73	0.69	0.68	0.66	0.66	0.7	0.73	0.77	0.8	J	(25)
3. He	at losse	s and he	eat loss p	paramete	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs ²	Net Ar A ,r	rea m²	U-valı W/m2	le K	A X U (W/I	<)	k-valu∉ kJ/m²∙l	e A K k	∖Xk J/K
Doors						1.91	x	1.8	=	3.438				(26)
Windo	ws Type	e 1				1.39	x1		(27)					
Windo	ws Type	e 2				1.85	1.85 x1/[1/(1.2)+0.04] = 2.12							(27)
Rooflig	ghts Typ	e 1				0.53	x1	/[1/(1.2) +	0.04] =	0.636				(27b)
Rooflig	ghts Typ	e 2				0.36		/[1/(1.2) +	0.04] =	0.432				(27b)
Walls		21.7	9	1.91		19.88	3 X	0.17		3.38	Ξ r			(29)
Roof		34.6	6	1.78		32.82	2 X	0.15		4.92			\exists	(30)
Total a	area of e	elements	, m²			61.02	4		I					(31)
* for win ** inclug	ndows and de the area	l roof winde as on both	ows, use e sides of ir	effective wi	ndow U-va Is and part	alue calcul titions	ated using	g formula 1,	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	1 3.2	
Fabric	heat los	ss, W/K =	= S (A x	U)				(26)(30)	+ (32) =				21.99	(33)
Heat c	apacity	Cm = S(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	633.408	(34)
Therm	al mass	parame	ter (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For desi can be ι	ign asses: used inste	sments wh ad of a dei	ere the de tailed calci	tails of the ulation.	construct	ion are not	t known pi	recisely the	indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						9.15	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)							-	
Total fa	abric he	at loss							(33) +	(36) =			31.14	(37)
Ventila	ation hea	at loss ca	alculated	l monthly	/			1	(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	25.71	24.6	24.6	22.55	21.33	20.77	20.23	20.23	21.63	22.55	23.54	24.6	J	(38)
Heat tr	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m		1	
(39)m=	56.85	55.74	55.74	53.69	52.47	51.91	51.37	51.37	52.77	53.69	54.68	55.74		
										Average =	Sum(39)1	12 /12=	53.83	(39)

Heat lo	oss para	ameter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.64	1.61	1.61	1.55	1.52	1.5	1.48	1.48	1.53	1.55	1.58	1.61		
Numbe	er of day	vs in mo	nth (Tah		•		•	•		Average =	Sum(40)1.	12 /12=	1.56	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
•		Ū											1	
Assum if TF	1 A > 13.	upancy, 9, N = 1	N + 1.76 x	([1 - exp	o(-0.0003	849 x (TF	FA -13.9))2)] + 0.(0013 x (⁻	TFA -13	1. .9)	27		(42)
if TF	A £ 13.	9, N = 1		ara in liter		v Valav							I	(10)
Annua Reduce	the annu	ge not wa al average	hot water	ge in litre usage by	es per da 5% if the c	ay va,av Iwelling is	erage = designed	(25 X N) to achieve	+ 36 a water us	se target o	64 f	4.4		(43)
not mor	e that 125	ō litres per	person pe	r day (all w	vater use, i	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	in litres pei	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	: (43)					-	
(44)m=	70.83	68.26	65.68	63.11	60.53	57.96	57.96	60.53	63.11	65.68	68.26	70.83		_
Energy	content o	f hot water	used - ca	lculated m	onthly — 1	100 v Vd r	n v nm v l	DTm / 360(kW/b/mor	Total = Su	m(44) ₁₁₂ =	= c 1d)	772.74	(44)
Lifergy					0//////y = 4.								1	
(45)m=	105.3	92.09	95.03	82.85	79.5	68.6	63.57	72.95	73.82	86.03	93.9	101.97	1015.61	(45)
$Total = Sum(45)_{112} = 1015.61$ If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													1015.01	
(46)m=	15.79	13.81	14.25	12.43	11.92	10.29	9.54	10.94	11.07	12.9	14.09	15.3		(46)
Water	storage	loss:											1	
a) If m	anufact	urer's de	clared lo	oss facto	or is knov	wn (kWh	/day):					0		(47)
Tempe	erature f	factor fro	m Table	e 2b								0		(48)
Energy	y lost fro	om water	r storage	e, kWh/y ndor loc	ear Stoctor i	e not kny	2000	(47) x (48)) =			0		(49)
Cylind	er volun	ne (litres) includi	ng any s	olar stor	age with	nin same	9				0		(50)
If con	nmunity h	eating and	, I no tank ii	n dwelling,	enter 110	litres in bo	ox (50)					-	1	
Othe	rwise if no	o stored ho	ot water (th	nis includes	s instantan	eous com	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	factor fro	m Table	e 2b								0		(53)
Energy	y lost fro	om water	r storage	e, kWh/y	ear			((50) x (51	l) x (52) x	(53) =		0		(54)
Enter ((49) or (54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month		1	((56)m = (55) × (41)	m			1	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	is dedicate	a solar sto	orage, (57)	m = (56)m 1	x [(50) – ([H11)]÷(5 1	0), else (5	7)m = (56) I	m wnere (I	H11) IS Tro T	m Append	IX H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	t loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	t loss cal	Iculated	for each	month (59)m = ((58) ÷ 30	65 × (41)	m Novilia - La	r th a r	ata ¹			
(110) (59)m=												0	1	(59)
O creation		<u> </u>	<u> </u>		(04))				-	l	. /
			ior each		$(0^{\circ})^{\circ} =$	(60) ÷ 36	05 × (41)m	24.40	22.47	22.60	26.4	l	(61)
(01)[[]=	30.1	31.42	33.47	31.12	30.85	20.58	29.53	30.85	31.12	33.47	33.00	30.1	l .	(01)

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Total h	neat req	uired for	water	he	ating ca	alculate	d fo	r eac	h month	(62)	m =	0.85 × (45)m	+	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	141.39	123.51	128.5		113.97	110.34	9	97.18	93.1	103	8.79	104.94	119.	.5	127.57	138	8.07		(62)
Solar D	HW input	calculated	using Ap	ope	ndix G or	Appendi	хH	(negati	ve quantity	/) (ent	ter '0'	if no solar	r contri	ibuti	ion to wate	er hea	ting)	-	
(add a	dditiona	I lines if	FGHR	Sa	and/or V	WWHR	S ap	plies	, see Ap	penc	dix G	B)							
(63)m=	0	0	0		0	0		0	0	C)	0	0		0	()		(63)
Outpu	t from w	ater hea	ter																
(64)m=	141.39	123.51	128.5	Τ	113.97	110.34	9	97.18	93.1	103	8.79	104.94	119.	.5	127.57	138	8.07		
		-									Outp	out from wa	ater he	ate	r (annual)	12		1401.87	(64)
Heat g	ains fro	m water	heatin	g,	kWh/m	onth 0.2	25 x	[0.85	5 × (45)m	n + (6	61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (5	59)m	ו]	
(65)m=	44.04	38.48	39.97		35.33	34.14	2	9.95	28.52	31.	.97	32.32	36.9)7	39.64	42.	.93		(65)
inclu	ude (57)	m in calo	ulatior	۱0	f (65)m	only if	cylii	nder i	s in the o	dwel	ling	or hot w	ater i	s fr	om com	mun	ity h	eating	
5. Internal gains (see Table 5 and 5a):																			
Metab	olic gair	ns (Table	5) W	atte	s														
motab	Jan	Feb	Mar		Apr	May	Τ	Jun	Jul	A	ug	Sep	00	ct	Nov	D	ec		
(66)m=	76.28	76.28	76.28	╈	76.28	76.28	7	6.28	76.28	76.	.28	76.28	76.2	8	76.28	76.	.28		(66)
Liahtir	na aains	(calcula	ted in /	 Арі	pendix	L. equa	tion	L9 o	r L9a). a	lso s	see ⁻	Lable 5						1	
(67)m=	28.95	25.71	20.91	T	15.83	11.83		9.99	10.79	14.	.03	18.83	23.9)1	27.91	29.	.75		(67)
Applia	nces da	ins (calc	ulated	in	Append	l dixleo	ມ	tion I	13 or I 1	3a)	also	see Tab	ole 5					1	
(68)m=	161.54	163.21	158.99	 	150	138.65	1 1	27.98	120.85	119	0.17	123.4	132.	39	143.74	154	.41]	(68)
Cookir			L ted in	_L ∆n	nendiv			115	or 15a		:0 SE	a Table	5					I	
(69)m=	43.9	43.9	43.9		43.9	43.9		43.9	43.9	43	.9	43.9	43.9	9	43.9	43	.9]	(69)
Dump			(Table		2)		_		1010			1010		<u> </u>				I	
(70)m-	10 10			- - -	a) 10	10	1	10	10	1	0	10	10		10	1	0	1	(70)
								-10 	10		0	10	10		10		0	l	(10)
(71)m-	5 e.g. e					es) (Ta						50.05 50.05		50.85	50	95	1	(71)	
(71)III=	-50.85	-50.85		<u>`</u>	-30.85	-30.85	<u> </u>	50.85	-30.83	-50	.05	-50.65	-50.0	55	-50.85	-50	.05	l	(7.1)
vvater	neating	gains (1) 	40.07	45.00	Т	44.0	20.22	40	07	44.0	40.0					1	(72)
(72)m=	59.19	57.26	53.72		49.07	45.89		41.6	38.33	42.	.97	44.9	49.6	.9	55.05	57	.7		(12)
Total	Internal	gains =		. T	004.00	075 7		(66)	im + (67)m	1 + (68	8)m +	- (69)m + (70)m -	+ (/	1)m + (72)	m		1	(70)
(73)m=	329	325.51	312.94	•	294.22	275.7		258.9	249.3	25	5.5	266.45	285.	32	306.03	321	.19		(73)
0. Solar (nains are	S.	usina so	lar	flux from	Table 6a	and	25500	iated equa	tions	to co	nvert to th	e annl	icah	le orientat	ion			
Orient	ation:		actor				and	Flu	v		10 00	a	c appi	icac	FF	1011.		Gains	
Onent	-	Table 6d	actor		m²			Tal	ble 6a		Т	9_ able 6b		Та	able 6c			(W)	
Southe	ast 0.9x	1		x	1.3	9	x	3	37.39	×		0.76	x	Г	0.7		=	49.77	(77)
Southe	ast 0.9x	1		x	1.3	39	x	6	3.74	x		0.76	- x	F	0.7		=	84.84](77)
Southe	ast 0.9x	1		x	1.3	39	x	6	34.22	x		0.76	۲ × ۲	F	0.7		=	112.1](77)
Southe	ast <mark>0.9x</mark>	1		x	1.3	39	x	1	03.49	x		0.76	۲ ×	F	0.7		=	137.75	(77)
Southe	ast 0.9x	1		x	1.3	9	x	1	13.34	×		0.76	۲ × آ	F	0.7		=	150.86	(77)
Southe	ast <mark>0.9x</mark>	1		x	1.3	39	x	1	15.04	×		0.76	×	Ē	0.7		=	153.13	(77)
Southe	ast 0.9x	1		x	1.3	39	x	1	12.79	×		0.76	×	Γ	0.7		=	150.13	(77)
Southe	ast 0.9x 1 x 1.39		39	x	1	05.34	×		0.76	x		0.7		=	140.22	(77)			

Southeast 0.9x	1	x	1.39	x	92.9	x	0.76	x	0.7	=	123.65	(77)
Southeast 0.9x	1	×	1.39	x	72.36	×	0.76	x	0.7	i =	96.32	- (77)
Southeast 0.9x	1	×	1.39	x	44.83	x	0.76	x	0.7	=	59.67	_ (77)
Southeast 0.9x	1	×	1.39	x	31.95	x	0.76	x	0.7	=	42.53	_ (77)
Northwest 0.9x	1	x	1.85	x	11.51	×	0.63	x	0.7	=	8.45	(81)
Northwest 0.9x	1	×	1.85	x	23.55	x	0.63	x	0.7	=	17.3	(81)
Northwest 0.9x	1	×	1.85	x	41.13	×	0.63	x	0.7	=	30.2	(81)
Northwest 0.9x	1	×	1.85	x	67.8	×	0.63	x	0.7	=	49.78	(81)
Northwest 0.9x	1	×	1.85	x	89.77	×	0.63	x	0.7] =	65.91	(81)
Northwest 0.9x	1	x	1.85	x	97.5	×	0.63	x	0.7] =	71.59	(81)
Northwest 0.9x	1	x	1.85	x	92.98	×	0.63	x	0.7	=	68.27	(81)
Northwest 0.9x	1	x	1.85	x	75.42	x	0.63	x	0.7	=	55.38	(81)
Northwest 0.9x	1	x	1.85	x	51.24	x	0.63	x	0.7	=	37.63	(81)
Northwest 0.9x	1	x	1.85	x	29.6	x	0.63	x	0.7	=	21.73	(81)
Northwest 0.9x	1	x	1.85	x	14.52	x	0.63	x	0.7	=	10.67	(81)
Northwest 0.9x	1	x	1.85	x	9.36	×	0.63	x	0.7] =	6.87	(81)
Rooflights 0.9x	1	x	0.53	x	26	x	0.63	x	0.8	=	12.5	(82)
Rooflights 0.9x	1	x	0.36	x	26	x	0.63	x	0.8	=	8.49	(82)
Rooflights 0.9x	1	x	0.53	x	54	x	0.63	x	0.8	=	25.96	(82)
Rooflights 0.9x	1	x	0.36	x	54	x	0.63	x	0.8	=	17.64	(82)
Rooflights 0.9x	1	x	0.53	x	94	x	0.63	x	0.8	=	45.2	(82)
Rooflights 0.9x	1	x	0.36	x	94	x	0.63	x	0.8	=	30.7	(82)
Rooflights 0.9x	1	x	0.53	x	150	x	0.63	x	0.8	=	72.12	(82)
Rooflights 0.9x	1	×	0.36	x	150	×	0.63	x	0.8	=	48.99	(82)
Rooflights 0.9x	1	x	0.53	x	190	x	0.63	x	0.8] =	91.36	(82)
Rooflights 0.9x	1	x	0.36	x	190	×	0.63	x	0.8	=	62.05	(82)
Rooflights 0.9x	1	x	0.53	x	201	x	0.63	x	0.8	=	96.64	(82)
Rooflights 0.9x	1	x	0.36	x	201	×	0.63	x	0.8	=	65.64	(82)
Rooflights 0.9x	1	x	0.53	x	194	x	0.63	x	0.8	=	93.28	(82)
Rooflights 0.9x	1	x	0.36	x	194	x	0.63	x	0.8	=	63.36	(82)
Rooflights 0.9x	1	x	0.53	x	164	x	0.63	x	0.8	=	78.85	(82)
Rooflights 0.9x	1	x	0.36	x	164	×	0.63	x	0.8	=	53.56	(82)
Rooflights 0.9x	1	x	0.53	x	116	x	0.63	x	0.8	=	55.77	(82)
Rooflights 0.9x	1	x	0.36	x	116	x	0.63	x	0.8	=	37.88	(82)
Rooflights 0.9x	1	x	0.53	x	68	x	0.63	x	0.8	=	32.7	(82)
Rooflights 0.9x	1	x	0.36	×	68	×	0.63	×	0.8] =	22.21	(82)
Rooflights 0.9x	1	x	0.53	×	33	×	0.63	x	0.8	=	15.87	(82)
Rooflights 0.9x	1	x	0.36	×	33	×	0.63	x	0.8	=	10.78	(82)
Rooflights 0.9x	1	x	0.53	x	21	×	0.63	x	0.8] =	10.1	(82)
Rooflights 0.9x	1	x	0.36	x	21	×	0.63	x	0.8] =	6.86	(82)

Solar gains in watts, calculated for each month									(83)m = Sum(74)m(82)m						
(83)m=	79.21	145.73	218.19	308.64	370.18	387.01	375.04	328.01	254.94	172.96	96.98	66.36	(83)		

(84)m=	408.21	471.24	531.13	602.86	645.88	645.91	624.34	583.5	521.39	458.28	403.01	387.55		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.9	0.86	0.8	0.72	0.59	0.45	0.32	0.34	0.55	0.75	0.86	0.9		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	nllow ste	ns 3 to 7	in Tabl	e 9c)		<u> </u>			
(87)m=	18.48	18.84	19.38	19.97	20.51	20.81	20.94	20.93	20.69	20.07	19.13	18.56		(87)
Tom		l during h		l orioda ir	roct of	dwolling	from To		h2 (°C)					
(88)m=	19.59	19.61	19.61	19.65	19.68	19.69	197	19.7	19.67	19.65	19.63	19.61		(88)
(00)				10.00		10.00			10.01	10.00	10.00	10.01		()
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	n2,m (se		9a)	0.47	0.7	0.04	0.00	l	(80)
(89)m=	0.88	0.84	0.78	0.68	0.53	0.37	0.22	0.24	0.47	0.7	0.84	0.88		(09)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)			I	
(90)m=	17.39	17.75	18.27	18.84	19.34	19.59	19.68	19.68	19.49	18.95	18.05	17.48		(90) ¬
									f	LA = Livin	g area ÷ (4	1) =	0.49	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2					
(92)m=	17.92	18.28	18.81	19.39	19.91	20.19	20.3	20.3	20.08	19.5	18.58	18.01		(92)
Apply	adjustr	nent to t	ne mear	n internal	temper	ature fro	m Table	4e, whe	ere appro	opriate			L	
(93)m=	17.92	18.28	18.81	19.39	19.91	20.19	20.3	20.3	20.08	19.5	18.58	18.01		(93)
8. Space heating requirement														
Set T	i to the i	mean int	ernal ter	mperatui	re obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
uie ui	lan	Feh	Mar	Δnr	May	lun	lul	Διια	Sen	Oct	Nov	Dec		
Utilisa	ation fac	tor for a	ains. hm):	may	Uun	Uui	, tug	000	001	1101	000		
(94)m=	0.86	0.82	0.76	0.67	0.54	0.4	0.27	0.28	0.5	0.69	0.82	0.86		(94)
Usefu	ul gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	349.77	385.79	402.25	403.9	350.76	261.18	167.44	166.21	258.07	317.75	330.89	333.68		(95)
Montl	hly aver	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			I	
(97)m=	763.13	740.41	669.58	574.21	430.89	290.06	174.75	174.49	305.12	467.07	633.24	730.75		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Nh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m		l	
(98)m=	307.53	238.31	198.89	122.62	59.61	0					217 60	295 42		_
						Ű	Ű	0	0	111.1	217.09	200.12		(00)
Space heating requirement in kWh/m²/year										(kWh/year) = Sum(9	8)15,912 =	1551.18	(98)
Space	e heatin	g require	ement in	kWh/m²	/year	0		Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1551.18 44.83	(98) (99)
Spac 9a. En	e heatin ergy rec	g require quiremer	ement in hts – Ind	kWh/m² ividual h	/year eating sy	ystems i	ncluding	Tota micro-C	l per year	(kWh/year) = Sum(9	8)15,912 =	1551.18 44.83	(98) (99)
Space 9a. En Spac	e heatin ergy rec e heatir	g require quiremer 1g:	ement in hts – Ind	kWh/m² ividual h	/year eating sy	ystems i	ncluding	Tota micro-C	l per year	(kWh/year) = Sum(9	8)15,912 =	1551.18 44.83	(98) (99)
Space 9a. En Spac Fracti	e heatin ergy rec e heatir ion of sp	g require quiremer 1g: bace hea	ement in its – Indi it from se	kWh/m² ividual h econdar	/year eating sy y/supple	ystems i mentary	ncluding system	Tota micro-C	l per year CHP)	(kWh/year) = Sum(9	8)15.912 =	1551.18 44.83 0	(98) (99) (201)
Space 9a. En Spac Fracti Fracti	e heatin ergy rec e heatir ion of sp ion of sp	g require quiremer ng: pace hea pace hea	ement in its – Ind it from s it from m	kWh/m² ividual h econdar nain syst	?/year eating sy y/supple em(s)	ystems i mentary	ncluding system	Tota micro-C (202) = 1 -	0 I per year CHP) - (201) =	(kWh/year) = Sum(9	8)15,912 =	1551.18 44.83 0 1	(98) (99) (201) (202)
Space 9a. En Spac Fracti Fracti Fracti	e heatin ergy rec e heatir ion of sp ion of sp ion of to	g require quiremen ng: bace hea bace hea tal heatin	ement in its – Ind it from s it from m ng from	kWh/m² ividual h econdar nain syst main syst	/year eating sy y/supple em(s) stem 1	ystems i mentary	ncluding system	Tota micro-C (202) = 1 - (204) = (2)	0 I per year CHP) - (201) = 02) × [1 - 1	(kWh/year (203)] =) = Sum(9	8)15,912 =	1551.18 44.83 0 1 1	(98) (99) (201) (202) (204)

Total gains – internal and solar (84)m = (73)m + (83)m, watts

Efficie	ency of	main spa	ace heat	ting syste	em 1								92.6	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g requir	ement (o	alculate	d above))								
	307.53	238.31	198.89	122.62	59.61	0	0	0	0	111.1	217.69	295.42		
(211)m) = {[(98)m x (20	94)] + (2 ⁻	10)m } x	100 ÷ (2	06)				-				(211)
	332.11	257.35	214.79	132.42	64.38	0	0	0	0	119.98	235.09	319.03		_
								Tota	ll (kWh/yea	ar) =Sum(2	211) _{15,1012}	-	1675.14	(211)
Space	e heatin	g fuel (s	econdar	∙y), kWh/	month									
= {[(98])m x (20	01)] + (2	14) m } >	x 100 ÷ (208)	r								
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ıl (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating	9												
Output	from w	ater hea	ter (calc	ulated a	bove)	07.40		400.70	404.04	440.5	407.57	100.07	I	
F ((),) ,	141.39	123.51	128.5	113.97	110.34	97.18	93.1	103.79	104.94	119.5	127.57	138.07		
Efficier	ncy of w	ater hea	ater T										79.5	(216)
(217)m=	86.15	85.88	85.34	84.43	82.77	79.5	79.5	79.5	79.5	84.07	85.58	86.12		(217)
Fuel fo	r water	heating,	, kWh/m	onth										
(219)II (219)m=	164.12	143.83	150.57	134.99	133.31	122.24	117.11	130.56	132	142.15	149.06	160.33		
. ,		I						Tota	l I = Sum(2 ⁻	19a) ₁₁₂ =	1		1680.25	(219)
Annua	l totals									k	Wh/vear		kWh/vear	
Space	heating	fuel use	ed, main	system	1						, j		1675.14	7
Water	heating	fuel use	ed										1680.25	f
Electric	citv for r	oumps. f	ans and	electric	keep-ho	t								
centra	al heatir	ng pump	:									130		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	lectricit	v for the	above.	kWh/vea	r			sum	of (230a).	(230g) =			175	(231)
Electric	city for I	iahtina		.,									204.48] (232)
10a F		sts - indiv	vidual he	eating sv	stems:								20 10	
roarr			riddar rit	Sating by										
						Fu kV	i el Vh/year			Fuel P (Table	r ice 12)		Fuel Cost £/year	
Space	heating	- main s	system ?	1		(21	1) x			3.	1	x 0.01 =	51.9294	(240)
Space	heating	- main s	system 2	2		(21	3) x			0		x 0.01 =	0	(241)
Space heating - secondary						(21	5) x			0		x 0.01 =	0	(242)
Water	heating	cost (ot	her fuel)			(21	9)			3.1	1	x 0.01 =	52.09	(247)
Pumps	, fans a	ind elect	ric keep	-hot		(23	1)			11.4	46	x 0.01 =	20.06	(249)
(if off-p Energy	eak tari for ligh	iff, list ea nting	ach of (2	30a) to (230g) se	eparatel	y as app ²⁾	licable a	nd apply	/ fuel prid	ce accor	ding to 7 x 0.01 =	Table 12a	(250)
Additio	nal star	- ndina chi	arges (T	able 12)						L	<u> </u>		106	$\frac{1}{(251)}$
,	na sta	any on	900 (I	3510 12)									100	
Appendix Q items: repeat lines (253) and (254)) as needed													
--	---------------------------	--------------------------------------	------------------------------	----------------										
Total energy cost(245)	(247) + (250)(254) =		253.5058	(255)										
11a. SAP rating - individual heating systems														
Energy cost deflator (Table 12)			0.47	(256)										
Energy cost factor (ECF) [(255) >	(256)] ÷ [(4) + 45.0] =		1.4968	(257)										
SAP rating (Section 12)			79.1192	(258)										
12a. CO2 emissions – Individual heating systematic systematics and the systematic systematic systematic systematics and the systematic systematic systematics and the systematic systematic systematics and the systematic systemater systematic syst	ems including micro-CH	Р												
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/ye	s ar										
Space heating (main system 1)	(211) x	0.198 =	331.68	(261)										
Space heating (secondary)	(215) x	0 =	0	(263)										
Water heating	(219) x	0.198 =	332.69	(264)										
Space and water heating	(261) + (262) + (263) +	(264) =	664.37	(265)										
Electricity for pumps, fans and electric keep-ho	ot (231) x	0.517 =	90.48	(267)										
Electricity for lighting	(232) x	0.517 =	105.72	(268)										
Total CO2, kg/year		sum of (265)(271) =	860.56	(272)										
CO2 emissions per m ²		(272) ÷ (4) =	24.87	(273)										
El rating (section 14)			86	(274)										
13a. Primary Energy														
	Energy kWh/year	Primary factor	P. Energy kWh/year											
Space heating (main system 1)	(211) x	1.02 =	1708.64	(261)										
Space heating (secondary)	(215) x	0 =	0	(263)										
Energy for water heating	(219) x	1.02 =	1713.86	(264)										
Space and water heating	(261) + (262) + (263) +	(264) =	3422.5	(265)										
Electricity for pumps, fans and electric keep-ho	ot (231) x	2.92 =	511	(267)										
Electricity for lighting	(232) x	0 =	597.09	(268)										
'Total Primary Energy		sum of (265)(271) =	4530.59	(272)										

(272) ÷ (4) =

Primary energy kWh/m²/year

(273)

130.94

			User D	etails:						
Assessor Name:	Test User	0	:	Stroma	a Num	ber:		STRO	000000 p: 1 5 0 74	
Software Name:	Stroma FSAP 200	9 Dr	operty /		Third fl	SION:	ing	versio	n. 1.3.0.74	
Address ·	82 Guilford Street	ondon V	VC1N 1	DF	THICH		ing			
1. Overall dwelling dimer	isions:		VOINT							
Basement			Area 3	1 (m²) 4.6	(1a) x	Ave He	e ight(m) 693	(2a) =	Volume(m³) 93.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)) 3	4.6	(4)	L		J 1		_
Dwelling volume	, , , , , , , , , , , , , , , , , , , ,	, (,			(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	93.18	(5)
2. Ventilation rate:										
	main Se	econdary	y o	other		total			m ³ per hour	•
Number of chimneys		0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues		0	i + [0	」 = [0	x2	20 =	0	(6b)
Number of intermittent fan	s					2	x ′	10 =	20	_](7a)
Number of passive vents						0	x ^	10 =	0	_](7b)
Number of flueless gas fire	es					0	x 4	40 =	0	_](7c)
0					L	-			-	
								Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans = $(6a)$	a)+(6b)+(7a	a)+(7b)+(7	/c) =	Г	20	<u> </u>	÷ (5) =	0.21	(8)
If a pressurisation test has be	en carried out or is intende	d, proceed	to (17), o	therwise c	ontinue fro	om (9) to (16)			_
Number of storeys in the	e dwelling (ns)							11-0.4	0	(9)
Structural infiltration: 0.2	25 for steel or timber f	rame or l	0 35 for	maconr	v constr	uction	[(9)-	-1]XU.1 =	0	(10)
if both types of wall are pre deducting areas of opening	sent, use the value corresp s); if equal user 0.35	conding to	the greate	er wall area	a (after	uction		l	U	
If suspended wooden flo	oor, enter 0.2 (unseale	ed) or 0.1	l (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught sti	ripped							0	(14)
Window infiltration			(0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, c	50, expressed in cub	ic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	10	(17)
If based on air permeabilit	y value, then $(18) = [(1)$	7) ÷ 20]+(8)), otherwis	se (18) = (16)		1		0.71	(18)
Air permeability value applies	it a pressurisation test has	been done	e or a deg	ree air pei	meability i	is being us	sea	1	2	7(10)
Shelter factor	Sherierea			(20) = 1 - [0.075 x (1	9)] =			0.85	(13)
Infiltration rate incorporatir	ng shelter factor			(21) = (18)	x (20) =				0.61](21)
Infiltration rate modified fo	r monthly wind speed							I		
Jan Feb N	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
(22)m= 5.4 5.1 5	5.1 4.5 4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1		
Wind Factor $(22a)m = (22)^{2}$)m ÷ 4									
(22a)m= 1.35 1.27 1	.27 1.12 1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27		

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m				_	
0.1.1	0.82	0.77	0.77	0.68	0.62	0.59	0.56	0.56	0.64	0.68	0.73	0.77		
Calcul If me	ate ette echanic:	<i>ctive air</i> al ventila	<i>change</i> . ition:	rate for t	ne appli	cable ca	se						0	(23a)
lf exh	aust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othei	wise (23b) = (23a)			0	(23b)
lf bala	anced with	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	ı)m = (22	2b)m + (:	23b) × [1 – (23c)	÷ 100]	(====)
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mecha	anical ve	ntilation	without	heat rec	covery (I	MV) (24b)m = (22	2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	iouse ex	tract ver	tilation o	or positiv	ve input v	ventilatio	on from c	outside					
	if (22b)r	n < 0.5 ×	(23b), t	hen (240	c) = (23b	o); otherv	wise (24	c) = (22b	o) m + 0.	5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	ve input	ventilati	on from I	oft	0 51				
(24d)m-	0.84	1 = 1, un		111 = (221)			40) = 0.66	0.5 + [(2)]	20)III- X	0.5]	0.77	0.8	1	(24d)
Effo	ctive air		rate - or	tor (24a	1 or (24k)	(24)	c) or (24)		(25)	0.70	0.11	0.0	J	(=,
(25)m=	0.84			0.73	0.69	0.68		0.66	0.7	0.73	0.77	0.8	1	(25)
(20)111-	0.01	0.0	0.0	0.10	0.00	0.00	0.00	0.00	0.1	0.10	0.11	0.0]	()
3. He	at losse	s and he	eat loss	paramete	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs I ²	Net Ar A ,r	ea n²	U-valı W/m2	le K	A X U (W/ł	<)	k-value kJ/m²₊l	e A K k	X k J/K
Doors						1.91	x	1.8	=	3.438				(26)
Windo	ws Type	e 1				1.39	x1	/[1/(2.4)+	0.04] =	3.04				(27)
Windo	ws Type	e 2				1.85	x1	/[1/(1.6)+	0.04] =	2.78				(27)
Rooflig	ghts Typ	e 1				0.53	x1	/[1/(1.6) +	0.04] =	0.848				(27b)
Rooflig	ghts Typ	e 2				0.36		/[1/(1.6) +	0.04] =	0.576				(27b)
Walls		21.7	79	1.91		19.88	3 X	0.28	=	5.57				(29)
Roof		34.0	6	1.78		32.82	<u>2</u> x	0.18		5.91	i F		\exists	(30)
Total a	area of e	elements	, m²	L		61.02	4	L	'					(31)
* for win	dows and	l roof winde	ows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1,	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	n 3.2	
** inclua	le the area	as on both	sides of ir	nternal wali	ls and par	titions		(26) (20)	(22) -					
	neat los	55, VV/K :	= 5 (A X	0)				(20)(30)	((20)	(20) + (20	2) (22a)	(22a)	26.46	(33)
Thorm		CIII = S($(A \times K)$	2 – Cm ·		k l/m2k			((20)	(30) + (32)	2) + (32a). : Low	(320) =	633.408	(34)
For desi	al IIIass ian asses	sments wh		r = 011 -	construct	ion are not	t known ni	recisely the	indicative		TMP in T	ahle 1f	100	(35)
can be ι	used inste	ad of a de	tailed calc	ulation.	00/101/001		i nilowii pi	colocity and	maloative					
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						9.15	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			35.61	(37)
Ventila	ation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5))	1	
(20)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	NOV	Dec		(38)
(30)11)=	20./1	24.0	24.0	22.00	21.33	20.77	20.23	20.23	21.03	22.55	23.34	24.0]	(30)
Heat tr	ranster o	coefficier	nt, W/K	F0.47	50.05	50.00	55.04	FF 04	(39)m	= (37) + (37)	38)m	00.01	1	
(ວອ)ເມ=	01.33	00.21	00.21	58.17	26.95	50.38	55.84	55.84	ə7.24		59.16 Sum(30)	12/12-	58 31	(39)
													00.01	()

Heat lo	oss para	ameter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.77	1.74	1.74	1.68	1.65	1.63	1.61	1.61	1.65	1.68	1.71	1.74		
Numbe	er of dav	vs in mo	nth (Tab	le 1a)						Average =	Sum(40)1	12 /12=	1.69	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter hea	ting ene	rav reau	irement:								kWh/ve	ear:	
		J												
Assum if TF if TF	ed occi A > 13. A £ 13.	upancy, 9, N = 1 9, N = 1	N + 1.76 x	([1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	1. .9)	27		(42)
Annua	l averag	je hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		64	4.4		(43)
Reduce not more	the annua e that 125	al average i litres per j	hot water person pe	ˈusage by r day (all w	5% if the a /ater use, l	lwelling is hot and co	designed : ld)	to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Hot wate	er usage i	in litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	<u> </u>					
(44)m=	70.83	68.26	65.68	63.11	60.53	57.96	57.96	60.53	63.11	65.68	68.26	70.83		
_										Total = Su	m(44) ₁₁₂ =	=	772.74	(44)
Energy o	content of	f hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	n x nm x [OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	105.3	92.09	95.03	82.85	79.5	68.6	63.57	72.95	73.82	86.03	93.9	101.97		
lf instant	taneous v	vater heati	ng at poin	t of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1015.61	(45)
(46)m=	15.79	13.81	14.25	12.43	11.92	10.29	9.54	10.94	11.07	12.9	14.09	15.3		(46)
vvater	storage	IOSS: urer's de	clared l	nee facto	n is know	wn (k\//h	(dav).					0		(47)
Tompo	anulaci	actor fro		255 1aulu			/uay).					0		(47)
Energy	/ lost fro	m water	r storage	, ∠0 ≥ kWh/v	ear			(47) x (48)) =			0		(40)
If man	ufacture	er's decla	ared cyli	nder loss	s factor is	s not kno	own:	(11) x (10)	, –			0		(43)
Cylinde	er volun	ne (litres) includi	ng any s	olar stor	age with	iin same)			1	50		(50)
If con	nmunity h	eating and	l no tank ir	n dwelling,	enter 110	litres in bo	ox (50)							
Other	wise if no	stored ho	ot water (th	us includes	s instantan	eous comi	bi boilers)	enter '0' ın	box (50)					
Hot wa	iter stor	age loss	actor fi	rom Tab	le 2 (kW	h/litre/da	ay)				0.	.02		(51)
Volum	e factor	from 1a	ble 2a m Table	2h							0.	.93		(52)
Epora	/ loct fre				oor			((50) x (51	l) v (52) v	(52) -		.0		(53)
Enter (49) or (54) in (5	5)	, KVVII/y	cai			((JU) X (JI	1) X (32) X	(33) =	1	.6		(54)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m	· · ·	.0		()
(56)m=	49.48	44.69	49.48	47.88	49.48	47.88	49.48	49.48	47.88	49.48	47.88	49.48		(56)
If cylinde	er contain	s dedicate	d solar sto	prage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	49.48	44.69	49.48	47.88	49.48	47.88	49.48	49.48	47.88	49.48	47.88	49.48		(57)
Drimor			l nuol) fr	I om Toble							6	10		(58)
Primar	v circuit	loss (al	lculated	for each	month (59)m = ((58) ÷ 36	65 x (41)	m		0	10		(00)
(mod	dified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
	-	•	•	•	•	•	•	•	•	•	•			

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Total h	neat req	uired for	water l	ne	ating ca	alculate	d fo	r eac	h month	(62)	m =	0.85 × ((45)m	۱+	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	206.58	183.58	196.32		180.87	180.78	1	66.62	164.85	174	.23	171.83	187.	31	191.92	203	3.26		(62)
Solar D	HW input	calculated	using Ap	pe	ndix G or	Appendi	хH	(negati	ve quantity	/) (ent	ter '0'	if no sola	r contr	ibut	tion to wate	er hea	ating)	-	
(add a	dditiona	l lines if	FGHR	Sa	and/or V	VWHR	S ap	plies	, see Ap	penc	dix G	3)			-				
(63)m=	0	0	0		0	0		0	0	C)	0	0		0	(0		(63)
Outpu	t from w	ater hea	ter																
(64)m=	206.58	183.58	196.32		180.87	180.78	1	66.62	164.85	174	.23	171.83	187.	31	191.92	203	3.26		_
										-	Outp	ut from wa	ater he	eate	er (annual)	12		2208.15	(64)
Heat g	ains fro	m water	heating	g, I	kWh/mo	onth 0.2	25 x	[0.85	x (45)m	1 + (6	61)m	n] + 0.8 x	x [(46	5)m	n + (57)m	+ (5	59)m	ו]	
(65)m=	116.04	103.81	112.63		105.96	107.46	1	01.22	102.16	105	.28	102.96	109.	63	109.64	114	.93		(65)
inclu	ude (57)	m in calo	culation	0	f (65)m	only if	cyliı	nder i	s in the c	dwell	ling	or hot w	ater i	s f	rom com	mun	ity h	neating	
5. In	ternal ga	ains (see	Table	5	and 5a):													
Metab	olic gair	ns (Table	5) Wa	atte	s														
motab	Jan	Feb	Mar	T	Apr	May	Γ	Jun	Jul	A	ug	Sep	0	ct	Nov	D	ec		
(66)m=	76.28	76.28	76.28	Ť	76.28	76.28	7	6.28	76.28	76.	28	76.28	76.2	28	76.28	76.	.28		(66)
Lightir	ng gains	(calcula	ted in A	ı ۱۹/	pendix	L, equa	tion	L9 o	r L9a), a	lso s	iee T	Table 5						1	
(67)m=	41.01	36.42	29.62	Ť	22.42	16.76	1	4.15	15.29	19.	88	26.68	33.8	37	39.54	42.	.15		(67)
Applia	nces da	ins (calc	ulated	 in	Append	dix L. ea	nuat	tion L	13 or L1	3a),	also	see Tal	ble 5		1			1	
(68)m=	161.54	163.21	158.99	Т	150	138.65	1	27.98	120.85	119	.17	123.4	132.	39	143.74	154	1.41		(68)
Cookir		l (calcula	L Ited in <i>i</i>	_L An	nendix		tion	115	or I 15a)	l als		e Table	5					I	
(69)m=	43.9	43.9	43.9	Ť	43.9	43.9		43.9	43.9	43	.9	43.9	43.	9	43.9	43	3.9]	(69)
Pump	s and fa	ns dains	(Table	 5:	a)		1				-			-			-	I	
(70)m=	10	10	10	T	10	10	Т	10	10	1	0	10	10)	10	1	0]	(70)
								5)			° I						0	l	(-)
(71)m-	-50.85	-50.85	-50.85	T	-50.85	-50.85		50.85	-50.85	-50	85	-50.85	-50	85	-50.85	-50	85	1	(71)
Wotor	booting				00.00	00.00		.00	00.00	00	.00	00.00	00.		00.00	00		l	(***)
(72)m-	155 07	gains (1	able 5	, T	147 17	111 11	1	40.50	127.22	1.4.1	51	1/2	147	25	152.27	15/	1 / 9	1	(72)
	100.07	134.47	101.50		147.17	144.44	<u> </u>	40.00	107.02		.51 2)m 1	(60)m + ((70)m	. (7	$(1)_{2}^{(1)}$	- 134 m	1.40	l	()
(72)m-		gains =	410.22	Т	208 02	270.17	12	(00) 62.04	252 70	250		272.4	202		<u> 111 99</u>	420	1 27	1	(73)
(73)III=	lar gain	433.44	419.52	<u> </u>	390.92	579.17	3	02.04	552.79	339	.00	572.4	392.	94	414.88	430			(73)
Solar o	pains are o	s. calculated	usina so	ar	flux from	Table 6a	and	assoc	iated equa	tions	to co	nvert to th	e appl	ical	ble orientat	ion.			
Orient	ation:	Access F	actor		Area			Flu	x			a			FF			Gains	
	-	Table 6d			m²			Tal	ble 6a		Та	able 6b		Т	able 6c			(W)	
Southe	ast 0.9x	1		x	1.3	9	x	3	37.39	×		0.76	٦ x	Г	0.7		=	49.77	(77)
Southe	ast 0.9x	1		x	1.3	39	x	6	3.74	x		0.76	۲ ×	F	0.7		=	84.84](77)
Southe	ast 0.9x	1		x	1.3	39	x		34 22	 x		0.76	۲,	F	0.7		_	112 1](77)
Southe	ast 0.9x	1		x	1 9	19	x		03 49	 x		0.76	۲,	F	0.7		_	137.75](77)
Southe	ast 0.9x	1		· x	1 9	<u></u>	x		13.34	l î l x		0.76	╡ᆠ	L	0.7	\dashv	_	150.86](77)
Southe	ast <u>n ov</u> [1		- x	1.0		x		15.04			0.76	۲Ĵ	L	0.7	\dashv	=	153.13](77)
Southe	ast n ov	1		• •	1.0	20	x		12 70			0.76	۲Ŷ	L	0.7		_	150.13](77)
Southe	astoov	۱ ۸		°` ↓	1.3		Ŷ		05.24	^ ↓	<u> </u>	0.70	╡Ĵ	L	0.7	\dashv	_	140.00](<i>'''</i>)](77)
Journe		1		^	1.3	99	^		00.34	^		0.76	×	L	0.7		-	140.22	

Southeast 0.9x	1	x	1.39	x	92.9	x	0.76	x	0.7] =	123.65	(77)
Southeast 0.9x	1	×	1.39	x	72.36	x	0.76	x	0.7	i =	96.32	– (77)
Southeast 0.9x	1	x	1.39	x	44.83	x	0.76	x	0.7	=	59.67	(77)
Southeast 0.9x	1	×	1.39	x	31.95	x	0.76	x	0.7] =	42.53	(77)
Northwest 0.9x	1	×	1.85	x	11.51	x	0.63	x	0.7	j =	8.45	(81)
Northwest 0.9x	1	x	1.85	x	23.55	x	0.63	x	0.7	=	17.3	(81)
Northwest 0.9x	1	x	1.85	x	41.13	x	0.63	x	0.7] =	30.2	(81)
Northwest 0.9x	1	×	1.85	x	67.8	x	0.63	x	0.7	=	49.78	(81)
Northwest 0.9x	1	x	1.85	x	89.77	x	0.63	x	0.7] =	65.91	(81)
Northwest 0.9x	1	×	1.85	x	97.5	x	0.63	x	0.7] =	71.59	(81)
Northwest 0.9x	1	x	1.85	x	92.98	x	0.63	x	0.7] =	68.27	(81)
Northwest 0.9x	1	×	1.85	x	75.42	x	0.63	x	0.7	=	55.38	(81)
Northwest 0.9x	1	x	1.85	x	51.24	x	0.63	x	0.7] =	37.63	(81)
Northwest 0.9x	1	x	1.85	x	29.6	x	0.63	x	0.7	=	21.73	(81)
Northwest 0.9x	1	x	1.85	x	14.52	x	0.63	x	0.7	=	10.67	(81)
Northwest 0.9x	1	×	1.85	x	9.36	x	0.63	x	0.7	=	6.87	(81)
Rooflights 0.9x	1	x	0.53	x	26	x	0.63	x	0.8	=	12.5	(82)
Rooflights 0.9x	1	x	0.36	x	26	x	0.63	x	0.8	=	8.49	(82)
Rooflights 0.9x	1	×	0.53	x	54	x	0.63	x	0.8	=	25.96	(82)
Rooflights 0.9x	1	x	0.36	x	54	x	0.63	x	0.8	=	17.64	(82)
Rooflights 0.9x	1	x	0.53	x	94	x	0.63	x	0.8] =	45.2	(82)
Rooflights 0.9x	1	x	0.36	x	94	x	0.63	x	0.8] =	30.7	(82)
Rooflights 0.9x	1	x	0.53	x	150	x	0.63	x	0.8	=	72.12	(82)
Rooflights 0.9x	1	×	0.36	x	150	x	0.63	x	0.8] =	48.99	(82)
Rooflights 0.9x	1	x	0.53	x	190	x	0.63	x	0.8] =	91.36	(82)
Rooflights 0.9x	1	×	0.36	x	190	x	0.63	x	0.8] =	62.05	(82)
Rooflights 0.9x	1	x	0.53	x	201	x	0.63	x	0.8] =	96.64	(82)
Rooflights 0.9x	1	×	0.36	x	201	x	0.63	x	0.8	=	65.64	(82)
Rooflights 0.9x	1	x	0.53	x	194	x	0.63	x	0.8	=	93.28	(82)
Rooflights 0.9x	1	x	0.36	x	194	x	0.63	x	0.8	=	63.36	(82)
Rooflights 0.9x	1	×	0.53	x	164	x	0.63	x	0.8	=	78.85	(82)
Rooflights 0.9x	1	x	0.36	x	164	x	0.63	x	0.8	=	53.56	(82)
Rooflights 0.9x	1	×	0.53	x	116	x	0.63	x	0.8	=	55.77	(82)
Rooflights 0.9x	1	x	0.36	x	116	x	0.63	x	0.8	=	37.88	(82)
Rooflights 0.9x	1	×	0.53	x	68	x	0.63	x	0.8	=	32.7	(82)
Rooflights 0.9x	1	x	0.36	x	68	x	0.63	x	0.8] =	22.21	(82)
Rooflights 0.9x	1	x	0.53	x	33	x	0.63	×	0.8] =	15.87	(82)
Rooflights 0.9x	1	x	0.36	×	33	×	0.63	x	0.8	=	10.78	(82)
Rooflights 0.9x	1	x	0.53	x	21	x	0.63	×	0.8] =	10.1	(82)
Rooflights 0.9x	1	x	0.36	×	21	x	0.63	x	0.8	=	6.86	(82)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m			_
(83)m=	79.21	145.73	218.19	308.64	370.18	387.01	375.04	328.01	254.94	172.96	96.98	66.36	(83)

(84)m=	517.05	579.17	637.51	707.56	749.35	749.06	727.83	687.89	627.34	565.9	511.85	496.72		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.86	0.82	0.77	0.68	0.56	0.42	0.3	0.31	0.5	0.69	0.82	0.86		(86)
Mean	interna	temper	ature in	living are	ea T1 (fo	bllow ste	ps 3 to 7	r in Tabl	e 9c)					
(87)m=	18.59	18.91	19.43	19.98	20.51	20.81	20.94	20.93	20.71	20.12	19.23	18.67		(87)
Tomp		during b	ooting n	l orioda ir		dwolling	from To							
(88)m=	19.49	19.52	19.52	19.56	19.58	19.6	19.61	19.61	19.58	19.56	19.54	19.52		(88)
Utilisa		tor for g	ains for	rest of d	welling, I	h2,m (se		9a)	0.40	0.64	0.70	0.94		(80)
(69)11=	0.84	0.8	0.73	0.64	0.5	0.35	0.2	0.21	0.42	0.64	0.79	0.64		(03)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				(22)
(90)m=	17.43	17.75	18.24	18.77	19.25	19.5	19.59	19.59	19.42	18.92	18.08	17.53		(90) T
									Ť	'LA = Livin	g area ÷ (4	4) =	0.49	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	A) × T2					
(92)m=	18	18.32	18.82	19.37	19.87	20.14	20.25	20.25	20.05	19.51	18.65	18.09		(92)
Apply	adjustn	nent to t	ne mear	n internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18	18.32	18.82	19.37	19.87	20.14	20.25	20.25	20.05	19.51	18.65	18.09		(93)
8. Sp	ace hea	ting requ	uirement		• · •	• • •				/				
Set I	i to the r	nean int factor fo	ernal ter or gains	mperatui using Ta	re obtain able 9a	ied at ste	ep 11 of	l able 9	o, so tha	t II,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1 <u>'</u> 1:				- 5	1					
(94)m=	0.81	0.78	0.72	0.63	0.51	0.38	0.25	0.26	0.45	0.64	0.77	0.81		(94)
Usefu	ıl gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	419.65	449	456.05	447.3	382.45	282.29	179.59	178.56	283.08	361.89	393.74	404.13		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				(07)
(97)m=	827.68	802.21	723.89	620.52	465.08	312.32	187.23		329.1	506.73	688.88	794.26		(97)
Space	e heatin	g require		r each n			h = 0.02	24 x [(97])m – (95)m] x (4 107.76	1)m	200.26		
(90)11=	303.57	237.30	199.27	124.72	01.40	0	0	U Toto			212.01	290.20	1526.02	
					.,			Tota	i per year	(KVVII/year) = Sum(9	0)15,912 =	1536.92	
Space	e heatin	g require	ement in	kWh/m ²	/year								44.42	(99)
9a. En	ergy rec	luiremer	its – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:	1 f											
Fracti	ion of sp	ace nea	it from S	econdar	y/supple	mentary	system	(000) ((204)				0	
⊢racti	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (∠∪1) =	(2.2.2.)-			1	(202)
Fracti	ion of to	tal heatii	ng from	main sys	stem 1			(204) = (2)	02) × [1 –	(203)] =			1	(204)

Total gains – internal and solar (84)m = (73)m + (83)m, watts

Efficie	ncy of I	main spa	ace heat	ting syste	em 1								78.9	(206)
Efficie	ncy of s	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	heatin	g require	ement (o	calculate	d above))								
	303.57	237.36	199.27	124.72	61.48	0	0	0	0	107.76	212.51	290.26		
(211)m	= {[(98)m x (20	4)] + (2 ⁻	10)m } x	100 ÷ (2	06)		-	-	-	-			(211)
	384.75	300.83	252.56	158.07	77.92	0	0	0	0	136.58	269.34	367.88		_
								Tota	al (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	1947.94	(211)
Space	heatin	g fuel (s	econdar	′y), kWh/	month									
= {[(98)] 	m x (20	01)] + (2 ⁻	14) m }	x 100 ÷ (208)	r		1	1	1	1	r	1	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								lota	ai (kvvn/yea	ar) = Sum(2)	215) _{15,1012}	F	0	(215)
Water h	heating) 	ton (l.		h a a)									
	206.58	ater nea	ter (calc	180.87	180.78	166.62	164.85	174.23	171.83	187.31	191.92	203.26	1	
L Efficien	cv of w	ater hea	iter									200.20	68.8	(216)
(217)m=	74.47	74.15	73.54	72.59	71.11	68.8	68.8	68.8	68.8	72.17	73.76	74.4	00.0	(217)
Euel for	water	heating	kWh/m	onth									I	
(219)m_	= (64)	<u>m x 100</u>	$) \div (217)$)m		-		-	-		-	-	_	
(219)m=	277.39	247.56	266.94	249.16	254.23	242.18	239.61	253.24	249.76	259.53	260.19	273.19		
								Tota	al = Sum(2)	19a) ₁₁₂ =			3072.98	(219)
Annual	totals									k	Wh/year	•	kWh/year	_
Space I	heating	fuel use	ed, main	system	1								1947.94	
Water h	neating	fuel use	d										3072.98	
Electric	ity for p	oumps, f	ans and	electric	keep-ho	t								_
centra	l heatir	ig pump	:									130		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total el	ectricity	y for the	above,	kWh/yea	ır			sum	of (230a).	(230g) =			175	(231)
Electric	ity for li	ighting											289.68	(232)
10a. F	uel cos	sts - indiv	vidual he	eating sy	stems:									
						_								
						Fu kW	lel Vh/year			(Table	' rice 12)		Fuel Cost £/year	
Space ł	heating	- main s	system 2	1		(21	1) x			3.	1	x 0.01 =	60.3861	(240)
Space ł	heating	- main s	system 2	2		(21	3) x					x 0.01 =	0](241)
' Space l	heating	- secon	darv			(21	5) x					x 0.01 =	0	_`´´´](242)
' Water h	neating	cost (ot	, her fuel)			(21	9)			3	1	x 0.01 =	95.26](247)
Pumps.	. fans a	nd elect	ric keep	-hot		(23	1)			11	46	x 0.01 =	20.06	_`´´](249)
(if off-pe	eak tari	ff, list ea	ach of (2	30a) to (230a) se	eparatel	v as apn	licable a	nd apply	/ fuel pri	ce accor	dina to T	L <u></u> Fable 12a	
Energy	for ligh	iting	\	.,	0, 5	(23	2)		· · · · · ·	11.	46	x 0.01 =	33.2	(250)
Additior	nal star	nding cha	arges (T	able 12)									106	(251)
(if off-pe Energy Additior	eak tari for ligh nal star	ff, list ea iting inding cha	ach of (2 arges (T	30a) to (able 12)	(230g) se	eparately (23	y as app ²⁾	licable a	nd apply	/ fuel pri 11.	ce accor 46	rding to 7 x 0.01 =	Fable 12 3: 1	2a 3.2 06

Appendix Q items: repeat lines (253) and (2	54) as needed			
Total energy cost (24	5)(247) + (250)(254) =		314.901	(255)
11a. SAP rating - individual heating system	าร			
Energy cost deflator (Table 12)			0.47	(256)
Energy cost factor (ECF) [(25	5) x (256)] ÷ [(4) + 45.0] =		1.8593	(257)
SAP rating (Section 12)			74.0622	(258)
12a. CO2 emissions – Individual heating s	ystems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.198 =	385.69	(261)
Space heating (secondary)	(215) x	0 =	0	(263)
Water heating	(219) x	0.198 =	608.45	(264)
Space and water heating	(261) + (262) + (263) + (2	64) =	994.14	(265)
Electricity for pumps, fans and electric keep	-hot (231) x	0.517 =	90.48	(267)
Electricity for lighting	(232) x	0.517 =	149.77	(268)
Total CO2, kg/year		sum of (265)(271) =	1234.38	(272)
CO2 emissions per m ²		(272) ÷ (4) =	35.68	_ (273)
EI rating (section 14)			79	(274)
13a. Primary Energy				
	Energy kWh/year	Primary factor	P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02 =	1986.9	(261)
Space heating (secondary)	(215) x	0 =	0	(263)
Energy for water heating	(219) x	1.02 =	3134.44	(264)
Space and water heating	(261) + (262) + (263) + (2	64) =	5121.34	(265)
Electricity for pumps, fans and electric keep	-hot (231) x	2.92 =	511	(267)
Electricity for lighting	(232) x	0 =	845.87	(268)
'Total Primary Energy		sum of (265)(271) =	6478.21	_ (272)

Primary energy kWh/m²/year

(272) ÷ (4) =

(273)

187.23

						User D	etails:						
Assessor Na	me:	Tes	st User				Strom	a Num	ber:		STRC	000000	
Software Nar	ne:	Str	oma FS	AP 200	9		Softwa	are Ver	rsion:		Versio	on: 1.5.0.74	
					Р	roperty	Address	Ground	l floor m	aisonette	e propos	ed	
Address :		82	Guilford	Street, L	ondon,	WC1N 1	IDF						
1. Overall dwell	ling dir	nension	s:										
Decement						Area	a(m²)		Ave He	eight(m)		Volume(m ³)	
Basement						4	5.71	(1a) x	2	2.4	(2a) =	109.7	(3a)
Ground floor						4	0.51	(1b) x	3	.46	(2b) =	140.16	(3b)
Total floor area	TFA =	(1a)+(1b	o)+(1c)+	(1d)+(1e	e)+(1r	ו) נ	36.22	(4)					
Dwelling volume								(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	249.87	(5)
2. Ventilation ra	ate:												
		I	main neating	S h	econdai leating	у	other		total			m ³ per hou	•
Number of chim	neys	Γ	0	+	0	+	0] = [0	X 4	40 =	0	(6a)
Number of open	flues	Г	0	_ + _	0	<u> </u> + [0	_] = [0	x	20 =	0	(6b)
Number of intern	nittent	fans						- F	4	x ′	10 =	40	(7a)
Number of passi	ve ven	nts						Ē	0	x /	10 =	0	(7b)
Number of fluele	ess gas	s fires						Г	0	X 4	40 =	0	(7c)
								L					
											Air ch	nanges per ho	ur
Infiltration due to	o chimr	neys, flu	es and f	ans = <mark>(6</mark>	a)+(6b)+(7	a)+(7b)+(7c) =		40		÷ (5) =	0.16	(8)
If a pressurisation	test ha	s been ca	rried out or	r is intende	ed, procee	d to (17),	otherwise o	continue fr	om (9) to ((16)			
Additional infil	tration	i the dw	ening (n	5)						[(0)]	-11v0 1 –	0	(9)
Structural infilt	tration:	0.25 fo	r steel o	r timber f	frame or	0.35 fo	r masoni	v constr	uction	[(0)	1,00.1 -	0	(10)
if both types of	wall are	e present,	use the va	lue corres	ponding to	the great	ter wall are	a (after				Ŭ	
deducting area	is of ope	enings); if (equal user	0.35		4 (-
If suspended v	noodel	n lloor, e	enter U.Z	(unseal	ea) or 0.	T (seale	ea), eise	enter U				0	(12)
Percentage of	windo	ws and	doors dr	aught st	rinned							0	(13)
Window infiltra	ation	wo unu		augin or	nppeu		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate	;						(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeabilit	ty valu	e, q50, e	expresse	ed in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	10	(17)
If based on air p	ermea	bility val	ue, then	(18) = [(1	7) ÷ 20]+(8	3), otherw	ise (18) = ((16)				0.66	(18)
Air permeability v	alue app	olies if a pi	ressurisatio	on test has	s been dor	e or a de	gree air pe	rmeability	is being us	sed			_
Number of sides	on wh	ich shel	tered				(20) – 1 -	[0 075 x (1	9)1 -			2	(19)
Infiltration rate in	ornoi	ratina sh	altar fac	tor			$(20) = 1^{-1}$ (21) = (18)	$(0.070 \times (10)) =$	[0]] –			0.85	(20)
Infiltration rate m	odifier	d for mo	nthly wir	noi nd sneer	4		(21) = (10)	, ^ (20) -				0.56	_(21)
	Feh	Mar	Anr	Mav	Jun	Jul	Aug	Sen	Oct	Nov	Dec	1	
Monthly average	wind	sneed fr	om Tahl	e 7			Ling					1	
(22)m= 5.4	5.1	5,1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1	1	
· /			L		1		1	l	L			J	

Wind Factor (22a)m = (22)m ÷ 4								
(22a)m= 1.35 1.27 1.27 1.12 1.02	0.98	0.92 0.92	1.05	1.12	1.2	1.27		
Adjusted infiltration rate (allowing for shelter an	d wind spe	ed) = (21a) x	(22a)m					
0.76 0.72 0.72 0.63 0.58	0.55	0.52 0.52	0.59	0.63	0.67	0.72		
Calculate effective air change rate for the appli	cable case						_	
II Mechanical ventilation:		ation (N5)) other	wieg (23h	(23a)			0	(23a)
If balanced with best recovery: efficiency in % allowing f	or in-use fact	or (from Table $4b^{\circ}$	wise (200) – (23a)			0	(230)
a) If balanced mechanical ventilation with her	at recovery	v (MVHR) (24a))m = (2	2b)m + (23b) × [′	1 – (23c)	0 ÷ 100]	(230)
(24a)m= 0 0 0 0 0	0	0 0	0	0	0	0	-	(24a)
b) If balanced mechanical ventilation without	heat recov	very (MV) (24b)m = (22	2b)m + (i	23b)		I	
(24b)m= 0 0 0 0 0	0	0 0	0	0	0	0		(24b)
c) If whole house extract ventilation or positiv	e input ver	ntilation from c	outside	-	•	-		
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwis	e (24c) = (22b) m + 0	.5 × (23b)		I	
(24c)m= 0 0 0 0 0	0	0 0	0	0	0	0		(24c)
d) If natural ventilation or whole house positivity if $(22b)m = 1$, then $(24d)m = (22b)m$ other	ve input ve erwise (24d	ntilation from I	oft 2b)m² x	0.51				
(24d)m= 0.79 0.76 0.76 0.7 0.67	0.65	0.63 0.63	0.67	0.7	0.73	0.76		(24d)
Effective air change rate - enter (24a) or (24k) or (24c) (or (24d) in box	(25)	Į		<u> </u>		
(25)m= 0.79 0.76 0.76 0.7 0.67	0.65	0.63 0.63	0.67	0.7	0.73	0.76		(25)
3 Heat losses and heat loss narameter					•			
FIFMENT Gross Openings	Net Area	U-valı	le	AXU		k-value	;	AXk
area (m²) m²	A ,m²	W/m2	K	(W/I	<)	kJ/m²∙ł	<	kJ/K
Doors Type 1	1.89	× 1.6	=	3.024				(26)
Doors Type 2	1.89	× 1.6	=	3.024				(26)
Windows Type 1	1.29	x1/[1/(2.4)+	0.04] =	2.82				(27)
Windows Type 2	2.39	x1/[1/(1.2)+	0.04] =	2.74				(27)
Windows Type 3	3.82	x1/[1/(1.8)+	0.04] =	6.41				(27)
Windows Type 4	2.32	x1/[1/(2.4)+	0.04] =	5.08				(27)
Windows Type 5	1.61	x1/[1/(1.2)+	0.04] =	1.84				(27)
Windows Type 6	0.61	x1/[1/(1.2)+	0.04] =	0.7				(27)
Rooflights	0.41	x1/[1/(1.2) +	0.04] =	0.492				(27b)
Floor	45.71	x 0.15	=	6.86				(28)
Walls Type1 72.16 7.22	64.94	× 0.17	=	11.04				(29)
Walls Type2 33.65 8.43	25.22	× 0.17	=	4.29			7	(29)
Walls Type3 42.17 3.78	38.39	x 0.24	=	9.07				(29)
Walls Type4 6.26 0	6.26	x 0.39	=	2.44				(29)
Roof 4.84 0.82	4.02	× 0.15	=	0.6	_ ī			(30)
Total area of elemente m ²					-			
	204.789							(31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions

Fabric heat loss, $W/K = S (A \times U)$

(26)(30)	+ (32) =
----------	----------

Heat c Therm <i>For desi</i>	apacity	Cm = S(_
Therm For desi		0 = 0(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	8478.6729	(34)
For des	al mass	parame	ter (TMF	⁻ = Cm ÷	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
can be ι	gn assess ised instea	ments wh ad of a det	ere the de tailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	<						30.72	(36)
if details	of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			99.5	(37)
Ventila	ition hea	t loss ca	alculated	monthly	y			1	(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	64.88	62.33	62.33	57.65	54.86	53.57	52.33	52.33	55.54	57.65	59.92	62.33		(38)
Heat ti	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (38)m		1	
(39)m=	164.39	161.83	161.83	157.16	154.37	153.07	151.84	151.84	155.04	157.16	159.42	161.83		_
Heat lo	oss para	meter (H	HLP), W	/m²K					ہ (40)m	Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	157.48	(39)
(40)m=	1.91	1.88	1.88	1.82	1.79	1.78	1.76	1.76	1.8	1.82	1.85	1.88		
Numbe	er of day	rs in mor	nth (Tab	le 1a)					,	Average =	Sum(40)₁.	₁₂ /12=	1.83	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
								•						
4. Wa	ter heat	ing ener	gy requ	irement:								kWh/y	ear:	
•													1	
Assum		ipancy, i	N											(42)
IT IF	A > 13.5	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ГFA -13.	2. .9)	57]	(42)
if TF if TF Annua	A > 13.9 A £ 13.9 I averag	9, N = 1 9, N = 1 e hot wa	+ 1.76 x ater usad	: [1 - exp	(-0.0003 es per da	849 x (TF av Vd.av	FA -13.9 erage =)2)] + 0.((25 x N))013 x (⊺ + 36	ГFA -13.	<u>2</u> . .9)	25]	(42)
if TF if TF Annua <i>Reduce</i>	A > 13.8 A £ 13.9 I averag	9, N = 1 9, N = 1 e hot wa al average	+ 1.76 x ater usag hot water	t [1 - exp ge in litre usage by t	(-0.0003 es per da 5% if the d	349 x (TF ay Vd,av Iwelling is	FA -13.9 erage = designed)2)] + 0.((25 x N) to achieve)013 x (1 + 36 a water us	ΓFA -13. se target o	2. 9)	.25]	(42)
If IF if TF Annua Reduce not more	A > 13.8 A £ 13.9 I averag the annua e that 125	9, N = 1 9, N = 1 e hot wa al average litres per p	+ 1.76 x ater usag hot water person per	t [1 - exp ge in litre usage by t r day (all w	(-0.0003 es per da 5% if the d vater use, l	849 x (TF ay Vd,av Iwelling is hot and co	FA -13.9 erage = designed i ld))2)] + 0.((25 x N) to achieve	0013 x (1 + 36 a water us	ΓFA -13. se target o	9) 2. 9) 95	.25]	(42)
If IF if TF Annua Reduce not more	A > 13.5 A £ 13.5 I averag the annua the that 125	9, N = 1 9, N = 1 e hot wa al average litres per p Feb	+ 1.76 x ater usag hot water person per Mar	t [1 - exp ge in litre usage by t r day (all w Apr	(-0.0003 es per da 5% if the o vater use, l May	349 x (TF ay Vd,av Iwelling is hot and co	FA -13.9 erage = designed : Id))2)] + 0.0 (25 x N) to achieve	0013 x (1 + 36 a water us Sep	rFA -13. se <i>target o</i> Oct	9) 2. 9) 7 7 Nov	.25 Dec]	(42)
If IF if TF Annua Reduce not more Hot wate	A > 13.8 A £ 13.9 I averag the annua that 125 Jan er usage in	9, N = 1 9, N = 1 e hot wa al average litres per p Feb n litres per	+ 1.76 x ater usag hot water person per Mar day for ea	t [1 - exp ge in litre usage by t r day (all w Apr ach month	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from T	FA -13.9 erage = designed i ld) Jul Table 1c x)2)] + 0.0 (25 x N) to achieve Aug (43)	0013 x (7 + 36 <i>a water us</i> Sep	FFA -13. se target o Oct	9) 2. 9) 1 95 7 Nov	.25 Dec]	(42)
If TF if TF Annua Reduce not more Hot wate (44)m=	$A > 13.5$ $A \pm 13.5$ $I averag$ $the annual the annual the that 125 Jan I average in 104.77$	 P, N = 1 P, N = 1 P, N = 1 P hot was P hot w	+ 1.76 x ater usag hot water person per Mar day for ea 97.15	[1 - exp ge in litre usage by s r day (all w Apr ach month 93.34	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 89.53	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72)2)] + 0.0 (25 x N) to achieve Aug (43) 89.53	0013 x (7 + 36 a water us Sep 93.34	FFA -13. se target o Oct 97.15	9) 9) 100.96	.25 Dec 104.77]	(42)
If IF if TF Annua Reduce not more Hot wate (44)m= Enerav	A > 13.8 A £ 13.9 I averag the annua e that 125 Jan Jan 104.77	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P P P P P P P P	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal	t [1 - exp ge in litre usage by s r day (all w Apr ach month 93.34	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4.	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72)2)] + 0.0 (25 x N) to achieve (43) (43) 89.53	0013 x (7 + 36 a water us Sep 93.34	FFA -13. Se target o Oct 97.15 Total = Su th (see Ta	2. 9) 7 Nov 100.96 m(44) ₁₁₂ =	.25 Dec 104.77 c. 1d)	1142.95	(42)
If TF if TF Annua Reduce not more Hot wate (44)m= Energy	A > 13.8 A £ 13.9 I averag the annuation that 125 Jan Jan 104.77 content of	P, N = 1 P, N = 1 P, N = 1 P hot was P hot water P hot water P hot water	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal	E [1 - exp ge in litre usage by a r day (all w Apr ach month 93.34 culated mo	(-0.0003) es per da 5% if the or vater use, I May Vd,m = fa 89.53 onthly = 4.	A49 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 85.72 190 x Vd,r	FA - 13.9 $erage =$ $designed =$ Id Jul $Table 1c x$ 85.72 $n x nm x E$ 94.02)2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600	0013 x (7 + 36 a water us Sep 93.34 0 kWh/mon	FFA -13. se target o Oct 97.15 Fotal = Su th (see Ta	2. 9) 100.96 m(44)112 = ables 1b, 1 138.89	57 .25 Dec 104.77 <i>c, 1d</i>)	1142.95	(42)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m=	$A > 13.5$ $A \ge 13.5$ $A = 13.5$ $A \ge 13.5$ $A = 13.5$	P, N = 1 P, N = 1 P, N = 1 P hot was P hot was P hot water P hot water P hot water	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56	E [1 - exp ge in litre usage by a r day (all w Apr ach month 93.34 culated mo 122.54	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 89.53 onthly = 4.	A9 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72 190 x Vd,r 101.47	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 m x nm x D 94.02)2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600 107.89	0013 x (7 + 36 a water us Sep 93.34 0 kWh/mon 109.18	FFA -13. se target o Oct 97.15 Fotal = Su th (see Ta 127.24 Fotal = Su	2. 9) 100.96 m(44)112 ables 1b, 1 138.89 m(45), 12	57 .25 Dec 104.77 c, 1d) 150.83	1142.95	(42) (43)](44)](45)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan	$A > 13.8$ $A > 13.8$ $A \pm 13.8$ $A \pm 13.8$ $A \pm 13.8$ $A \pm 125$ Jan $ar usage in$ 104.77 104.77 155.74 $taneous w$	P, N = 1 P, N = 1 P, N = 1 P + N	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56	[1 - exp ge in litre usage by a r day (all w Apr ach month 93.34 culated mode 122.54 f of use (not)	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water	A9 x (TF Ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72 190 x Vd,r 101.47	A -13.9 erage = designed i ld) Jul Table 1c x 85.72 m x nm x D 94.02 enter 0 in)2)] + 0.0 (25 x N) to achieve (43) 89.53 07m / 3600 107.89 boxes (46)	0013 x (7 + 36 a water us Sep 93.34 9 kWh/mor 109.18	FFA -13. se target o Oct 97.15 Total = Su th (see Ta 127.24 Total = Su	2. 9) 100.96 m(44) ₁₁₂ = ables 1b, 1 138.89 m(45) ₁₁₂ =	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83	1142.95	(42) (43)](44)](45)
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If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water	A > 13.8 A \ge 13.8 A \pounds 13.8 I averag the annual the annual the annual the annual the annual the annual the annual the annual the annual the annual the annual the annual the annual the	P, N = 1 P, N = 1 P, N = 1 P	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08	E [1 - exp ge in litre usage by s r day (all w Apr ach month 93.34 culated mo 122.54 f of use (no 18.38	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64	A9 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72 190 x Vd,r 101.47 r storage), 15.22	FA -13.9 erage = designed i ld) Table 1c x 85.72 m x nm x D 94.02 enter 0 in 14.1)2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600 107.89 boxes (46, 16.18	0013 x (7 + 36 a water us Sep 93.34 0 kWh/mon 109.18 0 to (61) 16.38	FFA -13. ee target o Oct 97.15 Fotal = Su 127.24 Fotal = Su 19.09	2. 9) 7 Nov 100.96 m(44)112 ables 1b, 1 138.89 m(45)112 20.83	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83	1142.95	(42) (43) (44) (45) (46)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water a) If m	A > 13.8 A \ge 13.8 A \pounds 13.9 I averag the annual e that 125 Jan 104.77 104.77 content of 155.74 taneous w 23.36 storage anufactu	P, N = 1 P, N = 1 P, N = 1 P	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo	Image in litre usage by a r day (all w Apr ach month 93.34 culated mod 122.54 t of use (not 18.38 poss facto	(-0.0003) es per da 5% if the a vater use, l May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know	A49 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun <i>ctor from 1</i> 85.72 190 x Vd,r 101.47 <i>r storage),</i> 15.22 wn (kWh	A -13.9 erage = designed i ld) Jul Table 1c x 85.72 m x nm x D 94.02 enter 0 in 14.1 /day):)2)] + 0.0 (25 x N) to achieve (43) 89.53 07m / 3600 107.89 boxes (46) 16.18	0013 x (7 + 36 a water us Sep 93.34 98Wh/mon 109.18 0 to (61) 16.38	FFA -13. se target o Oct 97.15 Total = Su 127.24 Total = Su 19.09	2. 9) 100.96 m(44) ₁₁₂ = ables 1b, 1 138.89 m(45) ₁₁₂ = 20.83	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83 22.62 0	1142.95	(42) (43) (44) (44) (45) (46) (47)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water a) If m	A > 13.8 A £ 13.8 I averag the annuation that 125 Jan ar usage in 104.77 content of 155.74 taneous w 23.36 storage anufactue	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P P P P P P P P	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table	[1 - exp ge in litre usage by s r day (all w Apr ach month 93.34 culated mod 122.54 cof use (not 18.38 poss facto 2b	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know	A49 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 85.72 190 x Vd,r 101.47 r storage), 15.22 wn (kWh	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 m x nm x L 94.02 enter 0 in 14.1 /day):)2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600 107.89 boxes (46) 16.18	0013 x (7 + 36 a water us Sep 93.34 0 kWh/mon 109.18 0 to (61) 16.38	FFA -13. ee target o Oct 97.15 Fotal = Su th (see Ta 127.24 Fotal = Su 19.09	2. 9) 9) 100.96 m(44)112 ables 1b, 1 138.89 m(45)112 20.83	57 .25 Dec 104.77 = c, 1d) 150.83 = 22.62 0 0	1142.95	(42) (43) (44) (44) (45) (46) (47) (48)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water a) If m Tempe Energy	A > 13.8 A \ge 13.8 A \pounds 13.8 I averag the annual the annual the annual the annual the annual transaction (104.77) 104.77 (104.77) 104.77 (104.77) 105.74 (105.74) taneous w 23.36 (105.74) taneous w 23.36 (105.74) taneous w (23.36) storage anufacture fa	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P hot was P hot was P hot water 100.96 hot water 136.21 P hot water 20.43 P hoss: P are solved P hoss for the solved P hose solv	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table	 [1 - exp ge in litre usage by service day (all we have (all we have) Apr ach month 93.34 culated mode 122.54 f of use (not 18.38 oss facto 2b k, kWh/ye 	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know ear	A9 x (TF Ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72 190 x Vd,r 101.47 r storage), 15.22 wn (kWh	 A -13.9 erage = designed i ld) Jul Table 1c x 85.72 m x nm x E 94.02 enter 0 in 14.1 /day):)2)] + 0.0 (25 x N) to achieve (43) 89.53 07m / 3600 107.89 boxes (46, 16.18	0013 x (7 + 36 a water us Sep 93.34 98.Wh/mor 109.18 0 to (61) 16.38	FFA -13. se target o Oct 97.15 Fotal = Su 127.24 Fotal = Su 19.09	2. 9) 100.96 m(44)112 ables 1b, 1 138.89 m(45)112 20.83	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83 22.62 0 0	 	(42) (43) (43) (44) (45) (45) (46) (47) (48) (49)
If IF if TF Annua <i>Reduce</i> <i>not more</i> <i>Hot wate</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i> (46)m= Water a) If m Tempe Energy If man Cvlind	A > 13.8 A \ge 13.8 A \pounds 13.8 I averag the annual e that 125 Jan 104.77 104.77 content of 155.74 taneous w 23.36 storage anufacture facture facture er volum	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P hot was P hot was P hot water P hot water P hot water P hot water P hot water P hot	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table storage ured cylin) includii	 [1 - exp ge in litre usage by a r day (all w Apr ach month 93.34 culated model for use (not 122.54 for use (not 18.38 poss facto 2b kWh/yee nder loss any s 	(-0.0003) es per da 5% if the or vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know ear s factor is olar stor	A49 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun <i>ctor from 1</i> 85.72 190 x Vd,r 101.47 r <i>storage),</i> 15.22 wn (kWh	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 n x nm x E 94.02 enter 0 in 14.1 /day): pwn: in same)2)] + 0.0 (25 x N) to achieve (43) 89.53 07m / 3600 107.89 boxes (46) 16.18	0013 x (7 + 36 a water us Sep 93.34 9 kWh/mon 109.18 0 to (61) 16.38	FFA -13. se target o Oct 97.15 Total = Su 127.24 Total = Su 19.09	2. 9) 100.96 m(44) ₁₁₂ = ables 1b, 1 138.89 m(45) ₁₁₂ = 20.83	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83 22.62 0 0 0	 1142.95 1502.18	 (42) (43) (43) (44) (45) (46) (47) (48) (49) (50)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water a) If m Tempe Energy If man Cylind If cor	A > 13.8 A £ 13.8 I averag the annuate that 125 Jan 104.77 104.77 content of 155.74 taneous w 23.36 storage anufacture facture facture oufacture er volum	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P hot was P hot was P hot water 100.96 hot water 136.21 P hot water 20.43 P hoss: P hoss:	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table storage ired cylir) includin no tank ir	Image in litre usage by strate r day (all w Apr ach month 93.34 culated mod 122.54 cof use (not 18.38 poss facto 2b e, kWh/yee nder loss nder loss adwelling.	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know ear s factor is olar stor enter 110	A49 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72 190 x Vd,r 101.47 r storage), 15.22 wn (kWh s not kno age with litres in bo	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 enter 0 in 14.1 /day): own: in same ox (50))2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600 107.89 boxes (46) 16.18	0013 x (7 + 36 a water us Sep 93.34 0 kWh/mon 109.18 0 to (61) 16.38	FFA -13. ee target o Oct 97.15 Fotal = Su th (see Ta 127.24 Fotal = Su 19.09	2. 9) 100.96 m(44)112 ables 1b, 1 138.89 m(45)112 20.83	57 .25 Dec 104.77 = c, 1d) 150.83 = 22.62 0 0 0 0	 	 (42) (43) (43) (44) (45) (45) (46) (47) (48) (49) (50)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water a) If m Tempe Energy If man Cylind If cor Othe	A > 13.8 A \ge 13.8 A \pounds 13.8 I averag the annual e that 125 Jan 104.77 104.77 content of 155.74 taneous w 23.36 storage anufacture fature fa v lost fro ufacture er volum nmunity he rwise if no	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P hot was P hot was P hot water 100.96 hot water 136.21 P hot water 20.43 P hore the the the the the the the the the th	+ 1.76 x ater usag hot water person per Mar Mar 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table storage ired cylin) includin no tank ir t water (th	Image in litre usage by a r day (all w Apr ach month 93.34 culated mod 122.54 cof use (not 18.38 poss facto 2b x, kWh/ye nder loss nder loss ndwelling, is includes	(-0.0003) es per da 5% if the a vater use, l May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know ear s factor is olar stor enter 110 s instantan	349 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun <i>ctor from</i> 85.72 190 x Vd,r 101.47 <i>r storage),</i> 15.22 wn (kWh <i>s not kno</i> <i>age with</i> <i>litres in bo</i> <i>eous com</i>	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 n x nm x D94.02 enter 0 in 14.1 /day): but boilers))2)] + 0.0 (25 x N) to achieve (43) 89.53 07m / 3600 107.89 boxes (46, 16.18 (47) x (48) enter '0' in	0013 x (7 + 36 a water us Sep 93.34 98.Wh/mon 109.18 109.18 100.61) 16.38	FFA -13. se target o Oct 97.15 Fotal = Su 127.24 Fotal = Su 19.09	2. 9) 100.96 m(44)112 ables 1b, 1 138.89 m(45)112 20.83	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83 22.62 0 0 0 0	 	 (42) (43) (44) (44) (45) (46) (47) (48) (49) (50)
If IF if TF Annua Reduce not more Hot wate (44)m= (44)m= (45)m= If instan (46)m= Water a) If m Tempe Energy If man Cylind If con Othe Hot wate	A > 13.8 A £ 13.8 I averag the annual the annual the annual the annual the annual the annual transaction taneous w 23.36 Storage anufacture trature fa v lost fro ufacture the volum munity he twise if no atter stora	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P hot was P hot was P hot water 100.96 hot water 136.21 P hot water 20.43 P hot water P hot water	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table storage ared cylin) includin no tank ir t water (th factor fi	 [1 - exp ge in litre usage by a rady (all we have (all we have) (all	(-0.0003) es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know ear s factor is olar stor enter 110 s instantan le 2 (kW	A49 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 85.72 190 x Vd,r 101.47 r storage), 15.22 wn (kWh s not kno age with litres in bo eous comi h/litre/da	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 enter 0 in 14.1 /day): in same x (50) bi boilers) ay))2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600 107.89 boxes (46) 16.18 (47) x (48)	0013 x (7 + 36 a water us Sep 93.34 9 kWh/mon 109.18 0 to (61) 16.38	FFA -13. ee target o Oct 97.15 Fotal = Su th (see Ta 127.24 Fotal = Su 19.09	2. 9) 100.96 m(44) ₁₁₂ = ables 1b, 1 138.89 m(45) ₁₁₂ = 20.83	57 .25 Dec 104.77 <i>c, 1d)</i> 150.83 22.62 0 0 0 0 0	 1142.95 1502.18	 (42) (43) (43) (44) (45) (46) (47) (48) (49) (50) (51)
If IF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instan (46)m= Water a) If m Tempe Energy If man Cylind If cor Othe Hot wa Volum	A > 13.8 A £ 13.8 I averag the annuation that 125 Jan ar usage in 104.77 content of 155.74 taneous w 23.36 storage anufacture facture fa v lost fro ufacture ar volum nmunity he rwise if no ater stora e factor	P, N = 1 P, N = 1 P, N = 1 P, N = 1 P, N = 1 P P P P P P P P	+ 1.76 x ater usag hot water person per Mar day for ea 97.15 used - cal 140.56 ng at point 21.08 clared lo m Table storage red cylir) includin no tank ir t water (th factor fr ble 2a	Image in litre usage by strate r day (all w Apr ach month 93.34 culated mod 122.54 cof use (not 18.38 poss facto 2b x, kWh/yee nder loss nder loss adwelling, is includes rom Tabl	e(-0.0003 es per da 5% if the of vater use, I May Vd,m = fa 89.53 onthly = 4. 117.58 o hot water 17.64 or is know ear s factor is olar stor enter 110 s instantant le 2 (kW	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 85.72 190 x Vd,r 101.47 r storage), 15.22 wn (kWh s not kno age with litres in bo eous comi h/litre/da	FA -13.9 erage = designed i ld) Jul Table 1c x 85.72 enter 0 in 14.1 /day): bi same bi boilers) ay))2)] + 0.0 (25 x N) to achieve Aug (43) 89.53 07m / 3600 107.89 boxes (46) 16.18 (47) x (48) enter '0' in	0013 x (7 + 36 a water us Sep 93.34 0 kWh/mon 109.18 0 to (61) 16.38	FFA -13. e target o Oct 97.15 Fotal = Su 127.24 Fotal = Su 19.09	2. 9) 100.96 m(44)112 ables 1b, 1 138.89 m(45)112 20.83	57 .25 Dec 104.77 = c, 1d) 150.83 = 22.62 0 0 0 0 0 0 0 0	 	 (42) (43) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52)
(41)m= 4. Wa Assum	31 ater heat	28 ing ener	31 rgy requ N	30 irement:	31	30	31	31	30	31	30	31 kWh/y	ear:	(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Numbe	er of day	rs in mor	nth (Tab	le 1a)									1	
Numb	un of day	re in mor	uth (Tab	le 12)	1	1	1		/	Average =	Sum(40) ₁ .	12 /12=	1.83	(40)
(40)m=	1.91	1.88	1.88	1.82	1.79	1.78	1.76	1.76	1.8	1.82	1.85	1.88]	
Heat lo	oss para	meter (H	HLP), W	/m²K					ر (40)m	= (39)m ÷	Sum(39)₁. · (4)	12 / 12=	137.40	
(39)m=	164.39	161.83	161.83	157.16	154.37	153.07	151.84	151.84	155.04	157.16	159.42 Sum(30)	161.83	157 /8	(39)
Heat ti	anster c		nt, W/K	457.40	454.07	452.07	454.04	454.04	(39)m	= (37) + (38)m	404.00	1	
(30)11=	04.00	02.33	02.33	57.05	54.00	55.57	52.55	52.55	55.54	57.05	59.92	02.33		(30)
(20)	Jan	Feb	Mar	Apr	May	Jun	JUI	Aug	Sep	OCt	NOV	Dec		(29)
Ventila	tion hea	t loss ca	alculated	monthly	y L Ma				(38)m	= 0.33 × (25)m x (5)	Du	1	
Total f	abric he	at loss							(33) +	(36) =			99.5	(37)
if details	of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	<						30.72	(36)
can be ι	used instea	ad of a det	tailed calc	ulation.	construct	ion are no	t known pi	ecisely life	muicative	values of				
1 01 003	al IIIass	parame		= $ -$	- IFA) II	ion are no	t known n	ocisoly the	indicative		TMP in Ta	blo 1f	100	(35)
For desi	al mace	narama	tor (TME	- Cm -	- TFΔ) ir	n k l/m²k				tive Value	-) (02u). · Low	(020) =	6476.0729	
Therm For desi	apaony		Axk)						((28)	(30) + (32)	(32a)	(32e) =	8478 6720	(34)

Energy lost from water storage, kWh/year Enter (49) or (54) in (55)							((50) x (51	l) x (52) x	(53) =		0		(54)	
Water	storage	loss cal	culated :	for each	month			((56)m = (55) x (41)ı	m		0		(55)
(56)m						0	0				0	0		(56)
lf cylind	er contain:	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (U H11)] ÷ (50	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	(00)
(57)~		0							, (,		,			(57)
(57)m=	0	0	0	0	0	0	0	0	0	0		0		(57)
Prima	ry circuit	loss (ar	nual) fro	om Table	e 3	50)	(50) 00					0		(58)
Prima (mo	ry circuit dified by	loss cal factor fi	culated	for each	montn (boro is s	59)m = (solar wat	(58) ÷ 36 tor boatir	5 × (41) og and s	m cylinder	r thormo	etat)			
(110 (59)m=												0		(59)
Comb			l	month	(G1)m		25 (44)	L	1	l	I			
	50.06				(01)(11) =	$(00) \div 30$	00 × (41)	111	46.02	40.51	40.22	50.06		(61)
	50.90	40.03	49.51	40.05		42.27	43.00	40.02	40.03	(45) m	(40)	(57)	(50)	(01)
10tal 1			water n					(02) III =	0.85 X ((45)m +	(46)m +	(57)m +	(59)m + (61)m	(62)
(02)III=				100.00		143.74		(optor '0	lif no colo	r contribut		201.79		(02)
(add a	dditiona	l lines if	FGHRS	and/or \		annlies	see An	nendix (r contribut	ION IO WAIE	er neaung)		
(63)m=										0	0	0		(63)
Outou	t from w	ater hea	tor	-		-	-	-	-	-	-	-		
(64)m=	206.7	182.24	190.07	168.58	163.21	143.74	137.71	153.52	155.21	176.75	188.21	201.79		
()								Outr	out from wa	ater heate	r (annual)₁		2067.72	(64)
Heat	nains fro	m water	heating	k\//h/m	onth 0.2	5 x [0 85	5 x (45)m	1 + (61)r	n] + 0 8 s	x [(46)m	+ (57)m	1 + (59)m	1], ,
(65)m=	64.52	56.8	59.11	52.25	50.5	44.31	42.18	47.28	47.81	54.68	58.51	62.89	· 1	(65)
inclu	 Ide (57)	n in cale		of (65)m	only if c	vlinder i	s in the c	l	or hot w	ater is fr		munity h	eating	
5 In	ternal as	nine (soc		and 5a).	yiiriddi i		awoning	or not w		oni ooni	indincy i	loating	
O. III		a (Table)•									
Metab	olic gain	Feb	<u>), wai</u> Mar	IS Anr	May	Jun	Jul	Aug	Sen	Oct	Nov	Dec		
(66)m=	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22		(66)
Lightin		(calcula	L ted in Δι	nendix		ion I 9 o	rl0a)a		Table 5	_	-	-		
(67)m=	64.75	57.51	46.77	35.41	26.47	22.35	24.15	31.39	42.13	53.49	62.43	66.55		(67)
Annlia	nces da	ins (calc	L ulated in			Luation L	13 or I 1	(3a) also	see Ta	hle 5				
(68)m=	346.19	349.79	340.73	321.46	297.13	274.27	258.99	255.4	264.45	283.73	308.05	330.92		(68)
Cooki		(calcula	ted in A	nnendiv		tion 15	or 15a)		 A Table	5				
(69)m=	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99		(69)
Pump	s and fai		(Table /	[52)										
(70)m=	10	10 10	10	10	10	10	10	10	10	10	10	10		(70)
				tivo valu	As) (Tab	<u> </u>								
(71)m=	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81		(71)
Water	heating	naine (T	able 5)											. /
(72)m=	86.73	84.52	79.45	72.57	67.88	61.54	56.7	63.55	66.4	73.5	81.27	84.53		(72)
Total	internal	aaine –					L	L	L (69)m + ((70)m + (7	1)m + (72)			× /
(73)m=	612.07	606.22	581.36	543 84	505 88	472.55	454 24	464 74	487.38	525 11	566 15	596.4		(73)
									101.00			0000.1		

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	x	1.29	×	37.39	×	0.76	×	0.7	=	24.94	(77)
Southeast 0.9x	0.54	x	2.32	x	37.39	x	0.76	x	0.7	=	44.85	(77)
Southeast 0.9x	0.54	x	1.29	x	63.74	x	0.76	x	0.7	=	42.52	(77)
Southeast 0.9x	0.54	x	2.32	×	63.74	×	0.76	×	0.7	=	76.46	– (77)
Southeast 0.9x	0.54	x	1.29	x	84.22	x	0.76	x	0.7] =	56.18	(77)
Southeast 0.9x	0.54	x	2.32	×	84.22	×	0.76	×	0.7] =	101.03	(77)
Southeast 0.9x	0.54	x	1.29	x	103.49	×	0.76	x	0.7	=	69.03	(77)
Southeast 0.9x	0.54	x	2.32	x	103.49	x	0.76	x	0.7	=	124.15	(77)
Southeast 0.9x	0.54	x	1.29	x	113.34	x	0.76	x	0.7	=	75.6	(77)
Southeast 0.9x	0.54	x	2.32	x	113.34	×	0.76	x	0.7	=	135.97	(77)
Southeast 0.9x	0.54	x	1.29	x	115.04	x	0.76	x	0.7	=	76.74	(77)
Southeast 0.9x	0.54	x	2.32	x	115.04	×	0.76	x	0.7	=	138.02	(77)
Southeast 0.9x	0.54	x	1.29	x	112.79	×	0.76	x	0.7	=	75.24	(77)
Southeast 0.9x	0.54	x	2.32	x	112.79	x	0.76	x	0.7	=	135.31	(77)
Southeast 0.9x	0.54	x	1.29	x	105.34	×	0.76	x	0.7	=	70.27	(77)
Southeast 0.9x	0.54	x	2.32	x	105.34	x	0.76	x	0.7	=	126.38	(77)
Southeast 0.9x	0.54	x	1.29	x	92.9	x	0.76	x	0.7	=	61.97	(77)
Southeast 0.9x	0.54	x	2.32	x	92.9	x	0.76	x	0.7	=	111.45	(77)
Southeast 0.9x	0.54	x	1.29	x	72.36	x	0.76	x	0.7	=	48.27	(77)
Southeast 0.9x	0.54	x	2.32	x	72.36	x	0.76	x	0.7	=	86.81	(77)
Southeast 0.9x	0.54	x	1.29	×	44.83	x	0.76	×	0.7	=	29.9	(77)
Southeast 0.9x	0.54	x	2.32	x	44.83	x	0.76	x	0.7	=	53.78	(77)
Southeast 0.9x	0.54	x	1.29	x	31.95	x	0.76	x	0.7	=	21.31	(77)
Southeast 0.9x	0.54	x	2.32	x	31.95	x	0.76	x	0.7] =	38.33	(77)
Northwest 0.9x	0.54	x	2.39	x	11.51	x	0.63	x	0.7	=	5.9	(81)
Northwest 0.9x	0.54	x	3.82	x	11.51	x	0.63	x	0.7	=	9.42	(81)
Northwest 0.9x	0.54	x	1.61	×	11.51	x	0.63	x	0.7] =	3.97	(81)
Northwest 0.9x	0.54	x	0.61	x	11.51	×	0.63	x	0.7	=	1.5	(81)
Northwest 0.9x	0.54	x	2.39	×	23.55	×	0.63	×	0.7	=	12.07	(81)
Northwest 0.9x	0.54	x	3.82	x	23.55	x	0.63	x	0.7] =	19.28	(81)
Northwest 0.9x	0.54	x	1.61	x	23.55	x	0.63	x	0.7] =	8.13	(81)
Northwest 0.9x	0.54	x	0.61	×	23.55	x	0.63	×	0.7] =	3.08	(81)
Northwest 0.9x	0.54	x	2.39	x	41.13	x	0.63	x	0.7	=	21.07	(81)
Northwest 0.9x	0.54	x	3.82	×	41.13	x	0.63	x	0.7] =	33.67	(81)
Northwest 0.9x	0.54	x	1.61	x	41.13	x	0.63	x	0.7	=	14.19	(81)
Northwest 0.9x	0.54	x	0.61	x	41.13	x	0.63	x	0.7	=	5.38	(81)
Northwest 0.9x	0.54	x	2.39	×	67.8	x	0.63	x	0.7] =	34.73	(81)
Northwest 0.9x	0.54	x	3.82	×	67.8	×	0.63	×	0.7] =	55.51	(81)
Northwest 0.9x	0.54	x	1.61	x	67.8	x	0.63	x	0.7] =	23.39	(81)

Northwest 0.9x	0.54	x	0.61	x	67.8	x	0.63	x	0.7	=	8.86	(81)
Northwest 0.9x	0.54] x	2.39	x	89.77	x	0.63	x	0.7	j =	45.98] (81)
Northwest 0.9x	0.54	x	3.82	x	89.77	x	0.63	x	0.7	=	73.49	(81)
Northwest 0.9x	0.54	x	1.61	x	89.77	x	0.63	x	0.7	=	30.98	(81)
Northwest 0.9x	0.54	x	0.61	x	89.77	x	0.63	x	0.7	=	11.74	(81)
Northwest 0.9x	0.54	x	2.39	x	97.5	x	0.63	x	0.7	=	49.94	(81)
Northwest 0.9x	0.54	x	3.82	×	97.5	x	0.63	x	0.7] =	79.83	(81)
Northwest 0.9x	0.54	x	1.61	x	97.5	x	0.63	x	0.7	=	33.64	(81)
Northwest 0.9x	0.54	x	0.61	x	97.5	x	0.63	x	0.7	=	12.75	(81)
Northwest 0.9x	0.54	x	2.39	x	92.98	x	0.63	x	0.7	=	47.63	(81)
Northwest 0.9x	0.54	x	3.82	x	92.98	x	0.63	x	0.7	=	76.12	(81)
Northwest 0.9x	0.54	x	1.61	x	92.98	x	0.63	x	0.7	=	32.08	(81)
Northwest 0.9x	0.54	x	0.61	x	92.98	x	0.63	x	0.7	=	12.16	(81)
Northwest 0.9x	0.54	x	2.39	x	75.42	x	0.63	x	0.7	=	38.63	(81)
Northwest 0.9x	0.54	x	3.82	x	75.42	x	0.63	x	0.7	=	61.75	(81)
Northwest 0.9x	0.54	x	1.61	x	75.42	x	0.63	x	0.7	=	26.02	(81)
Northwest 0.9x	0.54	x	0.61	x	75.42	x	0.63	x	0.7	=	9.86	(81)
Northwest 0.9x	0.54	x	2.39	x	51.24	x	0.63	x	0.7	=	26.25	(81)
Northwest 0.9x	0.54	x	3.82	x	51.24	x	0.63	x	0.7	=	41.96	(81)
Northwest 0.9x	0.54	x	1.61	x	51.24	x	0.63	x	0.7	=	17.68	(81)
Northwest 0.9x	0.54	x	0.61	x	51.24	x	0.63	x	0.7	=	6.7	(81)
Northwest 0.9x	0.54	x	2.39	x	29.6	x	0.63	x	0.7	=	15.16	(81)
Northwest 0.9x	0.54	x	3.82	x	29.6	x	0.63	x	0.7	=	24.23	(81)
Northwest 0.9x	0.54	x	1.61	x	29.6	x	0.63	x	0.7	=	10.21	(81)
Northwest 0.9x	0.54	x	0.61	x	29.6	x	0.63	x	0.7	=	3.87	(81)
Northwest 0.9x	0.54	x	2.39	x	14.52	x	0.63	x	0.7	=	7.44	(81)
Northwest 0.9x	0.54	x	3.82	x	14.52	x	0.63	x	0.7] =	11.89	(81)
Northwest 0.9x	0.54	x	1.61	x	14.52	x	0.63	x	0.7	=	5.01	(81)
Northwest 0.9x	0.54	x	0.61	x	14.52	x	0.63	x	0.7	=	1.9	(81)
Northwest 0.9x	0.54	x	2.39	x	9.36	x	0.63	x	0.7] =	4.79	(81)
Northwest 0.9x	0.54	x	3.82	x	9.36	x	0.63	x	0.7	=	7.66	(81)
Northwest 0.9x	0.54	x	1.61	x	9.36	x	0.63	x	0.7] =	3.23	(81)
Northwest 0.9x	0.54	x	0.61	x	9.36	x	0.63	x	0.7	=	1.22	(81)
Rooflights 0.9x	1	x	0.41	x	26	x	0.63	x	0.8	=	9.67	(82)
Rooflights 0.9x	1	x	0.41	x	54	x	0.63	x	0.8	=	20.09	(82)
Rooflights 0.9x	1	x	0.41	x	94	x	0.63	x	0.8	=	34.96	(82)
Rooflights 0.9x	1	x	0.41	x	150	x	0.63	x	0.8	=	55.79	(82)
Rooflights 0.9x	1	x	0.41	×	190	x	0.63	x	0.8	=	70.67	(82)
Rooflights 0.9x	1	x	0.41	×	201	x	0.63	x	0.8	=	74.76	(82)
Rooflights 0.9x	1	x	0.41	×	194	x	0.63	×	0.8] =	72.16	(82)
Rooflights 0.9x	1	x	0.41	×	164	x	0.63	x	0.8	=	61	(82)

Rooflig	nts 0.9x	1	×	0.4	11	x		116) x 🔽	0.63] × [0.8	=	43.15	(82)
Rooflig	nts 0.9x	1	×	0.4	11	x		68	x [0.63		0.8	=	25.29	(82)
Rooflig	nts 0.9x	1	×	0.4	11	x		33	x [0.63		0.8	=	12.27	(82)
Rooflig	nts 0.9x	1	×	0.4	¥1	x		21	, 	0.63		0.8	=	7.81	(82)
	L														
Solar o	ains in	watts, ca	alculate	d for eac	h month	ı			(83)m = S	um(74)m .	(82)m				
(83)m=	100.26	181.62	266.48	371.48	444.43	4	65.68	450.7	393.91	309.15	213.85	122.2	84.37	1	(83)
Total g	ains – i	nternal a	ind sola	r (84)m =	- = (73)m	+ (83)m	, watts		<u>!</u>		<u> </u>		1	
(84)m=	712.33	787.84	847.84	915.32	950.31	9	38.23	904.94	858.64	796.53	738.97	688.34	680.76		(84)
7. Me	an inter	nal temp	perature	(heating	seasor	י. ר(•	•		•	•	•		
Temp	erature	durina h	eating	periods in	n the liv	ina	area	from Tab	ole 9. Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for a	ains for	living are	a h1 n	n (s	ee Ta	ble 9a)		()					
Otinoc	Jan	Feb	Mar		May	T	Jun		Aug	Sen	Oct	Nov	Dec	1	
(86)m-	0.95	0.93	0.91	0.87	0.8	╋	0.69	0.54	0.56	0.75	0.87	0.93	0.95		(86)
(00)11-	0.00	0.00	0.01	0.07	0.0		0.05	0.04	0.00	0.75	0.07	0.00	0.00	l	(00)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	7 in Tabl	e 9c)		· · · ·		1	()
(87)m=	17.66	17.93	18.47	19.09	19.85	2	20.43	20.77	20.76	20.26	19.39	18.35	17.76	J	(87)
Temp	erature	during h	eating	periods in	n rest of	dw	elling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.4	19.42	19.42	19.46	19.48	ſ	19.49	19.5	19.5	19.48	19.46	19.44	19.42		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina	h2	m (se	ee Table	9a)			•	•	•	
(89)m=	0.94	0.92	0.89	0.84	0.75	T	0.59	0.39	0.4	0.67	0.84	0.92	0.94		(89)
	• • • • • • •			1			το ((1	
Mean	Interna	I temper	ature in	the rest	of dwel	ling	12 (1	ollow ste	eps 3 to	/ in Tabl		47.40	40.50	1	(00)
(90)m=	16.48	16.76	17.29	17.91	18.65		19.17	19.43	19.42	19.03	18.22	17.19	16.59		
												ng area ÷ (+) =	0.22	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	ellin	g) = fl	$LA \times T1$	+ (1 – fL	A) × T2	i			•	
(92)m=	16.74	17.02	17.55	18.17	18.91	1	19.44	19.72	19.71	19.29	18.47	17.44	16.84		(92)
Apply	adjustr	nent to t	he mea	n interna	l tempe	ratu	ure fro	m Table	4e, whe	ere appro	opriate			1	
(93)m=	16.74	17.02	17.55	18.17	18.91		9.44	19.72	19.71	19.29	18.47	17.44	16.84		(93)
8. Sp	ace hea	ting requ	uiremen	t											
Set T	i to the I	mean int	ernal te	mperatu	re obtai	nec	l at ste	ep 11 of	Table 9	b, so tha	t Ti,m=	(76)m an	d re-calo	culate	
the ut	ilisation	factor to	or gains			T								1	
1.1411:	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	
Utilisa		tor for g	ains, nn		0.70	Т	0.50	0.44	0.42	0.66	0.01	0.00	0.01	1	(94)
(94)m=	0.91	0.89	0.00	1) m x (0	(1)		0.59	0.41	0.43	0.00	0.61	0.89	0.91	J	(34)
Useiu	ii gains,		, VV = (9	$\frac{4}{1742.25}$	4)m	5	52 16	272.00	269.76	525.07	600.81	614 15	622 72	1	(95)
(95)m=		704.30	rpol top	743.33	from T		00.10	373.99	308.70	525.97	000.01	014.15	022.73	J	(55)
							146	16.0	16.0	1/1 2	10.9	7	4.0	1	(96)
	4.5		0.0				14.0	-[(20)m	10.9 v [(02)m	(06)m	10.0	1	4.9	J	(30)
(07)m-	2011 26	10/ 110	1730.46	1488 16	1112 47		1, VV =	428.05	X [(93)]] 126 70	774.08	1205.88	1664.41	1033.06	1	(97)
Space	2011.20			$\int \frac{1400.10}{1400h}$	000th	<u> </u>	-0.74	h = 0.00	1×10.19	$\frac{1}{100}$	$m_{1200.00}$	1)m	1900.00	J	(07)
(98)m-	1012 76	833 /1	751 10	536.26	317 /9			u1 = 0.02 ∩		ر (95 م ا	450 17	756 10	974 88	1	
(00)11-	1012.70	000.41	101.13	000.20			0					$r_{\rm r} = Sum(0)$	8)	5622.24	(98)
-					.,				TOLE	a per year	(KVVII/Y88	a) = 3011(9	UJ 15,912 =	5052.34	
Space	e heatin	g require	ement ir	n kWh/m²	²/year									65.33	(99)

9a. En	ergy re	quiremer	nts – Ind	lividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating: Fraction of space heat from secondary/supplementary system														
Fraction of space heat from main system(s) $(202) = 1 - (201) =$													0	(201)
Fracti	on of s	bace hea	at from n	naın syst	em(s)			(202) = 1 -	- (201) =	(000)]		·	1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 – 1	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ting syste	em 1								92.6	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
_	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space	e heatir	ng require	ement (c		d above)	0		0	0	450.47	750.40	074.00		
(0.1.1)	1012.76	833.41	/51.19	536.26	317.48	0	0	0	0	450.17	756.19	974.88		(2.1.1)
(211)m	$1 = \{[(98)] = (1003) = (100) = (100) = (100) = (100) = (1003) = (1003) = (1003) = $	$\frac{3}{100001}$	$[4)] + (2^{\circ})$	10)m } x	100 ÷ (2	06)	0	0	0	196 11	916.62	1052 70		(211)
	1093.09	900.01	011.23	579.11	342.03	0	0	U Tota	l (kWh/vea	400.14	211)	=	6082.44	1 (211)
Snace	a haatir	na fuel (s	econdar	·ν) k\Λ/h/	month				()		/15,101	2	0002.44](2)
= {[(98)m x (20	01)] + (2	14) m } ;	x 100 ÷ (2	208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,101}	2=	0	(215)
Water	heating	g												-
Output	from w	ater hea	ter (calc	ulated a	bove)	440.74	407.74	450.50	455.04	470 75	400.04	004 70		
Efficier	206.7	182.24	190.07	168.58	163.21	143.74	137.71	153.52	155.21	176.75	188.21	201.79	70.5	1(216)
(217)m-	87 71	87.6	87 36	86.96	85.89	79 5	79.5	79.5	79.5	86 5	87 39	87.69	79.5	(217)
Euel fo	or water	heating	kWh/m	onth	00.00	10.0	10.0	10.0	10.0	00.0	01.00	01.00		()
(219)m	n = (64)	<u>)m x 100</u>) ÷ (217))m										
(219)m=	235.66	208.03	217.57	193.86	190.01	180.81	173.22	193.1	195.24	204.33	215.37	230.12		-
_								Tota	I = Sum(2'	19a) ₁₁₂ =			2437.32	(219)
Annua	I totals	i n fuel usa	ad main	svetem	1					k	Wh/yeai	r	kWh/year	1
Watar	heating			system									0002.44	J
valer	neating	iuei use	eu .										2437.32]
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ng pump	:									130		(230c)
boiler	with a	fan-assis	sted flue									45		(230e)
Total e	electricit	y for the	above,	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electric	city for I	ighting											457.41	(232)
10a. I	- uel cos	sts - indi	vidual he	eating sy	stems:									J
						Fu kW	el /h/year			Fuel P (Table	r ice 12)		Fuel Cost £/year	
Space	heating	g - main :	system ²	1		(21	1) x			3.4	1	x 0.01 =	188.5556	(240)
Space	heating	g - main :	system 2	2		(21:	3) x			0		x 0.01 =	0	(241)
Space	heating	g - secon	idary			(21	5) x					x 0.01 =	0	(242)
Water	heating	cost (ot	her fuel)			(219	9)			3.4	1	x 0.01 =	75.56	(247)

Pumps, fans and electric keep-hot	(231)	11.46 x 0.01 =	20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) Energy for lighting	separately as applicable an (232)	d apply fuel price according to $11.46 \times 0.01 =$	Table 12a
Additional standing charges (Table 12)			106 (251)
	- 4)		
Appendix Q items: repeat lines (253) and (25 Total energy cost (245)	04) as needed)(247) + (250)(254) =		442 5864 (255)
11a. SAP rating - individual heating systems	s		
Energy cost deflator (Table 12)			0.47 (256)
Energy cost factor (ECF) [(255	5) x (256)] ÷ [(4) + 45.0] =		1.5852 (257)
SAP rating (Section 12)			77.8859 (258)
12a. CO2 emissions – Individual heating sy	stems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198 =	1204.32 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Water heating	(219) x	0.198 =	482.59 (264)
Space and water heating	(261) + (262) + (263) + (26	64) =	1686.91 (265)
Electricity for pumps, fans and electric keep-	hot (231) x	0.517 =	90.48 (267)
Electricity for lighting	(232) x	0.517 =	236.48 (268)
Total CO2, kg/year		sum of (265)(271) =	2013.87 (272)
CO2 emissions per m ²		(272) ÷ (4) =	23.36 (273)
El rating (section 14)			79 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.02 =	6204.09 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Energy for water heating	(219) x	1.02 =	2486.06 (264)
Space and water heating	(261) + (262) + (263) + (26	64) =	8690.15 (265)
Electricity for pumps, fans and electric keep-	hot (231) x	2.92 =	511 (267)
Electricity for lighting	(232) x	0 =	1335.63 (268)
'Total Primary Energy		sum of (265)(271) =	10536.78 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	122.21 (273)

					User D	etails:						
Assessor Name:	Те	st User				Strom	a Num	ber:		STRO	000000	
Software Name:	Str	oma FS	AP 200	9		Softwa	are Ver	rsion:		Versic	on: 1.5.0.74	
				Р	roperty	Address	Ground	d floor m	aisonette	e existin	g	
Address :	82	Guilford	Street, L	ondon,	WC1N 1	IDF						
1. Overall dwelling of	dimension	IS:										
					Area	a(m²)		Ave He	eight(m)	1	Volume(m ³))
Basement					4	5.71	(1a) x	2	2.4	(2a) =	109.7	(3a)
Ground floor					4	0.51	(1b) x	3	.46	(2b) =	140.16	(3b)
Total floor area TFA	= (1a)+(1	b)+(1c)+(1d)+(1e)+(1r	ו) נו	36.22	(4)					
Dwelling volume							(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	249.87	(5)
2. Ventilation rate:												
		main heating	So h	econdai eating	у	other		total			m ³ per hou	•
Number of chimneys	Γ	0	+	0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	s [0	<u></u> + [0	<u> </u> + [0	_] = [0	x	20 =	0	(6b)
Number of intermitter	nt fans						- <u> </u>	4	x ′	10 =	40	(7a)
Number of passive v	ents						Г	0	x ′	10 =	0	(7b)
Number of flueless g	as fires						Г	0	× 4	40 =	0	(7c)
							L					
										Air ch	anges per ho	ur
Infiltration due to chir	nneys, flu	ies and fa	ans = <mark>(6</mark>	a)+(6b)+(7	'a)+(7b)+(7c) =	Γ	40		÷ (5) =	0.16	(8)
If a pressurisation test	has been ca	rried out or	is intende	ed, procee	d to (17),	otherwise o	continue fr	om (9) to ((16)			
Number of storeys	in the dw	elling (ns	5)						[(0)	11-0.4	0	(9)
Structural infiltratio	n: 0 25 fo	r steel or	timber f	frame or	0 35 fo	r masoni	v constr	uction	[(9)	-1jx0.1 =	0	(10)
if both types of wall a	are present,	use the val	lue corres	ponding to	the great	ter wall are	a (after	uotion			0	
deducting areas of c	penings); if	equal user	0.35									_
If suspended wood	len floor,	enter 0.2	(unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby	, enter 0.0	05, else e	enter 0								0	(13)
Percentage of Wind	dows and	aoors ar	augnt st	rippea		0.25 [0.2	$(\sqrt{14}) \cdot 1$	001 -			0	(14)
						(8) + (10)	+ (11) + (1	00] – 12) + (13) -	+ (15) -		0	(15)
Air permeability va	lue a50	avarassa	d in cub	ic motro	s nor ha			etre of e		area	0	(10)
If based on air perme	ability va	lue then	(18) = [(1	7) ÷ 20]+(8	3 per no 3), otherw	ise (18) = ((16)		invelope	alea	0.66	(17)
Air permeability value a	pplies if a p	ressurisatio	on test has	s been dor	e or a de	gree air pe	rmeability	is being us	sed		0.00	
Number of sides on v	vhich she	Itered			·			Ū			3	(19)
Shelter factor						(20) = 1 -	[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorp	orating sl	nelter fac	tor			(21) = (18) x (20) =				0.51	(21)
Infiltration rate modifi	ed for mo	onthly win	d speed	1				1			1	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average win	d speed f	rom Tabl	e 7								1	
(22)m= 5.4 5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1		

Wind Fac	ctor (2	2a)m =	(22)m ÷	4										
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27		
Adjusted	l infiltra	ation rat	e (allowi	ing for sh	nelter ar	nd wind s	speed) =	= (21a) x	(22a)m					
	0.69	0.65	0.65	0.58	0.52	0.5	0.47	0.47	0.54	0.58	0.61	0.65		
Calculate	e effec	tive air	change	rate for t	he appli	cable ca	ise	•			<u>.</u>	•	[
If mecr	nanica	I ventila		andix NL (0	26) (22)	а) Г ари (и	acuation (nuice (22k	() () () () ()			0	(23a)
If balance	od with	boot room		$\frac{1}{1000}$	(23) = (23)	a) x FIIIV (e	equation (m Table $4b$	1 wise (23L)) = (23a)			0	(23b)
a) If ha	alance	d mech:	anical ve	ntilation	with he	at recov	erv (MV	HR) (24a) – a)m – (2	2h)m + (23h) y [1 – (23c)	0 	(23c)
(24a)m=	0	0		0	0	0			0			0	. 100]	(24a)
b) If ba	alance	d mecha	anical ve	ntilation	without	I heat red	L Coverv (MV) (24b	m = (2)	1 2b)m + (1 23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If wh	hole ho	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilati	on from c	outside	!	I	1		
if ((22b)m	< 0.5 ×	: (23b), t	then (24	c) = (23t	b); other	wise (24	lc) = (22b	o) m + 0	.5 × (23b))		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If na	atural v	ventilatio	on or wh	ole hous	e positi	ve input	ventilati	on from I	oft					
if ((22b)m	1 = 1, th	en (24d)	m = (22	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]			l	
(24d)m=	0.74	0.71	0.71	0.67	0.64	0.62	0.61	0.61	0.64	0.67	0.69	0.71		(240)
Effectiv	ve air (change	rate - er	nter (24a) or (24	o) or (24	c) or (24	1d) in boy	(25)	0.07	0.00	0.74	I	(25)
(25)m=	0.74	0.71	0.71	0.67	0.64	0.62	0.61	0.61	0.64	0.67	0.69	0.71		(23)
3. Heat	losses	and he	at loss	paramete	er:									
ELEME	ENT	Gros	SS (m²)	Openin	gs 2	Net Ar	ea n²	U-valı W/m2	le K	A X U	K)	k-value	e ≺	A X k k.I/K
Doors Ty	/pe 1	urou	()			1.89	 x	1.6	=	3.024			·	(26)
Doors Ty	/pe 2					1.89	x	1.6		3.024				(26)
Windows	з Туре	1				1.29	x1	I/[1/(1.6)+	0.04] =	1.94				(27)
Windows	з Туре	2				2.39	x1	I/[1/(1.6)+	0.04] =	3.59	=			(27)
Windows	з Туре	3				3.82	x1	I/[1/(1.6)+	0.04] =	5.74	=			(27)
Windows	з Туре	4				2.32	x1	I/[1/(1.6)+	0.04] =	3.49				(27)
Windows	з Туре	5				1.61		I/[1/(1.6)+	0.04] =	2.42				(27)
Windows	з Туре	6				0.61	x1	I/[1/(1.6)+	0.04] =	0.92				(27)
Rooflight														
	ts					0.41	x1	I/[1/(1.2) +	0.04] =	0.492				(27b)
Floor	ts					0.41	x1	0.22	0.04] =	0.492				(27b)
Floor Walls Tyj	ts pe1	72.1	6	7.22	2	0.41 45.71 64.94	x1 1 x 4 x	0.22	0.04] =	0.492 10.06 18.18				(27b) (28) (29)
Floor Walls Ty _l Walls Ty _l	ts pe1 pe2	72.1	6	7.22		0.41 45.71 64.94 25.22	x1 1 x 4 x 2 x	0.22 0.28 0.28	0.04] =	0.492 10.06 18.18 7.06				(27b) (28) (29) (29)
Floor Walls Ty _l Walls Ty _l Walls Ty	ts rpe1 rpe2 rpe3	72.1	6 5 7	7.22 8.43 3.78		0.41 45.71 64.94 25.22 38.39	x1 1 x 4 x 2 x 2 x	0.22 0.28 0.28 0.28	0.04] = = = = = = = =	0.492 10.06 18.18 7.06 8.59				(27b) (28) (29) (29) (29)
Floor Walls Ty _l Walls Ty _l Walls Ty _l Walls Ty _l	ts rpe1 rpe2 rpe3 rpe4	72.1 33.6 42.1 6.20	6 55 7	7.22 8.43 3.78 0		0.41 45.71 64.94 25.22 38.39 6.26	x1 x1 x x x x x x x x x x x x	0.22 0.28 0.28 0.22	0.04] = = = = = = = = = = = = = = = = = = =	0.492 10.06 18.18 7.06 8.59 1.4				(27b) (28) (29) (29) (29) (29) (29)
Floor Walls Ty Walls Ty Walls Ty Walls Ty Roof	ts pe1 pe2 pe3 pe4	72.1 33.6 42.1 6.20	6 5 7 6 4	7.22 8.43 3.78 0		0.41 45.71 64.94 25.22 38.39 6.26 4.02	x1 1 x 4 x 2	/[1/(1.2) + 0.22 0.28 0.28 0.22 0.22 0.22 0.22	0.04] = = = = = = = = = = = = = = = = = = =	0.492 10.06 18.18 7.06 8.59 1.4 0.72				(27b) (28) (29) (29) (29) (29) (29) (29) (30)
Floor Walls Ty Walls Ty Walls Ty Walls Ty Roof Total are	ts pe1 pe2 pe3 pe4 ea of el	72.1 33.6 42.1 6.20 4.84 ements	6 5 7 6 4 , m ²	7.22 8.43 3.78 0 0.82		0.41 45.71 64.94 25.22 38.39 6.26 4.02 204.78	x1 1 x 4 x 2 x 39 x 39	/[1/(1.2) + 0.22 0.28 0.28 0.22 0.22 0.22 0.22	0.04] = = = = = = = = = = = = =	0.492 10.06 18.18 7.06 8.59 1.4 0.72				(27b) (28) (29) (29) (29) (29) (29) (29) (30) (31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ** include the areas on both sides of internal walls and partitions

Fabric heat loss, $W/K = S (A \times U)$

(26)	.(30) +	(32) =
------	---------	--------

76.53 (33)

Heat c	apacity	Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	8478.6729	(34)
Therm	al mass	parame	ter (TMF		: TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For des can be l	ign assess used inste	ments wh ad of a det	ere the de tailed calci	tails of the ulation.	construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	K						30.72	(36)
if details	s of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			107.25	(37)
Ventila	ation hea	t loss ca	alculated	monthl	y	i	i		(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	60.89	58.77	58.77	54.88	52.56	51.48	50.46	50.46	53.12	54.88	56.77	58.77		(38)
Heat t	ransfer o	oefficier	nt, W/K	-					(39)m	= (37) + (3	38)m			
(39)m=	168.14	166.02	166.02	162.13	159.81	158.73	157.71	157.71	160.37	162.13	164.01	166.02		
									(10)	Average =	Sum(39)1	12 /12=	162.4	(39)
Heat lo	oss para	meter (F	1LP), W/	m²K	4.05	4.04	4.00	4.00	(40)m	= (39)m ÷	· (4)	4.00		
(40)m=	1.95	1.93	1.93	1.88	1.85	1.84	1.83	1.83	1.86	1.88	1.9	1.93	4.00	
Numb	er of day	rs in mor	nth (Tab	le 1a)					/	Average =	Sum(40)₁.	12 / 1 Z=	1.88	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
					1	1					1			
1 \//	ator boat	ing onor	av requi	iromont.								k\M/b/v	aar:	
- t . vvc		ing ener	gyrequ	nement.								KVVII/yt	-ai.	
Assum if TF	ned occu A > 13.9	ipancy, I 9, N = 1	N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.()013 x (⁻	ΓFA -13.	2. .9)	57		(42)
Π IF Δηριμα	A £ 13.3	θ , $N = 1$ θ hot wa	ater usar	ne in litre	es ner da	ve hV ve	erane -	(25 x NI)	+ 36		05	05	l	(13)
Reduce	the annua	l average	hot water	usage by	5% if the c	welling is	designed i	to achieve	a water us	se target o	f 95	.25		(40)
not mor	e that 125	litres per p	person per	^r day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage il	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					_	
(44)m=	104.77	100.96	97.15	93.34	89.53	85.72	85.72	89.53	93.34	97.15	100.96	104.77		
_							_	T (0000	-	Total = Su	m(44) ₁₁₂ =	=	1142.95	(44)
Energy	content of	hot water	used - cal	culated mo	onthly = 4. 1	190 x Vd,r 1	m x nm x L I	01m/3600	kwn/mor	ith (see Ta	ables 1b, 1 I	c, 1d)	I	
(45)m=	155.74	136.21	140.56	122.54	117.58	101.47	94.02	107.89	109.18	127.24	138.89	150.83		-
lf instan	taneous w	ater heatiı	na at point	of use (no	o hot wate	r storage).	enter 0 in	boxes (46	-) to (61)	Fotal = Su	m(45) ₁₁₂ =	-	1502.18	(45)
(46)m -	23.36	20.43	21.08	18.38	17.64	15.22	1/1	16.18	16.38	10.00	20.83	22.62		(46)
Water	storage	20.43	21.00	10.50	17.04	15.22	14.1	10.18	10.50	19.09	20.03	22.02		(40)
a) If m	anufactu	ırer's de	clared lo	oss facto	or is knov	wn (kWh	/day):					0		(47)
Tempe	erature f	actor fro	m Table	2b								0		(48)
Energ	y lost fro	m water	storage	, kWh/ye	ear			(47) x (48)	=			0		(49)
lf man	, ufacture	r's decla	red cylir	nder loss	s factor is	s not kno	own:					•		(-)
Cylind	er volum	e (litres)) includir	ng any s	olar stor	age with	nin same	•			1:	50		(50)
lf cor Othe	nmunity he rwise if no	eating and stored ho	' no tank in t water (th	n dwelling, is includes	enter 110 instantan	litres in bo eous comi	ox (50) bi boilers)	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor fr	om Tabl	le 2 (kW	h/litre/da	ay)				0.	02		(51)
Volum	e factor	from Tal	ble 2a								0.	93		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)

Energy	y lost fro	m water	storage	e, kWh/y	ear			((50) x (51	l) x (52) x	(53) =	1	.6		(54)
Enter ((49) or (54) in (5	5)					((50)	==) (11)		1	.6		(55)
water	storage	loss cal	culated T	for each	month			((56)m = (55) × (41)	m I	1		l .	
(56)m=	49.48	44.69	49.48	47.88	49.48	47.88	49.48	49.48	47.88	49.48	47.88	49.48		(56)
If cylinde	er contain:	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	49.48	44.69	49.48	47.88	49.48	47.88	49.48	49.48	47.88	49.48	47.88	49.48		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3						6	10		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	257.03	227.7	241.85	220.56	218.87	199.48	195.31	209.18	207.2	228.53	236.91	252.11		(62)
Solar Dł	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter				-	-	-	-		-		
(64)m=	257.03	227.7	241.85	220.56	218.87	199.48	195.31	209.18	207.2	228.53	236.91	252.11		
								Outp	out from wa	ater heate	r (annual)₁	12	2694.72	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 x [0.85	5 × (45)m	n + (61)n	n] + 0.8 :	x [(46)m	+ (57)m	ı + (59)m	1]	
(65)m=	132.81	118.48	127.76	119.16	120.12	112.15	112.29	116.9	114.72	123.33	124.6	131.18		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table	5) Wat	ts										
motab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22	154.22		(66)
Lightin	g gains	(calcula	ted in A	pendix	L, equat	ion L9 o	r L9a), a	lso see [·]	Table 5					
(67)m=	64.75	57.51	46.77	35.41	26.47	22.35	24.15	31.39	42.13	53.49	62.43	66.55		(67)
Applia	nces da	ins (calc	ulated ir	n Appene	dix L. ea	uation L	13 or L1	a), also	see Ta	ble 5	l	1	I	
(68)m=	346.19	349.79	340.73	321.46	297.13	274.27	258.99	255.4	264.45	283.73	308.05	330.92		(68)
Cookir	L	(calcula	L Ited in A	I ppendix	L equat	ion I 15	or I 15a') also se	I ee Table	5				
(69)m=	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99	52.99		(69)
Pumps	L	l ns dains	I (Table ⁱ	1 5a)			I	I						
(70)m=		10 10	10	10	10	10	10	10	10	10	10	10		(70)
			n (nega	tive valu	es) (Tab	L 5)	_	_	_			_		
(71)m-	-102 81	-102 81	-102 81	-102 81	-102 81	-102 81	-102 81	-102 81	-102 81	-102 81	-102.81	-102 81	l	(71)
Wotor	hooting			102.01	102.01	102.01	102.01	102.01	102.01	102.01	102.01	102.01		(***)
(72)m-	178 51	yanis (1	able 5)	165.5	161.46	155 77	150.03	157 13	150.33	165 77	173.05	176 31		(72)
	nterne"		<u> </u>	100.0	101.40		m + (67)~	1.07.10 1 ± (68)m	(60)m + ((70)m + (7)	$(1)m \pm (72)$			()
(72)m-			672.62	626 77	500.46	566 79	5/9/7	559.24	580.24	617 20	657.02	629 10		(73)
(13)III=	lar gaing	080	073.03	030.77	335.40	500.76	J+0.47	550.51	300.31	017.39	037.93	000.10		(10)
0.00	iai gains	<i>.</i>												

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	x	1.29	×	37.39	×	0.76	×	0.7	=	24.94	(77)
Southeast 0.9x	0.54	x	2.32	x	37.39	x	0.76	x	0.7	=	44.85	(77)
Southeast 0.9x	0.54	x	1.29	x	63.74	x	0.76	x	0.7	=	42.52	(77)
Southeast 0.9x	0.54	x	2.32	×	63.74	×	0.76	×	0.7	=	76.46	– (77)
Southeast 0.9x	0.54	x	1.29	x	84.22	x	0.76	x	0.7] =	56.18	(77)
Southeast 0.9x	0.54	x	2.32	×	84.22	×	0.76	×	0.7] =	101.03	(77)
Southeast 0.9x	0.54	x	1.29	x	103.49	×	0.76	x	0.7	=	69.03	(77)
Southeast 0.9x	0.54	x	2.32	x	103.49	x	0.76	x	0.7	=	124.15	(77)
Southeast 0.9x	0.54	x	1.29	x	113.34	x	0.76	x	0.7	=	75.6	(77)
Southeast 0.9x	0.54	x	2.32	x	113.34	×	0.76	x	0.7	=	135.97	(77)
Southeast 0.9x	0.54	x	1.29	x	115.04	x	0.76	x	0.7	=	76.74	(77)
Southeast 0.9x	0.54	x	2.32	x	115.04	×	0.76	x	0.7	=	138.02	(77)
Southeast 0.9x	0.54	x	1.29	x	112.79	×	0.76	x	0.7	=	75.24	(77)
Southeast 0.9x	0.54	x	2.32	x	112.79	x	0.76	x	0.7	=	135.31	(77)
Southeast 0.9x	0.54	x	1.29	x	105.34	×	0.76	x	0.7	=	70.27	(77)
Southeast 0.9x	0.54	x	2.32	x	105.34	x	0.76	x	0.7	=	126.38	(77)
Southeast 0.9x	0.54	x	1.29	x	92.9	x	0.76	x	0.7	=	61.97	(77)
Southeast 0.9x	0.54	x	2.32	x	92.9	x	0.76	x	0.7	=	111.45	(77)
Southeast 0.9x	0.54	x	1.29	x	72.36	x	0.76	x	0.7	=	48.27	(77)
Southeast 0.9x	0.54	x	2.32	x	72.36	x	0.76	x	0.7	=	86.81	(77)
Southeast 0.9x	0.54	x	1.29	×	44.83	x	0.76	×	0.7	=	29.9	(77)
Southeast 0.9x	0.54	x	2.32	x	44.83	x	0.76	x	0.7	=	53.78	(77)
Southeast 0.9x	0.54	x	1.29	x	31.95	x	0.76	x	0.7	=	21.31	(77)
Southeast 0.9x	0.54	x	2.32	x	31.95	x	0.76	x	0.7	=	38.33	(77)
Northwest 0.9x	0.54	x	2.39	x	11.51	x	0.63	x	0.7	=	5.9	(81)
Northwest 0.9x	0.54	x	3.82	x	11.51	x	0.63	x	0.7	=	9.42	(81)
Northwest 0.9x	0.54	x	1.61	×	11.51	x	0.63	x	0.7] =	3.97	(81)
Northwest 0.9x	0.54	x	0.61	x	11.51	×	0.63	x	0.7	=	1.5	(81)
Northwest 0.9x	0.54	x	2.39	×	23.55	×	0.63	×	0.7	=	12.07	(81)
Northwest 0.9x	0.54	x	3.82	x	23.55	x	0.63	x	0.7] =	19.28	(81)
Northwest 0.9x	0.54	x	1.61	x	23.55	x	0.63	x	0.7] =	8.13	(81)
Northwest 0.9x	0.54	x	0.61	×	23.55	x	0.63	×	0.7] =	3.08	(81)
Northwest 0.9x	0.54	x	2.39	x	41.13	x	0.63	x	0.7	=	21.07	(81)
Northwest 0.9x	0.54	x	3.82	×	41.13	x	0.63	x	0.7] =	33.67	(81)
Northwest 0.9x	0.54	x	1.61	x	41.13	x	0.63	x	0.7	=	14.19	(81)
Northwest 0.9x	0.54	x	0.61	x	41.13	x	0.63	x	0.7	=	5.38	(81)
Northwest 0.9x	0.54	x	2.39	×	67.8	x	0.63	x	0.7] =	34.73	(81)
Northwest 0.9x	0.54	x	3.82	×	67.8	×	0.63	×	0.7] =	55.51	(81)
Northwest 0.9x	0.54	x	1.61	x	67.8	x	0.63	x	0.7] =	23.39	(81)

Northwest 0.9x	0.54	x	0.61	x	67.8	x	0.63	x	0.7	=	8.86	(81)
Northwest 0.9x	0.54] x	2.39	x	89.77	x	0.63	x	0.7	j =	45.98] (81)
Northwest 0.9x	0.54	x	3.82	x	89.77	x	0.63	x	0.7	=	73.49	(81)
Northwest 0.9x	0.54	x	1.61	x	89.77	x	0.63	x	0.7	=	30.98	(81)
Northwest 0.9x	0.54	x	0.61	x	89.77	x	0.63	x	0.7	=	11.74	(81)
Northwest 0.9x	0.54	x	2.39	x	97.5	x	0.63	x	0.7	=	49.94	(81)
Northwest 0.9x	0.54	x	3.82	×	97.5	x	0.63	x	0.7] =	79.83	(81)
Northwest 0.9x	0.54	x	1.61	x	97.5	x	0.63	x	0.7	=	33.64	(81)
Northwest 0.9x	0.54	x	0.61	x	97.5	x	0.63	x	0.7	=	12.75	(81)
Northwest 0.9x	0.54	x	2.39	x	92.98	x	0.63	x	0.7	=	47.63	(81)
Northwest 0.9x	0.54	x	3.82	x	92.98	x	0.63	x	0.7	=	76.12	(81)
Northwest 0.9x	0.54	x	1.61	x	92.98	x	0.63	x	0.7	=	32.08	(81)
Northwest 0.9x	0.54	x	0.61	x	92.98	x	0.63	x	0.7	=	12.16	(81)
Northwest 0.9x	0.54	x	2.39	x	75.42	x	0.63	x	0.7	=	38.63	(81)
Northwest 0.9x	0.54	x	3.82	x	75.42	x	0.63	x	0.7	=	61.75	(81)
Northwest 0.9x	0.54	x	1.61	x	75.42	x	0.63	x	0.7	=	26.02	(81)
Northwest 0.9x	0.54	x	0.61	x	75.42	x	0.63	x	0.7	=	9.86	(81)
Northwest 0.9x	0.54	x	2.39	x	51.24	x	0.63	x	0.7	=	26.25	(81)
Northwest 0.9x	0.54	x	3.82	x	51.24	x	0.63	x	0.7	=	41.96	(81)
Northwest 0.9x	0.54	x	1.61	x	51.24	x	0.63	x	0.7	=	17.68	(81)
Northwest 0.9x	0.54	x	0.61	x	51.24	x	0.63	x	0.7	=	6.7	(81)
Northwest 0.9x	0.54	x	2.39	x	29.6	x	0.63	x	0.7	=	15.16	(81)
Northwest 0.9x	0.54	x	3.82	x	29.6	x	0.63	x	0.7	=	24.23	(81)
Northwest 0.9x	0.54	x	1.61	x	29.6	x	0.63	x	0.7	=	10.21	(81)
Northwest 0.9x	0.54	x	0.61	x	29.6	x	0.63	x	0.7	=	3.87	(81)
Northwest 0.9x	0.54	x	2.39	x	14.52	x	0.63	x	0.7	=	7.44	(81)
Northwest 0.9x	0.54	x	3.82	x	14.52	x	0.63	x	0.7] =	11.89	(81)
Northwest 0.9x	0.54	x	1.61	x	14.52	x	0.63	x	0.7	=	5.01	(81)
Northwest 0.9x	0.54	x	0.61	x	14.52	x	0.63	x	0.7	=	1.9	(81)
Northwest 0.9x	0.54	x	2.39	x	9.36	x	0.63	x	0.7] =	4.79	(81)
Northwest 0.9x	0.54	x	3.82	x	9.36	x	0.63	x	0.7	=	7.66	(81)
Northwest 0.9x	0.54	x	1.61	x	9.36	x	0.63	x	0.7] =	3.23	(81)
Northwest 0.9x	0.54	x	0.61	x	9.36	x	0.63	x	0.7	=	1.22	(81)
Rooflights 0.9x	1	x	0.41	x	26	x	0.63	x	0.8	=	9.67	(82)
Rooflights 0.9x	1	x	0.41	x	54	x	0.63	x	0.8	=	20.09	(82)
Rooflights 0.9x	1	x	0.41	x	94	x	0.63	x	0.8	=	34.96	(82)
Rooflights 0.9x	1	x	0.41	x	150	x	0.63	x	0.8	=	55.79	(82)
Rooflights 0.9x	1	x	0.41	×	190	x	0.63	x	0.8	=	70.67	(82)
Rooflights 0.9x	1	x	0.41	×	201	x	0.63	x	0.8	=	74.76	(82)
Rooflights 0.9x	1	x	0.41	×	194	x	0.63	×	0.8] =	72.16	(82)
Rooflights 0.9x	1	x	0.41	×	164	x	0.63	x	0.8	=	61	(82)

Rooflig	nts 0.9x	1	×	0.4	1	x		116	x	0.63	x	0.8	=	43.15	(82)
Rooflig	nts 0.9x	1	×	0.4	11	x		68	x [0.63	×	0.8	=	25.29	(82)
Rooflig	nts 0.9x	1	x	0.4	11	x		33	x [0.63	×	0.8	=	12.27	(82)
Rooflig	nts 0.9x	1	x	0.4	11	x		21	, 	0.63	×	0.8	=	7.81	(82)
	L														
Solar o	ains in	watts, ca	alculate	d for eac	h month	n			(83)m = S	um(74)m .	(82)m				
(83)m=	100.26	181.62	266.48	371.48	444.43	4	65.68	450.7	393.91	309.15	213.8	5 122.2	84.37	1	(83)
Total g	ains – i	nternal a	ind sola	r (84)m =	= (73)m	+ (83)m	, watts		<u>!</u>			1	1	
(84)m=	804.11	879.62	940.11	1008.24	1043.89	10	032.46	999.17	952.22	889.46	831.24	780.13	772.55		(84)
7. Me	an inter	nal temp	erature	(heating	seasor	1)		•	•						
Temp	erature	durina h	eating	periods in	n the livi	ina	area f	from Tal	ole 9. Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for a	ains for	living are	ea h1 m	ອ າ (s	ee Ta	ble 9a)		()					
Otinoc	Jan	Feb	Mar		Mav	T	Jun		Aug	Sen	Oct	Nov	Dec	1	
(86)m-	0.93	0.92	0.89	0.85	0.78		0.66	0.52	0.53	0.73	0.85	0.92	0.94		(86)
(00)11-	0.00	0.02	0.00	0.00	0.70		0.00	0.02	0.00	0.75	0.00	0.02	0.04]	(00)
Mean	interna	l temper	ature in	living ar	ea T1 (f		w ste	ps 3 to 7	7 in Tabl	e 9c)		1	r	1	()
(87)m=	17.73	17.99	18.53	19.13	19.87	2	20.44	20.78	20.77	20.29	19.44	18.41	17.82		(87)
Temp	erature	during h	eating p	periods in	n rest of	dw	elling	from Ta	able 9, T	h2 (°C)					
=m(88)	19.37	19.39	19.39	19.42	19.44	1	9.45	19.46	19.46	19.43	19.42	19.41	19.39		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2	.m (se	e Table	9a)	-	-		-	•	
(89)m=	0.92	0.91	0.87	0.82	0.72	T	0.57	0.36	0.38	0.64	0.82	0.9	0.92]	(89)
Maan	interne			1	مد مارینما		TO /6			I Zin Tahl			I	1	
	16 52					ing T	12 (10		20 20 20 20 20 20 20 20 20 20 20 20 20 2			17.00	16.62	1	(90)
(90)11=	10.05	10.79	17.52	17.92	10.03		9.14	19.59	19.30	19.01	10.23	17.22	(1) -		
												ing area ÷ (-	0.22	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	LA x T1	+ (1 – fL	A) × T2				•	
(92)m=	16.79	17.05	17.58	18.18	18.9	1	9.42	19.69	19.68	19.29	18.49	17.48	16.89		(92)
Apply	adjustn	nent to tl	he meai	n interna	l tempe	ratu	ire fro	m Table	4e, whe	ere appro	opriate			1	
(93)m=	16.79	17.05	17.58	18.18	18.9		9.42	19.69	19.68	19.29	18.49	17.48	16.89		(93)
8. Spa	ace hea	ting requ	uiremen	t											
Set T	i to the i	mean int	ernal te	mperatu	re obtai	ned	l at ste	ep 11 of	Table 9	b, so tha	at Ti,m=	=(76)m an	d re-calo	culate	
the ut	lisation		or gains			\mathbf{T}	l	1.1	A	0		Navi		1	
Litilion	Jan	Feb	iviar	Apr	мау		Jun	Jui	Aug	Sep	Oct	INOV	Dec		
(04)m-				1.	0.7		0.56	0.20	0.4	0.62	0.70	0.97	0.0	1	(94)
		0.00 hmCm	$\frac{0.04}{10}$	$\frac{0.79}{100 \times (9)}$	()m		0.50	0.39	0.4	0.03	0.79	0.87	0.9]	(04)
(95)m-	720 93	771.88	VV = (9)	4)111 X (04 798 45	720 10	5	82.28	388 24	383.63	560.68	654.8	681.01	693.95	1	(95)
Month			rnal ton		$\int from T$	- J	02.20	500.24	000.00	000.00	004.00	001.01	000.00]	(00)
(96)m-	11y aven		6.8	87	11 7		14.6	16.9	16.9	14.3	10.8	7	49	1	(96)
Heat	loss rate	for me	o.o			L m	ν W/ -	-[(30)m	v [(93)m	(96)m	1		4.0]	(00)
(97)m=	2065 77	2001 01	1789.98	1537 17	1150.97	7	65 29	439.82	438 69	800 1	1247.5	9 1718.38	1990 44	1	(97)
Snace	heatin		ement fr	I each n	nonth k	<u>L</u> ' W/h		h = 0.02	1)m _ (05	j)ml v (41)m	1.000.44	1	x = 7
(98)m=	1000.56	825.98	742.56	531.88	313.8		0	0			441.0	746.91	964.59	1	
(* */***						_	-		Tota	al per vear	(kWh/ve	ar) = Sum(9)	8)1 50 12 =	5567.3	(98)
0	. h	- السمع م			hing								- j ·		
Space	e neatin	g require	ementir	i KVVN/M	-year									64.57	(99)

9a. En	iergy re	quiremer	nts – Ind	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Spac	e heati	ng:												٦
Fract	ion of s	pace hea	at from s	econdar	y/supple	mentary	system	(222)	(22.1)				0	(201)
Fract	ion of s	pace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	otal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ting syste	em 1								78.9	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Spac	e heatir	ng require	ement (o		d above)					444.00		004 50		
(2.4.4)	1000.56	825.98	742.56	531.88	313.8	0	0	0	0	441.02	746.91	964.59		
(211)n	$n = \{[(98)] \\ 1269 \\ $	3)m x (20	$[04)] + (2^{-1})$	$10)m \} x$	100 ÷ (2	06)	0	0	0	559.06	046.65	1000 55		(211)
	1200.10	1040.07	941.14	074.12	391.12	0	0	Tota	l (kWh/vea	ar) = Sum(2)	211)	=	7056 15	7(211)
Snac	e heatir	na fuel (s	econdar	·v) k\//h/	month						/15,101	2	7000.10	
= {[(98	s)m x (2	01)] + (2	14) m } :	x 100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
			•	-				Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,101}	2=	0	(215)
Water	heatin	g												_
Output	t from w	/ater hea	ter (calc	ulated a	bove)	100.48	105.01	200.49	207.2	000 50	226.04	252.44		
Efficie	257.03	vater hea	241.60	220.56	210.07	199.46	195.31	209.16	207.2	228.03	236.91	292.11	69.9	7(216)
(217)m=	76.6	76.47	76.15	75.64	74.41	68.8	68.8	68.8	68.8	75.14	76.21	76.57	00.0	(217)
Fuel fo	or water	heating.	kWh/m	onth		00.0	00.0	00.0	00.0	10.11	10.21	10.01		()
(219)m	<u>n = (64</u>	<u>)m x 100</u>) ÷ (217)m										
(219)m=	335.54	297.74	317.58	291.57	294.13	289.95	283.88	304.04	301.16	304.15	310.88	329.26		-
	• · · •							lota	I = Sum(2)	19a) ₁₁₂ =			3659.88	(219)
Annua Space	heating	s n fuel use	ed main	system	1					K	Wh/yea	r	7056.15	1
Water	Space heating: O (201) Fraction of space heat from main system (s) (202) = 1 - (201) = 1 (202) Fraction of space heat from main system 1 (204) = (202) × (1 - (203)] = 1 (204) Efficiency of main space heating system 1 (204) = (202) × (1 - (203)] = 1 (204) Efficiency of secondary/supplementary heating system, % 0 (208) 0 0 0 (201) Space heating requirement (calculated above) 1 (204) (201) (201) (201) (201) 1000.56 525.89 742.56 531.88 133.8 0 0 0 441.02 746.91 964.59 (211) 1000.56 525.89 742.56 531.88 133.8 0													
	ineating		u										3039.00	
Electri	city for	pumps, f	ans and	electric	keep-no	t								
centra	al heati	ng pump	:									130		(230c)
boiler	r with a	fan-assis	sted flue									45		(230e)
Total e	electricit	ty for the	above,	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electri	city for	lighting											457.41	(232)
10a. I	Fuel co	sts - indi	vidual he	eating sy	stems:									-
						Fu kW	el /h/year			Fuel P (Table	rice 12)		Fuel Cost £/year	
Space	heating	g - main :	system ²	1		(21	1) x			3.	1	x 0.01 =	218.7405	(240)
Space	heating	g - main :	system 2	2		(21:	3) x			0		x 0.01 =	0	(241)
Space	heating	g - secon	dary			(21	5) x			0		x 0.01 =	0	(242)
Water	heating	g cost (ot	her fuel)			(219	9)			3.	1	x 0.01 =	113.46	(247)

Pumps, fans and electric keep-hot	(231)	11.46 × 0.01 =	20.06 (249)
(if off-peak tariff, list each of (230a) to (230g Energy for lighting) separately as applicable and (232)	apply fuel price according to 11.46 × 0.01 =	Table 12a
Additional standing charges (Table 12)		11.40	(251)
Additional standing charges (Table 12)			106 (231)
Appendix Q items: repeat lines (253) and (24	54) as needed		540.0700 (255)
11a SAP rating - individual heating system)(247) + (230)(234) =		510.6706 (200)
Energy cost deflator (Table 12)			0.17
Energy cost denator (FCE) [(25	5) x (256)] ÷ [(4) + 45.0] =		0.47 (256)
SAP rating (Section 12)			74.484 (258)
12a. CO2 emissions – Individual heating sy	stems including micro-CHP		74.404
	F	E mission (actor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating (main system 1)	(211) x	0.198 =	1397.12 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Water heating	(219) x	0.198 =	724.66 (264)
Space and water heating	(261) + (262) + (263) + (264	4) =	2121.77 (265)
Electricity for pumps, fans and electric keep	-hot (231) x	0.517 =	90.48 (267)
Electricity for lighting	(232) x	0.517 =	236.48 (268)
Total CO2, kg/year		sum of (265)(271) =	2448.73 (272)
CO2 emissions per m ²		(272) ÷ (4) =	28.4 (273)
El rating (section 14)			75 (274)
13a. Primary Energy			
	Energy	Primary	P. Enerav
	kWh/year	factor	kWh/year
Space heating (main system 1)	(211) x	1.02 =	7197.27 (261)
Space heating (secondary)	(215) x	0 =	0 (263)
Energy for water heating	(219) x	1.02 =	3733.07 (264)
Space and water heating	(261) + (262) + (263) + (264)	4) =	10930.34 (265)
Electricity for pumps, fans and electric keep	-hot (231) x	2.92 =	511 (267)
Electricity for lighting	(232) x	0 =	1335.63 (268)
'Total Primary Energy		sum of (265)(271) =	12776.97 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	148.19 (273)

			User D	etails:						
Assessor Name:	Test User			Stroma	a Num	ber:		STRO	000000	
Software Name:	Stroma FSAP 200	9		Softwa	are Ver	sion:		Versio	n: 1.5.0.74	
		Pr	operty A	Address:	First flo	or flat				
Address :										
1. Overall dwelling dimer	nsions:									
Cround floor			Area	a(m²)	(1 -)	Ave He	ight(m)		Volume(m ³)	
	· //· · // · · // · · //		4	3.02	(1a) X	3.	67	(2a) =	157.88	(38)
Total floor area TFA = (1a	ı)+(1b)+(1c)+(1d)+(1e)+(1n)) 43	3.02	(4)					_
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	157.88	(5)
2. Ventilation rate:		_							<u> </u>	
	main Se heating h	econdary eating	y	other		total			m ³ per hour	
Number of chimneys	0 +	0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	ns				- _	2	x ^	10 =	20	(7a)
Number of passive vents					Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fir	es					0	x 4	40 =	0	(7c)
					L					1
								Air ch	anges per hou	ır
Infiltration due to chimney	s, flues and fans = (63)	a)+(6b)+(7a	a)+(7b)+(7	7c) =		20		÷ (5) =	0.13	(8)
If a pressurisation test has be	en carried out or is intende	d, proceed	to (17), c	otherwise c	continue fro	om (9) to (16)	i		
Number of storeys in th Additional infiltration	e dweiling (ns)						[(0)]	11v0 1 -	0	(9)
Structural infiltration: 0	25 for steel or timber f	rame or	0 35 for	masonr	v constr	uction	[(9)-	- 1jx0. i =	0	(10)
if both types of wall are pre deducting areas of opening	esent, use the value corres gs); if equal user 0.35	conding to	the greate	er wall area	a (after	Gottori			0]()
If suspended wooden fl	oor, enter 0.2 (unseal	ed) or 0.′	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught st	ripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate	50 11 1			(8) + (10) -	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value, o	150, expressed in cub	IC metres 7) \div 201+(8)	s per no	ur per so so (18) – (quare m	etre of e	nvelope	area	10	(17)
Air permeability value applies	r_{i} if a pressurisation test has	been done	e or a deo	iree air pei	rmeability	is heina us	sed		0.63	(18)
Number of sides on which	sheltered		o a a ag	, ee all per	mousing	io boing ac	,ou		0	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			1	(20)
Infiltration rate incorporati	ng shelter factor			(21) = (18)	x (20) =				0.63	(21)
Infiltration rate modified for	or monthly wind speed									_
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
(22)m= 5.4 5.1	5.1 4.5 4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1		
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4									
(22a)m= 1.35 1.27 1	.27 1.12 1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27		
	II							I	I	

Adjust	ed infiltra	ation rat	e (allowi	ng for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m				_		
	0.85	0.8	0.8	0.7	0.64	0.61	0.58	0.58	0.66	0.7	0.75	0.8			
Calcul	ate etter	ctive air	change i tion:	rate for t	he appli	cable ca	se								
lf ovh			using Anne	andix N (2	(23a) – (23a	a) × Emv (e	acuation (I	N5)) other	nwise (23h) – (23a)				U	
If bal	anced with		werv: effici		allowing f	for in-use f	actor (from	n Table 4b) –) – (200)				0	
		d moob) = (2)	2b)m i (f	00h) v [1 (22a)	. 1001	0	(23c)
a) II (24a)m-				0					$\frac{1}{1}$			$\frac{1-(230)}{1-0}$]]		(24a)
(2-10)11-		d moch		ntilation	without	boot roc		1 °	$\int_{-\infty}^{\infty}$		22h)	Ů	J		()
(24b)m-				0				10)(240			230)	0	1		(24b)
(2-10)III-			tract ven	tilation			Ventilatio	n from c		Ŭ			J		(,
0) 11	if (22b)n	n < 0.5 ×	(23b), t	hen (24	c) = (23b	b); other	wise (24	c) = (22k	b) m + 0.	5 × (23b)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural if (22b)n	ventilation = 1, th	on or whe	ole hous m = (221	se positiv o)m othe	ve input erwise (2	ventilati 24d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]		-	-		
(24d)m=	0.86	0.82	0.82	0.75	0.71	0.69	0.67	0.67	0.72	0.75	0.78	0.82			(24d)
Effe	ctive air	change	rate - en	iter (24a) or (24t) or (24	c) or (24	ld) in boy	(25)				1		
(25)m=	0.86	0.82	0.82	0.75	0.71	0.69	0.67	0.67	0.72	0.75	0.78	0.82			(25)
3 He	at losse	s and he	eat loss r	aramet	≏r·	•		•	•			•	•		
		Gros	ss.	Openin	as	Net Ar	ea	U-valı	Ie	ΑΧΠ		k-value	2	Δ)	K k
		area	(m²)	m	90 1 ²	A ,r	n²	W/m2	K	(W/I	<)	kJ/m²·l	K	kJ/	Ϋ́Κ
Windo	ws Type	e 1				1.93	x1	/[1/(2.4)+	0.04] =	4.23					(27)
Windo	ws Type	2				1.65	x1	/[1/(1.2)+	0.04] =	1.89					(27)
Windo	ws Type	93				1.74	x1	/[1/(1.2)+	0.04] =	1.99					(27)
Walls ⁻	Type1	79.4	16	7.25	;	72.21	I X	0.17	=	12.28					(29)
Walls ⁻	Type2	10.9	96	0		10.96	6 X	0.24	=	2.59					(29)
Walls ⁻	Туре3	12.3	32	0		12.32	<u>2</u> x	0.39	=	4.8					(29)
Total a	area of e	lements	, m²			102.74	42								(31)
* for win ** incluc	dows and le the area	roof wind as on both	ows, use e sides of in	ffective wi ternal wal	ndow U-va Is and par	alue calcul titions	ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	is given in	paragraph	n 3.2		
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)) + (32) =				3	32	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	1056	3.619	(34)
Therm	al mass	parame	ter (TMF	? = Cm .	: TFA) ir	n kJ/m²K	,		Indica	tive Value:	Low		1	00	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calcu	tails of the ılation.	construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in T	able 1f			
Therm	al bridge	es : S (L	x Y) cale	culated	using Ap	pendix l	K						15	.41	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)									_
Total f	abric he	at loss							(33) +	(36) =			47	.41	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y I	l .	I		(38)m	= 0.33 × (25)m x (5)	1		
(20)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			(39)
(38)m=	44./	42.68	42.68	39	30.8	35.78	34.8	34.8	37.33	39	40.78	42.68	J		(30)
Heat ti	ransfer o	coefficie	nt, W/K	-	-			<u> </u>	(39)m	= (37) + (3	38)m		1		
(39)m=	92.11	90.09	90.09	86.41	84.21	83.19	82.21	82.21	84.74	86.41	88.19	90.09			
										+verage =	5um(39)	12/12=	86	.00	(39)

Heat lo	oss para	ameter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	2.14	2.09	2.09	2.01	1.96	1.93	1.91	1.91	1.97	2.01	2.05	2.09		
Numbe	er of day	vs in mo	nth (Tab	le 1a)	•		•	•		Average =	Sum(40)1.	12 /12=	2.01	(40)
- tainio	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum	ied occu A > 13.	upancy, 9, N = 1	N + 1.76 x	(1 - exp	o(-0.0003	349 x (TF	FA -13.9)2)] + 0.()013 x (⁻	TFA -13	1. .9)	49		(42)
Annua Reduce not more	A £ 13. I averag the annua e that 125	9, IN = 1 ge hot wa al average 5 litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	73 f	.22		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	in litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	80.54	77.61	74.68	71.75	68.82	65.9	65.9	68.82	71.75	74.68	77.61	80.54		_
Enerav	content of	f hot water	used - cal	lculated m	onthlv = 4.	190 x Vd.ı	m x nm x I)))))))))))))))))))) kWh/mor	Total = Su hth (see Ta	m(44) ₁₁₂ = ables 1b. 1	= c. 1d)	878.61	(44)
(45)m=	119.72	104.71	108.05	94.2	90.39	78	72.28	82.94	83.93	97.81	106.77	115.95		
()			100100					02.01		Total = Su	m(45) ₁₁₂ =	=	1154.76	(45)
lf instan	taneous v	vater heati	ng at point	t of use (ne	o hot water	r storage),	enter 0 in	boxes (46) to (61)	-	-			
(46)m=	17.96	15.71	16.21	14.13	13.56	11.7	10.84	12.44	12.59	14.67	16.02	17.39		(46)
a) If m	anufact	urer's de	clared lo	oss facto	or is knov	vn (kWh	/dav):					0		(47)
, Tempe	erature f	actor fro	m Table	2b		,	57					0		(48)
Energy	/ lost fro	om water	r storage	e, kWh/y	ear			(47) x (48)) =			0		(49)
If man	ufacture	er's decla	ared cylii	nder loss	s factor is	s not kno	own:						1	(50)
lf.con	er volun	ne (iltres) INCludii I no tank ir	ng any s a dwelling	olar stor	litres in bo	iin same	;				0		(50)
Othe	rwise if no	stored ho	ot water (th	is includes	instantan	eous com	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stor	age loss	factor fi	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	om water	r storage	e, kWh/y	ear			((50) x (51) x (52) x	(53) =		0		(54)
Enter ((49) or (54) in (5	5)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m I	1		I	
(56)m=	0	0 s dodicato	0 d color sto	0	0 = (56)m	0	0	0	$0_{7} = (56)$		0		iv Ll	(56)
						x [(30) – ([]] ÷ (3		/)iii = (30)					(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar Primar	y circuit y circuit	t loss (ar t loss cal , factor fi	nnual) fro lculated	om Table for each	e 3 month (59)m = ((58) ÷ 36	65 × (41)	m	r thormo	(0		(58)
(1100 (59)m=					0						0	0		(59)
Combi			for each		1	(60) <u>·</u> ?	1 35 v (11)m	I	1	1	I	l	
(61)m=	41.04	35.72	38.06	35.39	35.07	32.5	33.58	35.07	35.39	38.06	38.27	41.04		(61)
()=		1	1	1	1	L	1	1 20.07		1	L			. /

(e2)me 160.77 140.43 140.11 129.58 125.46 110.5 105.86 118.01 119.32 135.87 145.04 156.89 (e2) Solar JEWI input calculated using Appendix G × Appendix H (negative quarter) (refer V f no solar contribution to water heating) (dad additional lines if FCHRS and/or WWHS applies, see Appendix G) (Ga)me 0	Total h	eat req	uired for	water	he	ating ca	alculate	d fo	r eac	h month	(62)	m =	0.85 × (45)m	ı +	(46)m +	(57)	m +	(59)m + (61)m					
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0 if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (ci) (ci)<td>(62)m=</td><td>160.77</td><td>140.43</td><td>146.11</td><td></td><td>129.59</td><td>125.46</td><td>1</td><td>10.5</td><td>105.86</td><td>118</td><td>.01</td><td>119.32</td><td>135.</td><td>87</td><td>145.04</td><td>156</td><td>6.99</td><td></td><td>(62)</td>	(62)m=	160.77	140.43	146.11		129.59	125.46	1	10.5	105.86	118	.01	119.32	135.	87	145.04	156	6.99		(62)				
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (G3) 0	Solar DH	- W input	calculated	using Ap	ppe	ndix G or	Appendi	хH	(negati	ve quantity	/) (ent	ter '0'	if no solar	r contr	ibut	ion to wate	er hea	ating)	•					
(e3)m= 0 <td>(add ad</td> <td>dditiona</td> <td>l lines if</td> <td>FGHR</td> <td>Sa</td> <td>and/or V</td> <td>VWHR</td> <td>S ap</td> <td>plies</td> <td>, see Ap</td> <td>pend</td> <td>dix G</td> <td>G)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	(add ad	dditiona	l lines if	FGHR	Sa	and/or V	VWHR	S ap	plies	, see Ap	pend	dix G	G)											
Output from water heater (64)me 160.77 140.43 146.11 129.59 125.46 110.5 105.86 118.01 119.32 126.87 145.04 156.99 (64)m Heat gains from water heating. kWh/month 0.25 x [0.85 x (45)m + (61)m] + 0.8 x ((46)m + (57)m + (59)m] (65)m 50.07 43.75 45.44 40.17 38.82 34.06 32.43 65.3 36.75 42.04 45.07 48.84 (65)m include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 50.07 43.87 49.32 89.	(63)m=	0	0	0		0	0		0	0	C)	0	0		0	(C		(63)				
(64)me 160.77 140.43 146.11 129.59 125.46 110.5 105.86 118.01 119.32 135.87 145.04 159.99 0.00put from water heating, kWh/month 0.25 x (0.85 x (45)m + (61)m] + 0.8 x (146)m + (57)m + (59)m] (64) 50.07 43.75 44.4 40.17 38.82 34.08 32.35 36.75 42.04 45.07 48.81 (65) 50.07 43.75 44.4 40.17 38.82 34.08 32.35 87.75 42.04 45.07 48.81 (65) 6(57)m incalude (657)m in calculation of (65m only if cylinder is in the dwelling or hot water is from community heating 5 110.5 110.5 110.5 110.5 110.5 110.5 110.5 110.5 140.4 159.932 89.32 <td>Output</td> <td>from w</td> <td>ater hea</td> <td>ter</td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td>	Output	from w	ater hea	ter				-				-				-								
Output from water heating, kWh/month 0.25 x (0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] (86)m= 50.07 43.75 45.44 40.17 38.82 34.06 32.43 36.35 36.75 42.04 45.07 46.81 (65) include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5 1 1 A.83 89.32	(64)m=	160.77	140.43	146.11		129.59	125.46	1	10.5	105.86	118	.01	119.32	135.	87	145.04	156	6.99						
Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$ (66)m 0.07 43.75 45.44 40.17 33.82 34.06 32.43 38.35 36.75 42.04 45.07 48.81 (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 52): Metabolic gains (Table 5). Wats (66)m 93.32 88.32	I											Outp	out from wa	ater he	ate	r (annual)	12		1593.95	(64)				
(85)m= 50.07 43.75 45.44 40.17 38.82 34.08 32.43 36.35 36.75 42.04 45.07 48.81 (65) include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5	Heat g	ains fro	m water	heating	g, I	kWh/mo	onth 0.2	25 x	[0.85	5 × (45)m	1 + (6	61)m	n] + 0.8 x	< [(46	5)m	+ (57)m	+ (5	59)m	1]					
include (67)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 <u>Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec</u> (66)m 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 89.32 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m $53.68 31.7 25.78 19.52 14.59 12.32 13.31 17.3 23.22 29.49 34.41 36.69 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m 192.83 194.83 189.79 179.05 166.5 152.77 144.26 142.28 147.3 158.04 171.59 184.32 (68) Cooking gains (calculated in Appendix L, equation L13 or L15a), also see Table 5 (69)m 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 (69) Pumps and fans gains (Table 5a) (70)m (10 \ 10 \ 10 \ 10 \ 10 \ 10 \ 10 \ 10 \$	(65)m=	50.07	43.75	45.44	Τ	40.17	38.82	3	4.06	32.43	36.	35	36.75	42.0)4	45.07	48.	.81		(65)				
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts (66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 99.32 89.32 </td <td>inclu</td> <td>ide (57)</td> <td>m in calo</td> <td>ulatior</td> <td>10</td> <td>f (65)m</td> <td>only if</td> <td>cylii</td> <td>nder i</td> <td>s in the o</td> <td>dwell</td> <td>ling</td> <td>or hot w</td> <td>ater i</td> <td>s fr</td> <td>rom com</td> <td>mun</td> <td>ity h</td> <td>eating</td> <td></td>	inclu	ide (57)	m in calo	ulatior	10	f (65)m	only if	cylii	nder i	s in the o	dwell	ling	or hot w	ater i	s fr	rom com	mun	ity h	eating					
	5. Int	ernal da	ains (see	a Table	5	and 5a):					Ū							, in the second s					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Motob		c (Toblo	5) \//	-++ <i>c</i>																			
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Melabl	Jan	Feb	, 5), Wa		Apr	Mav	Т	Jun	Jul	A	ua	Sep	0	ct	Nov	D	ec						
Lighting gains (calculated in Appendix L, equation L 9 or L9a), also see Table 5 (67) m= 35.69 31.7 25.78 19.52 14.59 12.32 13.31 17.3 23.22 29.49 34.41 36.69 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68) m= 192.83 194.83 189.79 179.05 165.5 152.77 144.26 142.26 147.3 158.04 171.59 184.32 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69) m= 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 (69) Pumps and fans gains (Table 5a) (70) m= 10 10 10 10 10 10 10 10	(66)m=	89.32	89.32	89.32	╈	89.32	89.32	ξ	9.32	89.32	89.	32	89.32	89.3	32	89.32	89.	.32		(66)				
$ \begin{array}{c} \mbox{(a)} \end{tabular} tabula$	Liahtin	n dains	(calcula	L ted in A	-L \ni	pendix	equa	tion	190	riga)a	l Iso s		Lable 5						1					
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)me 192.83 194.83 198.979 179.05 165.5 152.77 144.26 142.26 147.3 158.04 171.59 184.32 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)me 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 45.42 (69) Pumps and fans gains (Table 5a) (70)me 10 10 10 10 10 10 10 10 10 10 10 10 10	(67)m=	35.69	31.7	25.78		19.52	14.59		2.32	13.31	17	.3	23.22	29.4	19	34.41	36.	.69	l	(67)				
$ \begin{array}{c} \text{(a)} \text{(b)} \text$	Annliar		ine (calc	hatelu	 in	Annend			tion	13 or 1 1	3a)	معاد			-	-			l					
$\begin{array}{c} \mbox{(c)} \mbox{(c)} & $	(68)m-	102.83	104.83	180 70		179 05	165 5		52 77	144.26	5a),	26	147 3	158	04	171 59	18/	132	l	(68)				
Cooking gains (calculated in Appendix L, equation L15 of L15a), also see Table 5 (69) $= 45.42 + 45.$		102.00	(22/21/2		<u>^</u>		100.0	<u> </u>						- 100.		171.00	104	1.52	ł	(00)				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	COOKIN				чр Т		L, equa		1 L 15), ais			5 45 /	10	45.40	45	40	I	(60)				
Pumps and fans gains (1 able 5a) (70)m= 10 <th <="" colspan="4" td=""><td>(69)m=</td><td>45.42</td><td>40.42</td><td>45.42</td><td>Ţ</td><td>40.42</td><td>40.42</td><td></td><td>-0.4Z</td><td>40.42</td><td>45.</td><td>42</td><td>40.42</td><td>45.4</td><td>+2</td><td>45.42</td><td>45.</td><td>.42</td><td>l l</td><td>(03)</td></th>	<td>(69)m=</td> <td>45.42</td> <td>40.42</td> <td>45.42</td> <td>Ţ</td> <td>40.42</td> <td>40.42</td> <td></td> <td>-0.4Z</td> <td>40.42</td> <td>45.</td> <td>42</td> <td>40.42</td> <td>45.4</td> <td>+2</td> <td>45.42</td> <td>45.</td> <td>.42</td> <td>l l</td> <td>(03)</td>				(69)m=	45.42	40.42	45.42	Ţ	40.42	40.42		-0.4Z	40.42	45.	42	40.42	45.4	+2	45.42	45.	.42	l l	(03)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Pumps	s and fai	ns gains		5	a)	10	1	40	10			40	4.0		10		0	I	(70)				
Losses e.g. evaporation (negative values) (Table 5) (71) m= $\frac{-59.55}{-59.55} \frac{-59.55}{-59.55} \frac{-59.55}{-59.5} \frac{-59.55}{-59.5} \frac{-59.55}{-59.5} \frac{-59.55}{-59.5} -59.5$	(70)m=	10	10	10		10	10		10	10	1	0	10	10)	10	1	0		(70)				
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Losses	s e.g. ev	aporatio	on (neg	ati	ve valu	es) (Tal	ble	5)		i —					i			I					
Water heating gains (Table 5) (72)m= 67.3 65.1 61.08 55.79 52.18 47.3 43.59 48.85 51.05 56.5 62.6 65.61 (72) Total internal gains = ($66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$ (73)m= 381.02 376.83 361.85 339.56 317.47 297.59 286.35 293.61 306.76 329.22 357.99 371.81 (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 m ² Flux g g	(71)m=	-59.55	-59.55	-59.55		-59.55	-59.55		59.55	-59.55	-59	.55	-59.55	-59.	55	-59.55	-59	.55		(71)				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Water	heating	gains (T	able 5)			_											1					
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$ (73)m= 381.02 376.83 361.85 339.56 317.47 297.59 286.35 293.61 306.76 329.22 353.79 371.81 (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 Orientation: Access Factor Area Flux g_ FF Gains (W) Southeast $0.9x$ 0.77 x 1.93 x 37.39 x 0.76 x 0.7 = 90.7 (77) Southeast $0.9x$ 0.77 x 1.93 x 84.22 x 0.76 x 0.7 = 119.85 (77) Southeast $0.9x$ 0.77 x 1.93 x 103.49 x	(72)m=	67.3	65.1	61.08		55.79	52.18		47.3	43.59	48.	85	51.05	56.	5	62.6	65.	.61		(72)				
(73)m= 381.02 376.83 361.85 339.56 317.47 297.59 286.35 293.61 306.76 329.22 353.79 371.81 (73) 6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Area Flux g_ FF Gains Orientation: Access Factor Table 6d Area Flux g_ Table 6b Table 6c (W) Southeast 0.9x 0.77 x 1.93 x 37.39 x 0.76 x 0.7 = 53.21 (77) Southeast 0.9x 0.77 x 1.93 x 37.39 x 0.76 x 0.7 = 53.21 (77) Southeast 0.9x 0.77 x 1.93 x 63.74 x 0.76 x 0.7 = 119.85 (77) Southeast 0.9x 0.77 x 1.93 x 103.49 x 0.76 x 0.7 = 147.27 (77) Southeast 0.9x 0.77 x 1.93 x </td <td>Total i</td> <td>nternal</td> <td>gains =</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>(66)</td> <td>m + (67)m</td> <td>n + (68</td> <td>3)m +</td> <td>- (69)m + (</td> <td>70)m</td> <td>+ (7</td> <td>'1)m + (72)</td> <td>m</td> <td></td> <td></td> <td></td>	Total i	nternal	gains =						(66)	m + (67)m	n + (68	3)m +	- (69)m + (70)m	+ (7	'1)m + (72)	m							
6. Solar gains:Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.Orientation:Access Factor Table 6dArea m²Flux Table 6a g_{-} Table 6bFF Table 6cGains (W)Southeast 0.9x0.77×1.93×37.39×0.76×0.77=53.21(77)Southeast 0.9x0.77×1.93×63.74×0.76×0.77=90.7(77)Southeast 0.9x0.77×1.93×84.22×0.76×0.77=119.85(77)Southeast 0.9x0.77×1.93×103.49×0.76×0.77=147.27(77)Southeast 0.9x0.77×1.93×113.34×0.76×0.77=161.29(77)Southeast 0.9x0.77×1.93×115.04×0.76×0.77=163.72(77)	(73)m=	381.02	376.83	361.85	;	339.56	317.47	2	97.59	286.35	293	.61	306.76	329.	22	353.79	371	.81		(73)				
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.Orientation:Access Factor Table 6dArea m²Flux Table 6a g_{-} Table 6bFF Table 6bGains (W)Southeast 0.9x0.77x1.93x37.39x0.76x0.7=53.21(77)Southeast 0.9x0.77x1.93x63.74x0.76x0.7=90.7(77)Southeast 0.9x0.77x1.93x84.22x0.76x0.7=119.85(77)Southeast 0.9x0.77x1.93x103.49x0.76x0.7=147.27(77)Southeast 0.9x0.77x1.93x113.34x0.76x0.7=161.29(77)Southeast 0.9x0.77x1.93x115.04x0.76x0.7=163.72(77)	6. Sol	lar gains	8:																					
Orientation:Access Factor Table 6dArea m²Flux Table 6a g_{-} Table 6bFF Table 6cGains (W)Southeast $_{0.9x}$ 0.77 x 1.93 x 37.39 x 0.76 x 0.7 = 53.21 (77) Southeast $_{0.9x}$ 0.77 x 1.93 x 63.74 x 0.76 x 0.7 = 90.7 (77) Southeast $_{0.9x}$ 0.77 x 1.93 x 63.74 x 0.76 x 0.7 = 90.7 (77) Southeast $_{0.9x}$ 0.77 x 1.93 x 84.22 x 0.76 x 0.7 = 119.85 (77) Southeast $_{0.9x}$ 0.77 x 1.93 x 103.49 x 0.76 x 0.7 = 147.27 (77) Southeast $_{0.9x}$ 0.77 x 1.93 x 113.34 x 0.76 x 0.7 = 161.29 (77) Southeast $_{0.9x}$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Solar g	ains are o	alculated	using so	lar	flux from	Table 6a	and	assoc	iated equa	tions	to co	nvert to th	e appl	icat	ole orientat	ion.		. .					
Southeast $0.9x$ 0.77 x 1.93 x 37.39 x 0.76 x 0.7 = 53.21 (77) Southeast $0.9x$ 0.77 x 1.93 x 63.74 x 0.76 x 0.7 = 90.7 (77) Southeast $0.9x$ 0.77 x 1.93 x 84.22 x 0.76 x 0.7 = 119.85 (77) Southeast $0.9x$ 0.77 x 1.93 x 103.49 x 0.76 x 0.7 = 147.27 (77) Southeast $0.9x$ 0.77 x 1.93 x 113.34 x 0.76 x 0.7 = 161.29 (77) Southeast $0.9x$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Orienta	ation: A	Access F Fable 6d	actor		Area m²			Flu Tal	x ble 6a		Т	g_ able 6b		Т	FF able 6c			Gains (W)					
Southeast $0.9x$ 0.77 x 1.93 x 63.74 x 0.76 x 0.7 = 90.7 (77) Southeast $0.9x$ 0.77 x 1.93 x 84.22 x 0.76 x 0.7 = 119.85 (77) Southeast $0.9x$ 0.77 x 1.93 x 103.49 x 0.76 x 0.7 = 147.27 (77) Southeast $0.9x$ 0.77 x 1.93 x 113.34 x 0.76 x 0.7 = 161.29 (77) Southeast $0.9x$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	3	37.39	x		0.76	X	Γ	0.7		=	53.21	(77)				
Southeast $0.9x$ 0.77 x 1.93 x 84.22 x 0.76 x 0.7 = 119.85 (77) Southeast $0.9x$ 0.77 x 1.93 x 103.49 x 0.76 x 0.7 = 147.27 (77) Southeast $0.9x$ 0.77 x 1.93 x 113.34 x 0.76 x 0.7 = 161.29 (77) Southeast $0.9x$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	6	63.74	x		0.76	×	Γ	0.7		=	90.7	(77)				
Southeast $0.9x$ 0.77 x 1.93 x 103.49 x 0.76 x 0.7 = 147.27 (77) Southeast $0.9x$ 0.77 x 1.93 x 113.34 x 0.76 x 0.7 = 161.29 (77) Southeast $0.9x$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	8	34.22	×		0.76	۲ × آ	Ē	0.7		=	119.85	(77)				
Southeast $0.9x$ 0.77 x 1.93 x 113.34 x 0.76 x 0.7 = 161.29 (77) Southeast $0.9x$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	1	03.49	x		0.76	۲ ×	F	0.7		=	147.27	(77)				
Southeast $0.9x$ 0.77 x 1.93 x 115.04 x 0.76 x 0.7 = 163.72 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	1	13.34	×		0.76	۲×	F	0.7	╡	=	161.29	(77)				
	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	1	15.04	×		0.76	۲, ۲	F	0.7		=	163.72	-](77)				
Southeast 0.9x 0.77 x 1.93 x 112.79 x 0.76 x 0.7 = 160.51 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	1	12.79	×		0.76	۲, ۲	F	0.7	=	=	160.51	- (77)				
Southeast 0.9x 0.77 x 1.93 x 105.34 x 0.76 x 0.7 = 149.91 (77)	Southea	ast <mark>0.9x</mark>	0.77		x	1.9	3	x	1	05.34	×		0.76	۲ ×	F	0.7	=	=	149.91	(77)				

Southea	ast <mark>0.9x</mark>	0.77	;	•	1.9	3	x	9	92.9	x		0.76	x	0.7	-	- [132.2	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	(1.9	3	x	7	2.36	x		0.76	×	0.7	— .	- [102.98	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	(1.9	3	x	4	4.83	x		0.76	×	0.7	— .	- [63.79	(77)
Southea	ast <mark>0.9x</mark>	0.77	;	•	1.9	3	x	3	31.95	x		0.76	×	0.7	-	- [45.47	(77)
Northwe	est <mark>0.9x</mark>	0.77	;	(1.6	5	x	1	1.51	x		0.63	×	0.7	-	- [5.8	(81)
Northwe	est <mark>0.9x</mark>	0.77	3	(1.7	4	x	1	1.51	x		0.63	×	0.7		- [6.12	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.6	5	x	2	23.55	x		0.63	×	0.7	-	- [11.88	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.7	4	x	2	23.55	x		0.63	×	0.7	-	- [12.53	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	•	1.6	5	x	4	1.13	x		0.63	x	0.7		- [20.74	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.7	4	x	4	1.13	x		0.63	×	0.7	-	- [21.87	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.6	5	x		67.8	x		0.63	x	0.7		- [34.19	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.7	4	x		67.8	x		0.63	×	0.7		- [36.05	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.6	5	x	8	89.77	x		0.63	×	0.7	-	- [45.27	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.7	4	x	8	39.77	x		0.63	×	0.7	-	- [47.73	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	•	1.6	5	x		97.5	x		0.63	×	0.7	:	= [49.17	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.7	4	x		97.5	x		0.63	×	0.7	-	- [51.85	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.6	5	x	9	2.98	x		0.63	×	0.7	-	- [46.89	(81)
Northwe	est <mark>0.9x</mark>	0.77	3	•	1.7	4	x	g	2.98	x		0.63	×	0.7	-	- [49.44	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.6	5	x	7	75.42	x		0.63	×	0.7	-	- [38.03	(81)
Northwe	est <mark>0.9x</mark>	0.77	;	•	1.7	4	x	7	75.42	x		0.63	×	0.7	-	- [40.1	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	•	1.6	5	x	5	51.24	x		0.63	×	0.7	:	- [25.84	(81)
Northwe	est <mark>0.9x</mark>	0.77	,	(1.7	4	x	5	51.24	x		0.63	×	0.7	-	- [27.25	(81)
Northwe	est <mark>0.9x</mark>	0.77	3	•	1.6	5	x	:	29.6	x		0.63	×	0.7	=	= [14.93	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	•	1.7	4	x	:	29.6	x		0.63	×	0.7	:	- [15.74	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	•	1.6	5	x	1	4.52	x		0.63	×	0.7	-	- [7.32	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	•	1.7	4	x	1	4.52	x		0.63	x	0.7	-	= [7.72	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	(1.6	5	x		9.36	x		0.63	×	0.7	-	- [4.72	(81)
Northwe	est <mark>0.9x</mark>	0.77	2	(1.7	4	x		9.36	x		0.63	x	0.7	-	= [4.98	(81)
Solar g	ains in	watts, ca	alculate	d	for each	n mont	h L			(83)m	1 = SI	um(74)m	.(82)m			_		(00)
(83)m=	65.13	115.1	162.46		$\frac{217.51}{(94)m}$	254.29	$\frac{1}{2}$	64.73	256.84	228	.04	185.29	133.6	4 78.84	55.17	^		(83)
(84)m-	ans – n			T	(04)III =	571 76	+ (62 22	, waits	521	65	402.06	162.9	6 422.62	426.0	。		(84)
(04)111=	440.15	491.95	524.5	1	557.07	571.70	13	02.32	545.19	521	.05	492.00	402.0	432.03	420.9	0		(04)
7. Me	an inter	nal temp	perature) (heating	seaso	n)		(- 1- 0	The	4 (90)				Г		
I emp	erature	auring r	eating	pe	erioas in		'ing	area	from Tar	ole 9	, in [.]	1 (°C)					21	(85)
Utilisa	ation fac	tor for g	ains for	T	ving are	a, h1,r	n (s . T		ible 9a)			Con	0.00	Nev				
(86)m-	Jan			╉	Apr	0.76			Jui		ug 1	5ep				C		(86)
	0.93	0.91	0.00	1	0.04			0.04				0.71	0.04	0.91	0.93			(00)
Mean	interna	l temper	ature ir	n li	ving are	ea T1 (follo	w ste	ps 3 to 7	7 in T		e 9c)	40.45	40.04	4	$\overline{}$		(07)
(87)m=	17.6	17.9	18.45		19.1	19.87		20.44	20.78	20.	(1	20.29	19.42	18.34	17.72	<u> </u>		(07)
Temp	erature	during h	eating	pe	eriods in	rest o	f dw	elling	from Ta	able 9	9, Tł	n2 (°C)				_		1
(88)m=	19.25	19.28	19.28	1	19.33	19.37	1	9.38	19.4	19	.4	19.36	19.33	19.31	19.28	3		(88)

Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.91	0.89	0.86	0.8	0.7	0.54	0.34	0.35	0.61	0.8	0.89	0.91		(89)
Mean	n interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.32	16.64	17.18	17.83	18.57	19.08	19.33	19.33	18.95	18.16	17.1	16.46		(90)
				-					f	iLA = Livin	g area ÷ (4	4) =	0.46	(91)
Mear	n interna	l temper	ature (fo	or the wh	ole dwe	llina) = f	LA x T1	+ (1 – fL	A) × T2					_
(92)m=	16.91	17.22	17.77	18.42	19.17	19.71	20	20	, 19.57	18.74	17.67	17.04		(92)
Apply	/ adjustr	nent to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	16.91	17.22	17.77	18.42	19.17	19.71	20	20	19.57	18.74	17.67	17.04		(93)
8. Sp	ace hea	ting req	uiremen	t										
Set T	i to the i	mean int	ternal te	mperatu	re obtair	ned at st	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	tilisation	factor fo	or gains	using Ta	able 9a					-		_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	1: 1 o 70	0.00	0.57	0.44	0.40	0.00	0.70	0.00			(04)
(94)m=	0.89	0.87	0.83	0.78	0.69	0.57	0.41	0.42	0.63	0.78	0.86	0.89		(94)
Useru	JI gains,	nmGm	, VV = (9)	4)m x (8-	4)m	219.61	001.00	249.59	200 72	250.49	272.47	270.64		(05)
(95)m=	395.71	420.00	435.40	435.06	395.40	able 9	221.02	216.56	308.73	339.46	373.17	379.01		(33)
	niy aver						16.0	16.0	14.2	10.9	7	4.0		(96)
Heat	loss rate	for me	an interr			lm W -	-[(30)m	v [(93)m	- (96)m	1	1	4.9		(00)
(97)m=	1143 39	1101.3	988 14	839.67	629.18	425.31	255 23	254 61	446.55	686.33	941 29	1093 77		(97)
Snac	e heatin	a requir	ement fo	r each n	$\int \frac{d^2 - d^2}{d^2 - d^2} d^2 d^2$	Wh/mon	$\frac{1}{1} = 0.02$	24 x [(97))m – (95)ml x (4	1)m	1000.11		()
(98)m=	556.28	453.9	411.19	291.3	173.89					243.18	409.05	531.34		
		Į	ļ	I	Į	I		I Tota	l per vear	l (kWh/veai	.) = Sum(9	8)1.59.12 =	3070.13	(98)
Snoo	o hootin	a roquir	omont in	k\//b/m	Woor					(,(-	- ,	74.07	
Spac	eneaun	g require	ementin		year							l	/1.3/	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	ı micro-C	CHP)					
Spac	e heatii	1g:	t from a	ooondor	v/ounnio	montor	watam					1		
	. ,				y/supple	ementary	system	(000) 4	(204)				0	
Fract	ion of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ting syste	em 1								92.6	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac	e heatin	g require	ement (c	alculate	d above)		<u> </u>	· ·				,	
	556.28	453.9	411.19	291.3	173.89	0	0	0	0	243.18	409.05	531.34		
(211)n	n = {[(98)m x (20)4)] + (2′	10)m } x	100 ÷ (2	206)	•							(211)
()	600.73	490.17	444.05	314.58	187.79	0	0	0	0	262.61	441.74	573.8		
		ļ	ļ	1	ļ	I		Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}		3315.47	(211)
Spac	e heatin	a fuel (s	econdar	v). kWh/	month							l		
= {[(98	s)m x (20)1)] + (2	14) m } ;	x 100 ÷ (208)									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
			•	•		•	•	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)

Water heating

Output	from w	ater hea	ter (calc	ulated a	oove)			_					-	
	160.77	140.43	146.11	129.59	125.46	110.5	105.86	5 118.01	119.32	135.87	145.04	156.99		_
Efficier	ncy of w	ater hea	iter										79.5	(216)
(217)m=	87.12	86.99	86.71	86.23	85.07	79.5	79.5	79.5	79.5	85.7	86.72	87.08		(217)
Fuel fo	or water (64)	heating, m x 100	kWh/mo (217) ∸ (217)	onth m										
(219)m=	184.54	161.44	168.5	150.29	147.48	138.99	133.15	5 148.44	150.08	158.55	167.26	180.29]	
								Tota	al = Sum(2	19a) ₁₁₂ =	_		1889.01	(219)
Annual totals kWh/year											kWh/year	-		
Space	heating	fuel use	ed, main	system	1								3315.47]
Water	heating	fuel use	d										1889.01	
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatin	g pump	:									130		(230c)
boiler with a fan-assisted flue											45]	(230e)	
Total electricity for the above, kWh/year sum of (230a)(230g) =									175	(231)				
Electric	city for li	ghting											252.15	(232)
10a. I	- uel cos	ts - indiv	vidual he	ating sy	stems:									_
						Fu kW	el /h/yea	r		Fuel P (Table	Price 12)		Fuel Cost £/year	
Space	heating	- main s	system 1			(21	1) x			3.	1	x 0.01 =	102.7797	(240)
Space	heating	- main s	system 2	2		(21:	3) x			0)	x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			0)	x 0.01 =	0	(242)
Water	heating	cost (otl	her fuel)			(219	9)			3.	1	x 0.01 =	58.56	(247)
Pumps, fans and electric keep-hot						(23	1)			11.	46	x 0.01 =	20.06	(249)
(if off-p Energy	eak tari / for ligh	ff, list ea ting	ach of (2	30a) to (230g) se	eparately (232	/ as ap ²⁾	plicable a	and apply	y fuel pri	<u>ce acco</u> i 46	rding to x 0.01 =	Table 12a 28.9	(250)
Additio	nal star	iding cha	arges (T	able 12)									106	(251)
Annon	div O ita	ma: ran	oot linoo	(252) 0	ad (251)	00 000	dod							-
Total	energ	y cost	eatimes	(200) al	(245)(247) + (25	50)(254	4) =					316.2903	(255)
11a. S	SAP rati	ng - indi	vidual he	eating sy	vstems									-
Enera	/ cost de	eflator (T	able 12										0.47	1 (256)
Energy	/ cost fa	ctor (EC	:F)		[(255) x	(256)] ÷ [((4) + 45.0	D] =					1 6889	(257)
SAP ra	ating (S	ection 1	2)										76.4399	(258)
12a. (CO2 em	issions -	– Individ	ual heati	ng syste	ms inclu	uding n	nicro-CHF	C					-4
	Energy Emission factor kWh/year kg CO2/kWh								Emissions kg CO2/yea	ır				
Space	heating	(main s	ystem 1))		(21	1) x			0.1	98	=	656.46	(261)

Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	374.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =	=		1030.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	130.36	(268)
Total CO2, kg/year	SL	ım of (265)(271) =		1251.32	(272)
CO2 emissions per m ²	(2	72) ÷ (4) =		29.09	(273)
El rating (section 14)				81	(274)
13a. Primary Energy					
	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	Energy kWh/year (211) x	Primary factor	=	P. Energy kWh/year 3381.78	(261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Primary factor 1.02 0	=	P. Energy kWh/year 3381.78	(261)
Space heating (main system 1) Space heating (secondary) Energy for water heating	Energy kWh/year (211) x (215) x (219) x	Primary factor 1.02 0 1.02	= =	P. Energy kWh/year 3381.78 0 1926.79)(261))(263))(264)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (219) x (261) + (262) + (263) + (264) =	Primary factor 1.02 0 1.02	= =	P. Energy kWh/year 3381.78 0 1926.79 5308.57)(261) (263) (264) (265)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x	Primary factor 1.02 0 1.02	= = =	P. Energy kWh/year 3381.78 0 1926.79 5308.57 511	(261) (263) (264) (265) (267)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	Primary factor 1.02 0 1.02 2.92 0	-	P. Energy kWh/year 3381.78 0 1926.79 5308.57 511 736.27	(261) (263) (264) (265) (267) (268)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting 'Total Primary Energy	Energy kWh/year (211) x (215) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x Su	Primary factor 1.02 0 1.02 2.92 0 um of (265)(271) =	-	P. Energy kWh/year 3381.78 0 1926.79 5308.57 511 736.27 6555.85	(261) (263) (264) (265) (267) (268) (272)

User Details:															
Assessor Name: Software Name:	Test User Stroma FSAP 2009	Stroma Number: STRC Software Version: Versio)000000 on: 1.5.0.74								
		Proper	ty Address	First flo	or existi	ng									
Address :															
1. Overall dwelling dimer	nsions:														
Ground floor		A	rea(m²) 43.02	(1a) x	Ave He	i ght(m) 67	(2a) =	Volume(m ³) 157.88	(3a)						
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)	+(1n)	43.02	(4)											
Dwelling volume				(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	157.88	(5)						
2. Ventilation rate:		_			_										
	main Se heating he	econdary eating	other		total			m ³ per hour	•						
Number of chimneys		0 +	0] = [0	x 4	40 =	0	(6a)						
Number of open flues	0 +	0 +	0] = [0	x2	20 =	0	(6b)						
Number of intermittent fan	s				2	x ^	10 =	20	(7a)						
Number of passive vents					0	x ^	10 =	0	(7b)						
Number of flueless gas fire	es			Г	0	x 4	40 =	0	(7c)						
				L					_]						
							Air ch	anges per ho	ur						
Infiltration due to chimney	s, flues and fans = $(6a)$)+(6b)+(7a)+(7t	o)+(7c) =		20		÷ (5) =	0.13	(8)						
It a pressurisation test has be Number of storeys in the	en carried out or is intended a dwalling (ns)	a, proceed to (1	7), otnerwise (continue fro	om (9) to (16)		0							
Additional infiltration	o awoning (no)					[(9)-	-1]x0.1 =	0	(10)						
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									(11)						
if both types of wall are pre deducting areas of opening	esent, use the value corresp gs); if equal user 0.35	oonding to the g	reater wall are	a (after					_						
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0								0	(12)						
If no draught lobby, ente	er 0.05, else enter 0							0	(13)						
Percentage of windows and doors draught stripped								0	(14)						
Window infiltration	(8) + (10)	x (14) ÷ 1	0	(15)											
Inflitration rate $(8) + (10) + (11) + (12) + (13) + (15) =$								0	(16)						
An permeability value, goo, expressed in cubic metres per nour per square metre or envelope area If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ otherwise $(18) = (16)$								10	(17)						
Air permeability value applies	if a pressurisation test has	been done or a	degree air pe	rmeability i	is being us	sed		0.03							
Number of sides on which	sheltered		0,		0			0	(19)						
Shelter factor	(20) = 1 -	[0.075 x (1	1	(20)											
Infiltration rate incorporation	(21) = (18) x (20) =	0.63	(21)											
Infiltration rate modified fo	r monthly wind speed														
Jan Feb M	Mar Apr May	Jun Ju	I Aug	Sep	Oct	Nov	Dec								
Monthly average wind spe	ed from Table 7														
(22)m= 5.4 5.1 5	5.1 4.5 4.1	3.9 3.7	3.7	4.2	4.5	4.8	5.1								
Wind Factor (22a)m = (22)m ÷ 4														
(22a)m= 1.35 1.27 1	.27 1.12 1.02	0.98 0.9	2 0.92	1.05	1.12	1.2	1.27								
Adjust	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m				_		
------------------------	-------------------------	-------------------------	---------------------------	---------------------------	--------------------------	------------------------	------------------	----------------	---------------------------	---------------	-------------	---------------------	--------	-------	-------
	0.85	0.8	0.8	0.7	0.64	0.61	0.58	0.58	0.66	0.7	0.75	0.8			
Calcul	ate ettec	ctive air	change i tion:	rate for t	he appli	cable ca	se								
lf exh	aust air he		using Appe	ndix N (2	¹ 3h) - (23a	a) x Emv (e	equation (I	N5)) othe	rwise (23h) – (23a)				0	
lf bal	anced with	heat reco	werv: effici	iency in %	allowing f	for in-use f	actor (fron	n Table 4b) –) = (20u)				0	
a) If	halance	d mach	anical ve		with he	at recove			y = (2)	2b)m ± (23P) ^ [1 _ (23c)	· 1001	0	(230)
(24a)m=				0								$\frac{1-(200)}{0}$	 		(24a)
(,)	halance	d mech	anical ve	ntilation	without	heat rec		1 MV/) (24h	$\int_{-\infty}^{\infty}$	$\frac{1}{2}$	23h)	ů	J		. ,
(24b)m=	0			0					0		0	0	1		(24b)
c) If	whole h		tract ven	tilation	n nositiv		Ventilatio	n from c					J		
0) 11	if (22b)n	י < 0.5 א ו < 0.5 א	(23b), t	hen (24	c) = (23b	b); other	vise (24	c) = (22k	o) m + 0.	.5 × (23b))				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural	ventilatio	on or wh	ole hous	se positiv	ve input	ventilatio	on from l	oft				1		
	if (22b)n	n = 1, th	en (24d)	m = (22l	b)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]					
(24d)m=	0.86	0.82	0.82	0.75	0.71	0.69	0.67	0.67	0.72	0.75	0.78	0.82	J		(24d)
Effe	ctive air	change	rate - en	ter (24a) or (24b	o) or (24	c) or (24	ld) in boy	(25)						
(25)m=	0.86	0.82	0.82	0.75	0.71	0.69	0.67	0.67	0.72	0.75	0.78	0.82			(25)
3. He	at losse	s and he	eat loss p	paramet	er:										
ELEN	IENT	Gros	SS	Openin	igs	Net Ar	ea	U-valu	Je	AXU		k-value	e	A)	Xk
		area	(m²)	rr	²	A ,r	m²	W/m2	K,	(W/I	K)	kJ/m²∙l	K	kJ/	/K
Windo	ws Type	e 1				1.93	x1	/[1/(1.6)+	0.04] =	2.9					(27)
Windo	ws Type	2				1.65	x1	/[1/(1.6)+	0.04] =	2.48					(27)
Windo	ws Type	93				1.74	x1	/[1/(1.6)+	0.04] =	2.62					(27)
Walls -	Type1	79.4	ł6	7.25	5	72.21	I X	0.28	=	20.22					(29)
Walls	Type2	10.9	96	0		10.96	3 <mark>х</mark>	0.22	=	2.45					(29)
Walls 7	Туре3	12.3	32	0		12.32	<u>2</u> X	0.22	=	2.76					(29)
Total a	rea of e	lements	, m²			102.74	42								(31)
* for win ** inclua	dows and le the area	roof wind as on both	ows, use e sides of in	ffective wi ternal wal	indow U-va Is and par	alue calcul titions	lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	n 3.2		
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				3	6.33	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	105	6.619	(34)
Therm	al mass	parame	ter (TMF	P = Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Low			100	(35)
For desi	ign assess	ments wh	ere the de	tails of the	construct	ion are no	t known pi	recisely the	e indicative	values of	TMP in T	able 1f			
Thorm	al bridae	ad or a de	talled calct	ulation. culated i	usina Ar	nondiv l	K								
if details	of therma	bridaina	are not kn	own (36) =	= 0 15 x (3		IX .						1	5.41	(30)
Total f	abric he	at loss	are not nit	0007-	- 0.70 x (0	"			(33) +	(36) =			5	1.74	(37)
Ventila	tion hea	at loss ca	alculated	monthl	у				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	44.7	42.68	42.68	39	36.8	35.78	34.8	34.8	37.33	39	40.78	42.68			(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		-		
(39)m=	96.44	94.42	94.42	90.74	88.54	87.52	86.54	86.54	89.07	90.74	92.52	94.42			
					•			•		Average =	Sum(39)	12 /12=	9	0.99	(39)

Heat lo	oss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	2.24	2.19	2.19	2.11	2.06	2.03	2.01	2.01	2.07	2.11	2.15	2.19		
Numbe	er of dav	vs in mo	nth (Tab	le 1a)				-		Average =	Sum(40)₁.	₁₂ /12=	2.12	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
							•	•		•				
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13. A £ 13.	upancy, 9, N = 1 9 N = 1	N + 1.76 x	(1 - exp	0(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13.	1. 9)	49		(42)
Annua Reduce not more	l averag the annua	ge hot wa al average 5 litres per	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is not and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	73 f	.22		(43)
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Αυα	Sep	Oct	Nov	Dec		
Hot wate	er usage i	in litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					I	
(44)m=	80.54	77.61	74.68	71.75	68.82	65.9	65.9	68.82	71.75	74.68	77.61	80.54		
_										Total = Su	m(44) ₁₁₂ =		878.61	(44)
Energy	content of	hot water	used - ca	Iculated m	$\frac{1}{2}$	190 x Vd,r	m x nm x L	JTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	l	
(45)m=	119.72	104.71	108.05	94.2	90.39	78	72.28	82.94	83.93	97.81	106.77	115.95	1154 76	(45)
lf instan	taneous v	vater heati	ing at poin	t of use (no	o hot water	· storage),	enter 0 in	boxes (46) to (61)	10181 = 50	III(43) ₁₁₂ =	-	1154.70	
(46)m=	17.96	15.71	16.21	14.13	13.56	11.7	10.84	12.44	12.59	14.67	16.02	17.39		(46)
Water	storage	loss:	-				(de).	-		-			I	
a) II ma	anulacii vroturo f	urer s de	m Tabla		or is know	vn (kvvn	/day):					0		(47)
Energy	/ lost fro	acior nu m water	r storage	; 20 a k\Mh/vi	oar			(47) x (48) –			0		(40)
If man	ufacture	er's decla	ared cyli	nder loss	s factor is	s not kno	own:	(+7) × (+0)	, –			0		(49)
Cylind	er volun	ne (litres) includi	ng any s	olar stor	age with	nin same	;			1:	50		(50)
If con	nmunity h	eating and	l no tank ir	n dwelling,	enter 110	litres in bo	ox (50)	antor 101 in	hay (EQ)					
	tor ctor		factor f	rom Tab		b/litro/dc		enter 0 m	DOX (50)				l	(54)
Volum	e factor	from To				n/nue/ua	ay)				0.	02		(51)
Tempe	erature f	actor fro	om Table	2b							0.	93 .6		(52)
Energy	/ lost fro	om watei	r storage	e, kWh/y	ear			((50) x (51	l) x (52) x	(53) =	1	.6		(54)
Enter (49) or (54) in (5	5)								1	.6		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	49.48	44.69	49.48	47.88	49.48	47.88	49.48	49.48	47.88	49.48	47.88	49.48		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	49.48	44.69	49.48	47.88	49.48	47.88	49.48	49.48	47.88	49.48	47.88	49.48		(57)
Primar	y circuit	t loss (ar	nnual) fro	om Table	e 3						6	10		(58)
Primar	y circuit	t loss cal	Iculated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(moo		/ tactor f	rom Tab	10 H5 If 1		50 14	er heati	ng and a			stat)	51 91		(59)
(33)11=		1 -0.79	<u> </u>	J4		(00)		1 31.01	50.14	51.01	50.14	51.01		(00)
Combi	loss ca	iculated	tor each	month	(61)m =	(60) ÷ 30	65 × (41)m			0	0		(61)
(o))m=	U	0	0	0	0	U	U	U	U	U	U	U		(01)

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Total h	eat requ	uired for	water h	nea	ating ca	alculate	d fo	r eac	h month	(62)	m =	0.85 × (45)m	ו +	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	221.01	196.19	209.34		192.22	191.67	1	76.02	173.56	184	.22	181.95	199	.1	204.79	217	.23		(62)
Solar Di	-IW input of	calculated	using Ap	per	ndix G or	Appendi	хH	(negati [,]	ve quantity	/) (en	ter '0'	if no solar	r contr	ibut	ion to wate	er hea	iting)		
(add a	dditiona	l lines if	FGHR	S a	and/or V	VWHR	S ap	oplies	, see Ap	pend	dix G	G)							
(63)m=	0	0	0		0	0		0	0	C)	0	0		0	C)		(63)
Output	from w	ater hea	ter				-				-				-				
(64)m=	221.01	196.19	209.34		192.22	191.67	1	76.02	173.56	184	.22	181.95	199	.1	204.79	217	.23		
											Outp	ut from wa	ater he	eate	r (annual)	12		2347.3	(64)
Heat g	ains fro	m water	heating	j, k	kWh/mo	onth 0.2	25 x	[0.85	x (45)m	n + (6	61)m	n] + 0.8 x	k [(46	6)m	+ (57)m	+ (5	59)m	n]	
(65)m=	120.84	108	116.95	Τ	109.74	111.08	1	04.35	105.06	108	3.6	106.32	113.	55	113.91	119	.58		(65)
inclu	ide (57)	m in calc	ulation	of	f (65)m	only if	cylii	nder i	s in the c	dwell	ling	or hot wa	ater i	s fi	rom com	mun	ity h	leating	
5. Int	ternal da	ains (see	Table	5 a	and 5a):	•				-							-	
Motab	olic gain	s (Tablo	5) Wa	otte															
Metab	Jan	Feb	Mar		Apr	Mav	Τ	Jun	Jul	A	ua	Sep	0	ct	Nov	D	ec		
(66)m=	89.32	89.32	89.32	╈	89.32	89.32	ξ	9.32	89.32	89.	32	89.32	89.3	32	89.32	89.	32		(66)
Liahtin	a gains	(calculat	L ted in A		oendix l	equa	tion	190	rl9a)a	lso s		Table 5							
(67)m=	35.69	31.7	25.78	T	19.52	14.59		2.32	13.31	17	.3	23.22	29.4	19	34.41	36.	69		(67)
Annlia		ins (calc	ulated i	in /	Annenc		1	tion	13 or 1 1	((2)	ا معاد	see Tal	hle 5						
(68)m=	192 83	194.83	189 79	T	179.05	165.5		52 77	144 26	142	26	147.3	158	04	171 59	184	.32	l	(68)
Cookir					nondiv		'	1 1 5	or 1 150				5	04	171.00	104	.02		()
(60)m-				- T		L, equa			01 L 15a)	, ais	10 SE		5	12	45.42	45	12		(69)
(09)III=	40.42	43.42	(Table		43.42	43.42		5.42	40.42	45.	42	43.42	40.4	+2	43.42	45.	42		(00)
Pumps		ns gains		58 T	a) 10	10	—	10	10	4		10	40		10	4	0	I	(70)
(70)m=	10	10	10		10	10	<u> </u>	-	10		0	10		,	10		0		(70)
Losses	s e.g. ev	aporatio	n (nega	ativ	ve valu	es) (Tal		5)	50.55		1				50.55			I	(74)
(71)m=	-59.55	-59.55	-59.55		-59.55	-59.55		59.55	-59.55	-59	.55	-59.55	-59.	55	-59.55	-59	.55		(71)
Water	heating	gains (T	able 5)	·			-								r –			1	
(72)m=	162.41	160.72	157.2		152.41	149.3	1	44.93	141.21	145	.97	147.67	152.	62	158.21	160	.72		(72)
Total i	nternal	gains =					_	(66)	m + (67)m	1 + (68	3)m +	· (69)m + (70)m	+ (7	'1)m + (72)	m		L	
(73)m=	476.13	472.45	457.96		436.18	414.59	3	95.21	383.98	390	.73	403.39	425.	34	449.41	466	.93		(73)
6. So	lar gains	8:																	
Solar g	ains are o	alculated	using sol -	ar f	flux from	Table 6a	and	assoc	iated equa	tions	to co	nvert to th	e appl	licat	ole orientat	ion.			
Orienta	ation: A	Access F Table 6d	actor		Area m²			Flu Tal	x ole 6a		Т	g_ able 6b		Т	FF able 6c			Gains (W)	
Southe	ast <mark>0.9x</mark>	0.77	;	< [1.9	3	x	3	57.39	x		0.76	x	Γ	0.7		=	53.21	(77)
Southe	ast <mark>0.9x</mark>	0.77	,	۰Ī	1.9	3	x	6	3.74	x		0.76	×	Γ	0.7		=	90.7	(77)
Southe	ast <mark>0.9x</mark>	0.77	;	، آ	1.9	3	x	8	4.22	x		0.76	_ x	Γ	0.7		=	119.85	(77)
Southe	ast <mark>0.9x</mark>	0.77	;	۲	1.9	3	x	1	03.49	x		0.76	۲ ×	Ē	0.7	=	=	147.27	(77)
Southe	ast <mark>0.9x</mark>	0.77	;	۰ľ	1.9	3	x	1	13.34	x		0.76	۲ ×	Γ	0.7	╡	=	161.29	(77)
Southe	ast <mark>0.9x</mark>	0.77	;	۰ľ	1.9	3	x	1	15.04	x		0.76	۲ ×	Ē	0.7	╡	=	163.72	- (77)
Southe	ast <mark>0.9x</mark>	0.77	;	۰ľ	1.9	3	x	1	12.79	x		0.76	۲ ×	F	0.7	╡	=	160.51	- (77)
Southo	act o ou [0.77	<u> </u>	ςΓ	1 0	3	x	1	05.34	x		0.76	۲ ×	Ē	0.7		=	149.91	1 (77)

Southe	ast <mark>0.9x</mark>	0.77	x		1.93	x		92.9	x		0.76	x	0.7	=	132.2	(77)
Southe	ast <mark>0.9x</mark>	0.77	x		1.93	T x	7	72.36	x		0.76	x	0.7	=	102.98	3 (77)
Southe	ast <mark>0.9x</mark>	0.77	x		1.93	x	4	14.83	x		0.76	x	0.7	=	63.79	(77)
Southe	ast <mark>0.9x</mark>	0.77	x		1.93	T x	3	31.95] ×		0.76	x	0.7	=	45.47	(77)
Northw	est 0.9x	0.77	x		1.65	T x	1	1.51] ×		0.63	×	0.7	=	5.8	(81)
Northw	est 0.9x	0.77	x		1.74	x	1	1.51	x		0.63	x	0.7	=	6.12	(81)
Northw	est 0.9x	0.77	x		1.65	×	2	23.55	x		0.63	x	0.7	=	11.88	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		1.74	x	2	23.55	x		0.63	x	0.7	=	12.53	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x	4	1.13	x		0.63	x	0.7	=	20.74	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.74	x	4	11.13	x		0.63	x	0.7	=	21.87	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x		67.8	x		0.63	x	0.7	=	34.19	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.74	x		67.8	x		0.63	x	0.7	=	36.05	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x	8	39.77	x		0.63	x	0.7	=	45.27	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.74	x	8	39.77	x		0.63	x	0.7	=	47.73	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x		97.5	x		0.63	x	0.7	=	49.17	(81)
Northw	est <mark>0.9x</mark>	0.77	х		1.74	x		97.5	x		0.63	x	0.7	=	51.85	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x	ę	92.98	x		0.63	x	0.7	=	46.89	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.74	x	ę	92.98	x		0.63	x	0.7	=	49.44	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x	7	75.42	x		0.63	x	0.7	=	38.03	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.74	x	7	75.42	x		0.63	x	0.7	=	40.1	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		1.65	×	5	51.24	x		0.63	×	0.7	=	25.84	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.74	x	5	51.24	x		0.63	x	0.7	=	27.25	(81)
Northw	est <mark>0.9x</mark>	0.77	x		1.65	x		29.6	x		0.63	x	0.7	=	14.93	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		1.74	x		29.6	x		0.63	x	0.7	=	15.74	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		1.65	x	1	4.52	x		0.63	×	0.7	=	7.32	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		1.74	x	1	4.52	x		0.63	x	0.7	=	7.72	(81)
Northwe	est <mark>0.9x</mark>	0.77	X		1.65	x		9.36	x		0.63	x	0.7	=	4.72	(81)
Northwe	est <mark>0.9x</mark>	0.77	х		1.74	×		9.36	x		0.63	x	0.7	=	4.98	(81)
Solar g	ains in	watts, ca	alculate	$\frac{1}{2}$ for e	ach moi	nth	264 72	256.94	(83)m	n = Su	195 20	(82)m	1 70.04	55 17	7	(83)
Total o	ains – i	nternal a	nd sola	r (84)r	1 = (73)	m + 1	(83)m	watts	220	.04	105.29	133.04	+ 70.04	55.17		(00)
(84)m=	541.26	587.55	620.42	653.6	9 668.	88 0	659.94	640.82	618	8.77	588.68	558.98	3 528.25	522.09	1	(84)
7 Me	an inter	nal temr	perature	(heat	na seas	son)		1	1	I	I		-		4	
Temp	erature	durina h	eating r	period	s in the	livina	area	from Tal	ble 9	. Th1	(°C)				21	(85)
Utilisa	ation fac	tor for a	ains for	livina	area. h1	.m (s	see Ta	ble 9a)		,	(-)					`
	Jan	Feb	Mar	Ap	r Ma	ay	Jun	Jul	A	ug	Sep	Oct	Nov	Dec	7	
(86)m=	0.9	0.88	0.85	0.81	0.72	2	0.6	0.46	0.4	47	0.66	0.8	0.88	0.9	1	(86)
Mean	interna	l temper	ature in	livina	area T1	(foll	ow ste	bs 3 to 7	7 in T	Table			-	•	-	
(87)m=	17.71	18	18.54	19.1	7 19.9	3	20.48	20.8	20.	.79	20.35	19.52	18.45	17.83	7	(87)
Tom		u durina h	L Leating :		in rest	 of dv	Nolling	I I from To		<u> </u> а ть	2 (°C)		_ <u>I</u>	1	_	
(88)m=	19.88	19.9	19.9	19.9	5 19.9	7	19.98	19.99	19.	.99	19.96	19.95	19.92	19.9	7	(88)
· · · ·						1	-				-					

Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.89	0.87	0.84	0.78	0.68	0.54	0.37	0.38	0.6	0.77	0.86	0.89		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.89	17.2	17.73	18.37	19.11	19.62	19.89	19.89	19.5	18.71	17.66	17.03		(90)
					•	•			f	LA = Livin	g area ÷ (4	4) =	0.46	(91)
Mear	interna	l temper	ature (fo	or the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) × T2			-		_
(92)m=	17.27	17.57	18.11	18.74	19.49	20.02	20.31	20.31	, 19.89	19.08	18.03	17.4		(92)
Apply	v adjustn	nent to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17.27	17.57	18.11	18.74	19.49	20.02	20.31	20.31	19.89	19.08	18.03	17.4		(93)
8. Sp	ace hea	ting requ	uirement	t	-	-								
Set T	i to the r	nean int	ernal te	mperatu	re obtair	ned at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	tilisation	factor fo	or gains	using Ta	able 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g	ains, hm		0.00	0.54	0.4	0.44	0.0	0.74	0.02			(04)
(94)m=	0.86	0.84	0.8	0.75	0.66	0.54	0.4	0.41	0.6	0.74	0.83	0.86		(94)
Useru	li gains,	nmGm	, VV = (94)	4)m x (84	4)m	250.44	055.07	252.95	250.00	11E 71	420.00	450.00		(05)
(95)m=	400.3	493.07	496.94	492.85	444.79	359.44	200.27	252.65	352.33	415.71	439.99	450.29		(33)
(96)m-							16.9	16.9	14.3	10.8	7	49		(96)
Heat	loss rate	for me	o.o			m W	-[(30)m	v [(93)m	- (96)m	10.0	,	4.5		(00)
(97)m=	1231.32	1186.67	1067.62	911.27	689.35	474.46	295.45	294.84	497.79	J 751.49	1020.22	1179.92		(97)
Spac	e heatin	a require	ement fo	r each n	nonth k	Nh/mon	h = 0.02	24 x [(97))m – (95)ml x (4'	1)m			(-)
(98)m=	569.17	465.7	423.1	301.26	181.95	0	0	0	0	249.82	417.76	542.84		
			l	ļ	Į	Į		Tota	l per year	(kWh/year) = Sum(9	8) _{15.912} =	3151.61	(98)
Snac	o hoatin	a roquir	omont in	k\//b/m2	Woor				1.5.7.5.		, (- ,	70.00	
Spac	eneaun	y require			year							l	73.26	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	HP)					
Spac	e heatir	ng:	t from o	aaandar	vlounnio	montory	avetam					Г		
	ion or sp	ace nea		econuar	y/supple	mentary	System	(202) 1	(004)			ļ	0	
Fract	ion of sp	ace nea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =	·		ļ	1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 – ((203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								78.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g system	ז, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	_ ar
Spac	e heatin	g require	ement (c	alculate	d above)							,	
	569.17	465.7	423.1	301.26	181.95	0	0	0	0	249.82	417.76	542.84		
(211)n	า = {[(98)m x (20	4)] + (2´	10)m } x	100 ÷ (2	206)								(211)
()	721.39	590.24	536.25	381.82	230.61	0	0	0	0	316.63	529.49	688.01		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	3994.43	(211)
Space	e heatin	a fuel (s	econdar	v). kWh/	month							L		^
= {[(98)m x (20)1)] + (2 ⁻	14) m } >	< 100 ÷ (208)									
(215)m=	0	0	0		, 0	0	0	0	0	0	0	0		
· ·			-	ľ	Ĭ	l v	v v		0	0	0	· ·		

Water heating

Output	from w	ater hea	ter (calc	ulated a	oove)								-	
	221.01	196.19	209.34	192.22	191.67	176.02	173.56	184.22	181.95	199.1	204.79	217.23		-
Efficie	ncy of w	ater hea	iter										68.8	(216)
(217)m=	75.79	75.61	75.24	74.63	73.37	68.8	68.8	68.8	68.8	74.08	75.27	75.72		(217)
Fuel fc (219)m	or water n = (64)	heating, m x 100	kWh/mo (217) – (2	onth Im										
(219)m=	291.61	259.48	278.21	257.56	261.23	255.84	252.27	267.77	264.46	268.77	272.09	286.87		
								Tota	al = Sum(2	19a) ₁₁₂ =	-		3216.15	(219)
Annua	al totals									k	Wh/year	•	kWh/year	-
Space	heating	fuel use	ed, main	system	1								3994.43	ļ
Water	heating	fuel use	d										3216.15	
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatin	ig pump:	:									130		(230c)
boiler	with a f	an-assis	sted flue									45]	(230e)
Total e	electricity	/ for the	above, l	kWh/yea	r			sum	of (230a)	(230g) =	:		175	(231)
Electri	city for li	ghting											252.15	(232)
10a. I	Fuel cos	sts - indiv	vidual he	eating sy	stems:									
						Fu kW	el /h/year			Fuel P (Table	Price 12)		Fuel Cost £/year	
Space	heating	- main s	system 1			(21	1) x			3.	1	x 0.01 =	123.8274	(240)
Space	heating	- main s	system 2	2		(21:	3) x			C)	x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			C)	x 0.01 =	0	(242)
Water	heating	cost (otł	her fuel)			(219	9)			3.	1	x 0.01 =	99.7	(247)
Pumps	s, fans a	nd elect	ric keep	-hot		(23	1)			11.	46	x 0.01 =	20.06	(249)
(if off-p Energy	beak tari / for ligh	ff, list ea ting	ach of (2	30a) to (230g) se	eparately (232	/ as app 2)	olicable a	ind apply	y fuel pri 11.	ce accor 46	ding to x 0.01 =	Table 12a 	(250)
Additic	onal star	nding cha	arges (T	able 12)									106	(251)
Appen	dix Q ite	ems: rep	eat lines	; (253) ai	nd (254)	as need	ded							
Total	energ	y cost		()	(245)(247) + (25	50)(254) =					378.4795	(255)
11a. S	SAP rati	ng - indi	vidual h	eating sy	vstems									-
Energy	/ cost de	eflator (T	able 12)									0.47	(256)
Energy	/ cost fa	ctor (EC	;F)		[(255) x	(256)] ÷ [((4) + 45.0] =					2.021	(257)
SAP ra	ating (S	ection 1	2)										71.8075	(258)
12a. (CO2 em	issions -	– Individ	ual heati	ng syste	ems inclu	uding m	icro-CHF	C					
						En kW	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	ır
Space	heating	(main s	ystem 1)		(21	1) x			0.1	98	=	790.9	(261)

Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	636.8	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		1427.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	130.36	(268)
Total CO2, kg/year	S	um of (265)(271) =		1648.53	(272)
CO2 emissions per m ²	(2	272) ÷ (4) =		38.32	(273)
El rating (section 14)				75	(274)
13a. Primary Energy					
	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	Energy kWh/year (211) x	Primary factor	=	P. Energy kWh/year 4074.32	(261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	Primary factor 1.02 0	=	P. Energy kWh/year 4074.32)(261) (263)
Space heating (main system 1) Space heating (secondary) Energy for water heating	Energy kWh/year (211) x (215) x (219) x	Primary factor 1.02 0 1.02	= =	P. Energy kWh/year 4074.32 0 3280.48)(261))(263))(264)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264)	Primary factor 1.02 0 1.02	= =	P. Energy kWh/year 4074.32 0 3280.48 7354.8	(261) (263) (264) (265)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (219) x (261) + (262) + (263) + (264) (231) x	Primary factor 1.02 0 1.02 =	= = =	P. Energy kWh/year 4074.32 0 3280.48 7354.8 511	(261) (263) (264) (265) (267)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting	Energy kWh/year (211) x (215) x (219) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Primary factor 1.02 0 1.02 = 2.92 0	-	P. Energy kWh/year 4074.32 0 3280.48 7354.8 511 736.27	(261) (263) (264) (265) (267) (268)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting 'Total Primary Energy	Energy kWh/year (211) x (215) x (219) x (219) x (261) + (262) + (263) + (264) (231) x (232) x	Primary factor 1.02 0 1.02 = 2.92 0 um of (265)(271) =	-	P. Energy kWh/year 4074.32 0 3280.48 7354.8 511 736.27 8602.07	(261) (263) (264) (265) (267) (268) (272)

Predicted Energy Assessment

82 Guilford Street London WC1N 1DF Dwelling type: Date of assessment: Produced by: Total floor area: Ground floor Maisonette 15 July 2014 Stroma Certification 86.22 m²

Environmental Impact (CO₂) Rating

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.



Predicted Energy Assessment

82 Guilford Street London WC1N 1DF

Dwelling type: Date of assessment: Produced by: Total floor area:

Ground floor Maisonette 15 July 2014 Stroma Certification 86.22 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.





Dwelling type: Date of assessment: Produced by: Total floor area: Mid floor Flat 21 July 2014 Stroma Certification 43.02 m²

Environmental Impact (CO₂) Rating

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.



Dwelling type: Date of assessment: Produced by: Total floor area: Mid floor Flat 21 July 2014 Stroma Certification 43.02 m²

Environmental Impact (CO₂) Rating

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Predicted Energy Assessment

82 Guilford Street London WC1N 1DF Dwelling type: Date of assessment: Produced by: Total floor area: Top floor Flat 15 July 2014 Stroma Certification 34.6 m²

Environmental Impact (CO₂) Rating

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

