ENERGY STATEMENT

551-557 Finchley Road

Proposed Residential-led Development

Produced by XCO2 for Hampstead Properties Ltd C/O Delta Properties

November 2020



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Remarks	Draft	Final			
Prepared by	AdT	AdT			
Checked by	КМ	КМ			
Authorised by	КМ	КМ			
Date	14/10/2020	05/11/2020			
Project reference	9.429	9.429			



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EXECUTIVE SUMMARY

The energy strategy for the 551-557 Finchley Road development has been developed in line with the energy policies of the London Plan and of the London Borough of Camden Local Plan and Planning Guidance policies. The three-step Energy Hierarchy has been implemented and the estimated regulated CO_2 savings on site are 55.1% for the domestic part and 36.2% for the non-domestic part of the development, against mixed Part L 2013 and existing buildings compliant scheme with SAP10 carbon factors.

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 551-557 Finchley Road, located in the London Borough of Camden.

The proposed development comprises of a part change of use from Use Class E and F1 and remodelling of the existing building to provide residential apartments (C3) along with flexible commercial (Class E)/pub/wine bar/drinking establishments/pub with expanded food provision (Sui Generis) uses, alterations including partial demolition and extensions at the rear at lower ground, ground and first floor levels, extension to provide an additional storey at roof level, levelling of the lower ground floor level, remodelling and restoration of front façade, amenity space, cycle parking and all associated works (Site does not include 1st to 3rd floor of 551 Finchley Road).

The proposed development includes a series of measures to reduce the energy demand and ensure an efficient supply of energy.

A zero-carbon target for major new-build residential developments has been in place for London since October 2016 and applies to major new-build non-residential developments on final publication of the New London Plan. For the scheme to be considered major, either the new-build residential portion is to be more than 10 units or the new-build non-residential portion is to be greater than 1000sqm. Due to the refurbishment nature of the development, this is not deemed applicable.

Reduction of energy demand has been implemented through the adoption of passive and active design measures, including improved levels of insulation, improved air tightness levels as far as possible, efficient lighting as well as energy saving controls for space conditioning and lighting.

The development has also been designed in line with GLA Guidance on preparing energy assessments and the London Plan's three-step Energy Hierarchy (Policy 5.2A) as well as Camden Planning Guidance: Energy efficiency and adaptation where feasible. The guidance document includes a requirement of 20% reduction in carbon dioxide emissions from on-site renewables, including refurbishments. The 20% reduction should be calculated from the regulated CO2 emissions of the development after all proposed energy efficiency measures and any CO2 reduction from non-renewable decentralised energy (e.g. CHP) have been incorporated.

The energy strategy outlined in this report has been developed using the SAP10 emissions factors to enable the development to meet the upcoming version of the Building Regulations.

SITE CONSTRAINTS

The project being of a refurbishment nature has some site constraints which limit any alteration to the character of the building. High efficiency individual gas boilers have been proposed to provide heating and hot water for the non-domestic portion as well as for 11 of the 15 units, the 4 lower ground maisonette units will be served with highly-efficient individual ASHP. Following a detailed design exercise with the design team, this is the maximum renewables provision that can be achieved on site.

Photovoltaic panels were not considered in the development as these would alter the character of the building and the orientation and inclination of the



551-557 Finchley Road Page 5 of 34 pitched roof would not enable the generation of any notable CO2 savings

The shortfall from 20% reduction from low and zero carbon technologies is due to spatial limitations and the project being of a refurbishment nature with alteration to the character of the building being unsuitable.

However, high-performance thermal envelope and passive design measures have been implemented to improve the carbon savings through demand reduction measures. The carbon savings from the demand reduction exceeds the new efficiency target set by the GLA of 15% for non-domestic portion and 10% for the domestic portion at the Be Lean stage.

The methodology used to determine the expected operational CO_2 emissions for the development is in accordance with the London Plan's three-step Energy Hierarchy (Policy 5.2A) and the CO_2 savings achieved for each step are outlined below:

BE LEAN – USE LESS ENERGY

The first step addresses reduction in energy demand, through the adoption of passive and active design measures.

The proposed energy efficiency measures include levels of insulation beyond Building Regulation requirements, improved air tightness levels, efficient lighting as well as energy saving controls for space conditioning and lighting.

Mechanical ventilation heat recovery (MVHR) is proposed for both the residential and non-residential portions of the development. The mechanical ventilation system will include heat recovery in order to achieve ventilation in the most energy-efficient way. MVHR is predominantly aimed to be incorporated for acoustic reasons, but from energy efficiency perspective it is a less optimal solution given the refurbishment nature of the scheme and the associated challenges with achieving very low air permeability rates that suit MVHR systems.

By means of energy efficiency measures alone, regulated CO_2 emissions are shown to reduce by:

Regulated CO $_2$ Savings at Be Lean Stage (SAP 10)			
	%	t/yr	
Domestic	47.5	22.0	
Non-domestic	36.2	3.2	
Site wide	45.7	25.2	

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

The application site is located in an area where district heating is not expected to be implemented in the future.

A site heat network has not been found to be feasible or viable for a development of this scale; a combination of high efficiency gas boilers and ASHP are instead proposed for the development.

BE GREEN – USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified source heat pumps as suitable technologies for the development.

The incorporation of renewable technologies will reduce CO_2 emissions by a further:

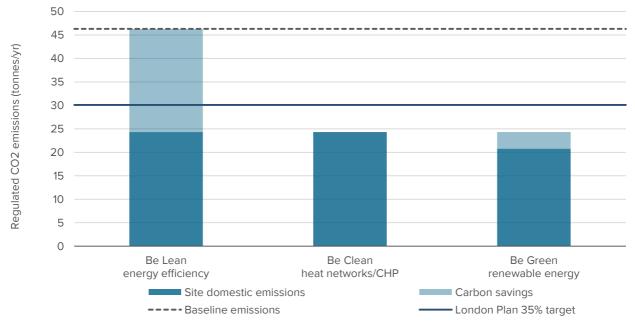
Regulated CO_2 Savings at Be Green Stage (SAP 10)			
	%	t/yr	
Domestic	7.6	3.5	
Non-domestic	0.0	0.0	
Site wide	6.4	3.5	

CUMULATIVE ON-SITE SAVINGS

The overall regulated CO₂ savings on site against a against a pre-refurbishment baseline are therefore:

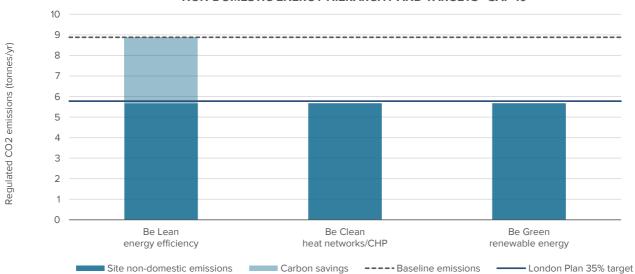
Cumulative Regulated CO ₂ Savings (SAP 10)			
	%	t/yr	
Domestic	55.1	25.5	
Non-domestic	36.2	3.2	
Site wide	52.1	28.7	





DOMESTIC ENERGY HIERARCHY AND TARGETS - SAP 10

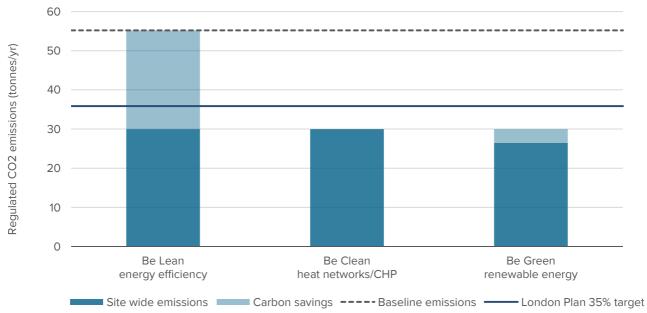
Figure 1: The Domestic Energy Hierarchy (SAP10 carbon factors)



NON-DOMESTIC ENERGY HIERARCHY AND TARGETS - SAP 10

Figure 2: The Non-Domestic Energy Hierarchy (SAP10 carbon factors)





SITE WIDE ENERGY HIERARCHY AND TARGETS - SAP 10

Figure 3: The Site Wide Energy Hierarchy (SAP10 carbon factors)



INTRODUCTION

This Chapter presents the description of the site and of the development proposal, the energy policy framework and the methodology employed for the energy assessment.

SITE & PROPOSAL

The site is located on Finchley Road Hampstead in the London Borough of Camden.

The site is bound by Finchley Road to the east, and mansion housing blocks to the west. The terrace of buildings continues to the north of 551-557, with detached three storey houses to the south.

The proposal is for part change of use from Use Class E and F1 and remodelling of the existing building to provide residential apartments (C3) along with flexible commercial (Class E)/ pub/ wine bar/ drinking establishments (Sui Generis) uses, alterations including partial demolition and extensions at the rear at lower ground, ground and first floor levels, extension to provide an additional storey at roof level, levelling of the lower ground floor level, remodelling and restoration of front façade, amenity space, cycle parking and all associated works (Site does not include 1st to 3rd floor of 551 Finchley Road).



Site Location



Figure 4: Location of the application site.



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POLICY FRAMEWORK

The proposal will seek to respond to the energy policies of the London Plan and of the policies within the London Borough of Camden.

The most relevant applicable energy policies in the context of the proposed development are presented below.

EMERGING LONDON PLAN (2019)

The current 2016 consolidation Plan is still the adopted Development Plan. However, the Draft London Plan, last updated in July 2019, is a material consideration in planning decisions. The New London Plan is scheduled to be published in 2020.

The following paragraphs highlight the key changes and additional requirements stemming from emerging policies.

GREENHOUSE GAS EMISSIONS

Policy GG6 (Increasing efficiency and resilience) sets a positive direction for the new draft Plan in terms of ambitious new greenhouse gas emission targets. At least 35% of this reduction must be made on site for major developments, with residential developments expected to achieve at least a 10% (and non-residential at least a 15%) reduction in emissions through energy efficiency measures alone (Policy SI2).

In a major departure from the previous London Plan, calculations will be required to include both regulated and unregulated emissions at each stage of the energy hierarchy. Furthermore, major developments will have to submit details of the method with energy performance and carbon dioxide emissions monitored post-construction for at least the first five years of building operation.

ENERGY INFRASTRUCTURE

In addition to upgrades to the lean and green stages of the energy hierarchy the clean stage has also been enhanced. A "be seen" stage has also been introduced so the development energy performance is monitored and reported. Most notably, all major developments within Heat Network Priority Areas will need to utilise a communal low-temperature heating system.

Policy SI3 (Energy infrastructure) recommends zeroemission or local secondary heat sources technology as step on the heating hierarchy but prioritises a connection to local existing or planned heat networks where feasible, for selecting communal heating systems. Where developments are utilising lowemission CHP this policy requires them to demonstrate that the CHP will *enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network.*

MATERIALS, WASTE & LIFE-CYCLE CARBON

Policy SI2 (Minimising greenhouse gas emissions) mentions the requirement for Energy Strategies to include a *whole life-cycle carbon emissions* assessment and actions to reduce life-cycle carbon *emissions*. This is to fully capture the development's carbon impact: unregulated and embodied emissions, and emissions associated with maintenance, repair and demolition will be considered. This may result in more sustainable material choices at design stage and could lead to straw, bamboo, clay and recycled materials alongside the more widely recognised crosslaminated timber becoming more commonplace in the capital. This section also links with Policy SI7 (Reducing waste and supporting the circular economy), whereby materials are retained in use at their highest value for as long as possible to minimise waste. All referable applications will be required to submit a Circular Economy Statement, intended to cover the whole life cycle of development.

AIR QUALITY

The new draft Plan addresses this crucial area by requiring large-scale development proposals to demonstrate how they maximise benefits to air quality and the measures or design solutions they will implement to minimise exposure to air pollution.

In practice this will mean that a preliminary Air Quality Assessment (AQA) will need to be carried out for all major developments prior to any design work taking place, with a full AQA submitted in support of the planning application. In addition, the new draft London Plan supports electric vehicle charging points and other transport alternatives to achieve carbon-free travel by 2050.

It should be noted that, as the policies in the draft London Plan are not yet adopted, the following sections demonstrate compliance with the current plan.



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THE LONDON PLAN

The London Plan (2016) is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years.

The overarching energy policies of the London Plan are included in Chapter Five *London's Response to Climate Change* and include Policies 5.2 to 5.9:

- Policy 5.2: Minimising carbon dioxide emissions;
- Policy 5.3: Sustainable Design and Construction;
- Policy 5.4: Retrofitting;
- Policy 5.4A: Electricity and gas supply;
- Policy 5.5: Decentralised energy networks;
- Policy 5.6: Decentralised energy in development proposals;
- Policy 5.7: Renewable energy;
- Policy 5.8: Innovative energy technologies, and,
- Policy 5.9: Overheating and cooling.

Extracts of Policies 5.2, 5.6, 5.7 and 5.9 are presented below as these are considered most relevant to the proposed scheme.

The London Plan also consists of a suite of guidance documents, most relevant of which are the Sustainable Design and Construction SPG (April 2014) & Energy Planning – GLA Guidance on preparing energy assessments (October 2018).





POLICY 5.2 MINIMISING CARBON DIOXIDE EMISSIONS

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy: Be lean: use less energy

Be clean: supply energy efficiently Be green: use renewable energy

B. The Mayor will work with boroughs and developers to ensure major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

POLICY 5.6 DECENTRALISED ENERGY IN DEVELOPMENT PROPOSALS

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

B. Major development proposals should select energy systems in accordance with the following hierarchy:

Connection to existing heating or cooling networks;

Site wide CHP network;

Communal heating and cooling.

C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 RENEWABLE ENERGY

B. Within the framework of the energy hierarchy (see Policy 5.2), major proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

D. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

POLICY 5.9 OVERHEATING AND COOLING

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- 1. Minimise internal heat generation through energy efficient design
- 2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- *3. Manage the heat within the building through exposed internal thermal mass and high ceilings*
- 4. Passive ventilation
- 5. Mechanical ventilation
- 6. Active cooling systems (ensuring they are the lowest carbon options).



GLA GUIDANCE ON PREPARING ENERGY ASSESSMENTS

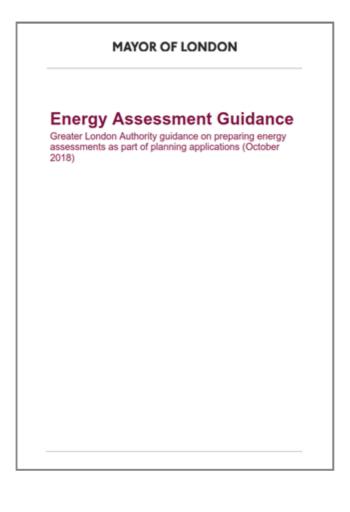
This document (last updated in October 2018) provides guidance on preparing energy assessments to accompany strategic planning applications; it contains clarifications on Policy 5.2 carbon reduction targets, as well as detailed guidelines on the content of the Energy Assessments undertaken for planning.

The guidance document specifies the emission reduction targets the GLA will apply to applications as follows:

The regulated carbon dioxide emissions reduction target for major domestic development is zero carbon and for non-domestic development it is 35 per cent beyond Part L 2013 of the Building Regulations.

The new guidance also includes changes to technical requirements relating to presenting carbon information separately for domestic and non-domestic elements of developments and the provision for cooling demand data where active cooling is required.

The structure of this report and the presentation of the carbon emission information for the development follows the guidance in this document.





CAMDEN LOCAL PLAN (2017)

Policy CC1 Climate change mitigation

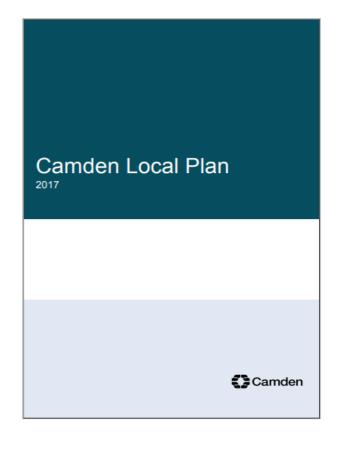
Camden Council will:

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

For decentralised energy networks, the council will promote decentralised energy by:

- a. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
- b. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
- c. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.





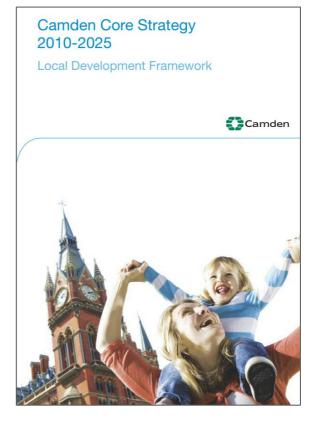
CAMDEN CORE STRATEGY (2010-2025)

CS13 – Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

- ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
- b) promoting the efficient use of land and buildings;
- c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
 - 1. ensuring developments use less energy,
 - 2. making use of energy from efficient sources;
 - 3. generating renewable energy on-site; and
- ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions.





CAMDEN PLANNING GUIDANCE: ENERGY EFFICIENCY AND ADAPTATION (2019)

Making buildings more energy efficient

Energy efficient design requires an integrated approach to solar gain, access to daylight, insulation, thermal materials, ventilation, heating and control systems. It is important that these aspects are considered in relation to each other when designing a scheme.

Energy efficient (passive) design measures should be considered prior to the inclusion of any active measures to ensure that the energy demand for developments is reduced as far as possible.

Developments should avoid electric heating systems unless there is no access to a gas connection, or where heating is required for very short periods in isolated locations.

Decentralised energy

The 'Be Clean' stage of the energy hierarchy aims to ensure that developments have an efficient supply of heat and power. It is the local supply of heat and energy which optimises supply to demand so is much more efficient. Until now, this step has typically been achieved through the installation of combined heat and power units (CHP) or connection to a Decentralised Energy Network (DEN) often powered by CHP and gas boilers.

Local Plan Policy CC1 requires all major developments to assess the feasibility of connecting to an existing decentralised energy network, and where this is not possible establishing a new network (see paragraph 8.25 Local Plan).

Renewable energy technologies

All developments should consider the feasibility of onsite renewable energy generation. Renewable energy generation should only be considered once the earlier stages of the energy hierarchy have been followed and energy demand has been reduced as far as possible.



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Energy reduction

The following energy reduction requirements are set out in the Camden Planning Guidance report:

- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.
- All new build major development to demonstrate compliance with London Plan targets for carbon dioxide emissions.
- Deep refurbishments (i.e. refurbishments assessed under Building Regulations Part L1A/L2A) should also meet the London Plan carbon reduction targets for new buildings.
- Developments of five or more dwellings and/or more than 500sqm of any gross internal floorspace to achieve 20% reduction in carbon dioxide emissions from on-site renewable energy generation

Energy efficiency in existing buildings

There are many opportunities for reducing energy, the design, fixtures, and materials used can make a significant contribution. Installing condensing boilers, heating controls and energy saving light bulbs and appliances reduce energy use and carbon dioxide emissions significantly.

Heating and Hot water

Heating and hot water carbon emissions can be improved through:

- Replacing an old boiler (more than 10 years old) with a high efficiency condensing boiler and heating controls to provide heating and hot water could significantly cut energy consumption.
- New/upgraded central heating if a new boiler is installed the rest of the central heating system may need upgrading, for example large, old radiators could be replaced with smaller, more efficient radiators that are better suited to the new boiler.
- Upgrading heating controls install heating controls that allow control of the temperature in different parts of a building. These can be included as an electronic timer control.

Camden Planning Guidance

Energy efficiency and adaptation

March 2019





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METHODOLOGY

The sections below present the methodology followed in determining the on-site and off-site carbon savings for the proposed scheme.

ON-SITE CARBON SAVINGS – THE ENERGY HIERARCHY

The methodology employed to develop the energy strategy for the scheme and achieve on-site carbon savings is in line with the GLA's *Guidance on preparing energy assessments* and is as follows:

Given that the development is a major refurbishment project it is expected that an estimate of the CO2 savings from the refurbishment of the building is provided.

For this, a pre-refurbishment regulated CO2 emissions 'baseline' should be modelled to determine a baseline Building Emission Rate (BER), estimating fabric and services performance based on available existing information.

The software used to model and calculate the energy performance and carbon emissions of the domestic element is SAP2012 and SBEM for the non-domestic elements. The baseline emissions of the domestic element are established by modelling representative dwelling types and multiplying the Dwelling Emission Rate (DER) of each type in its existing condition with the cumulative floor area for that type to establish the total emissions for the domestic element of the proposal. Similarly, the baseline TER (derived from the BER of the building in its existing condition) for each non-domestic element is multiplied by its floor area to establish the total emissions.

The same approach is followed to determine the energy performance and CO_2 emissions of the proposed scheme for each of the steps of the **Energy Hierarchy**. The CO_2 emissions are estimated based on the SAP Dwelling Emission Rate (DER) and SBEM Building Emission Rate (BER) figures for the domestic and non-domestic elements respectively. The Energy Hierarchy aims at delivering significant carbon savings on-site.

The three consecutive steps of the Energy Hierarchy are:

• **Be Lean** whereby the demand for energy is reduced through a range of passive and active

energy efficiency measures; as part of this step the Cooling Hierarchy (see Policy 5.9) is implemented and measures are proposed to reduce the demand for active cooling;

- **Be Clean** whereby as much of the remaining energy demand is supplied as efficiently as possible (e.g. by connecting to a district energy network or developing a site-wide CHP network), and,
- **Be Green** whereby renewable technologies are incorporated to offset part of the carbon emissions of the development. The uptake of renewable technologies is based on feasibility and viability considerations, including their compatibility with the energy system determined in the previous step.

The implementation of the Energy Hierarchy determines the total regulated carbon savings that can be feasibly and viably achieved on site.

The % improvement against the baseline emissions is compared to the relevant targets for each element and in case of a shortfall, savings through off-site measures should be achieved.

The structure of the main body of the assessment follows the Methodology presented above and comprises the sections:

- Be Lean;
- Be Clean:
- Be Green.

The Conclusions section summarises the energy strategy and associated carbon savings for the proposed development.



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BE LEAN – USE LESS ENERGY

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water and lighting. Measures will also be put in place to reduce the risk of overheating. The regulated carbon saving achieved in this step of the Energy Hierarchy is 45.7% over the site wide baseline level with SAP10 emission factors.

PASSIVE DESIGN MEASURES

ENHANCED U-VALUES

The heat loss of different building fabric elements is dependent upon their U-value. A building with low Uvalues provides better levels of insulation and reduced heating demand during the cooler months.

The proposed development will incorporate high levels of insulation and high-performance glazing beyond Part L 2013 targets and Part L1B/2B targets, in order to reduce the demand for space heating.

The tables to the right demonstrate the improved performance of the proposed building fabric beyond the Building Regulations requirements for both domestic and non-domestic uses.

AIR TIGHTNESS IMPROVEMENT

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration.

The proposed development will aim to improve upon the Part L 2013 minimum standards for air tightness by targeting air permeability rates of $15m^3/m^2$.h at 50Pa for all refurbished residential units and $15m^3/m^2$.h at 50Pa for non-domestic areas.

Refurbished Elements (U-values in W/m2.K)				
Element	Baseline (SAP Appendix S)	Proposed*	Improvement	
Walls	0.55	0.55	0%	
Floor	0.73	0.25	66%	
Roof	0.68	0.18	74%	
Windows	3.1	1.6	48%	
Nev	v Build Element	s (U-values in	W/m2.K)	
Element	Building Regulations	Proposed**	Improvement	
Walls	0.35	0.15	57%	
Floor	0.25	0.1	60%	
Roof	0.25	0.1	60%	
Windows	2.2	1.3	41%	

Table 1: Thermal Envelope U-values

*Based on Part L1B and Part L2B

**Based on XCO2 Recommendations

REDUCING THE NEED FOR ARTIFICIAL LIGHTING

The development has been designed to maximise daylight in all habitable spaces as a way of improving the health and wellbeing of its occupants.

All of the habitable areas will benefit from large areas of glazing to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.



ACTIVE DESIGN MEASURES

HIGH EFFICACY LIGHTING

The development intends to incorporate low energy lighting fittings throughout the residential and nonresidential spaces. All light fittings will be specified as low energy lighting, and will accommodate LED, compact fluorescent (CFLs) or fluorescent luminaires only.

HEAT RECOVERY VENTILATION

Mechanical ventilation heat recovery (MVHR) is proposed for both the residential and non-residential portions of the development. The mechanical ventilation system will include heat recovery in order to achieve ventilation in the most energy-efficient way. MVHR is predominantly aimed to be incorporated for acoustic reasons, but from energy efficiency perspective it is a less optimal solution given the refurbishment nature of the scheme and the associated challenges with achieving very low air permeability rates that suit MVHR systems.

CONTROLS

Advanced lighting and space conditioning controls will be incorporated, specifically for residential communal and non-residential areas of infrequent use, occupant sensors will be fitted for lighting, whereas day lit areas will incorporate daylight sensors where appropriate.

MINIMISING OVERHEATING

The potential risk of overheating will be mitigated by incorporating passive and active design measures, in line with the London Plan Policy 5.9 and the Cooling Hierarchy, as follows.

THE COOLING HIERARCHY

MINIMISING INTERNAL HEAT GENERATION THROUGH ENERGY EFFICIENT DESIGN

The distribution of heat infrastructure within the residential parts of the development will be designed to reduce the lateral pipework lengths within the internal spaces to reduce heat loss.

USE OF THERMAL MASS AND HIGH CEILINGS TO MANAGE THE HEAT WITHIN THE BUILDING

During peak summer periods the thermal mass of the building will absorb and store excess heat. The building will release its heat in the cooler evenings to allow for cooler internal spaces dampening the peak diurnal weather conditions.

MECHANICAL VENTILATION

MVHR will be capable of operating in summer bypass mode allowing for the dissipation of any heat build-up during peak summer conditions.

OVERHEATING RISK ASSESSMENT

The potential risk of overheating was assessed via the Part L Building Regulation compliance tools SAP and SBEM.

A 'not significant' overheating risk was found for all representative dwelling types modelled in SAP. The SAP overheating risk assessment outputs for a sample of the dwelling types modelled can be found in Appendix A – SAP Results.

All non-domestic areas have been found to pass Criterion 3 'Limiting Solar Gains' of Part L. The SBEM output for all non-domestic areas can be found in Appendix B – SBEM Results.



ENERGY USE

DWELLING EMISSION RATES AND ENERGY DEMAND

The table below shows a breakdown of carbon dioxide emissions associated with the proposed development's fossil fuel and electricity consumption along with total energy demand for the different uses. The site-wide data are presented, i.e. the sum of the demand for both the domestic and non-domestic parts of the development. The figures provide a comparison between the baseline condition and the proposed development once energy efficiency measures (Lean) have been applied.

This table demonstrates the energy savings achieved through energy efficiency measures (Lean stage of the Energy Hierarchy).

The subsequent table shows the breakdown of regulated energy demand for the residential and non-domestic portions of the scheme as requested by the GLA.

Table 2: Breakdown of energy consumption and CO_2 emissions for the baseline and the proposed schemes after 'Lean' measures are implemented

	Baseline		Lean			
	Energy (kWh/yr.)	kgCO ₂ /yr.	kgCO ₂ /m ²	Energy (kWh/yr.)	kgCO ₂ /yr.	kgCO ₂ /m ²
Hot Water	92,790	21,602	23.1	30,780	6,462	7.0
Space Heating	117,750	27,035	34.5	80,800	16,968	19.6
Cooling	0	0	0.0	0	0	0.0
Auxiliary	3,940	905	1.7	6,230	1,439	2.3
Lighting	24,740	5,647	13.4	22,400	5,116	12.0
Equipment	42,300	9,856	13.0	42,300	9,856	13.0
Total Part L	239,220	55,188	72.8	140,210	29,986	40.9
Total (incl. equipment)	281,520	65,044	85.8	182,510	39,842	54.0

BE LEAN CO₂ EMISSIONS

By means of energy efficiency measures alone, regulated CO2 emissions are shown to reduce by 45.7% (25.2 tonnes per annum) across the whole site.



BE CLEAN – SUPPLY ENERGY EFFICIENTLY

The proposed development site is located within an area where there is no existing district heat network within close proximity and an on-site wide CHP network is not feasible or viable for a development of this scale as well as in light of the new carbon emissions factors which are now much lower for electricity.

ENERGY SYSTEM HIERARCHY

The energy system for the development has been selected in accordance with the London Plan decentralised energy hierarchy. The hierarchy listed in Policy 5.6 states that energy systems should consider:

- 1. Connection to existing heating and cooling networks;
- 2. Site wide CHP network; and,
- 3. Communal heating and cooling.

Local heat and power sources minimise distribution losses and achieve greater efficiencies when compared to separate energy systems, thus reducing CO_2 emissions.

In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network of insulated pipes to surrounding residences.

CONNECTION TO AN EXISTING NETWORK

The London Heat Map identifies existing and potential opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study.

An excerpt from the London Heat Map can be seen on the following page which shows existing and proposed district heating networks within the vicinity of the development.

A review of the map shows that the site is not in proximity of an existing or proposed district heating network. Due to this, it has not been found feasible or viable for the proposed development to incorporate the supply of low carbon heating or cooling through district heating.

SITE-WIDE CHP NETWORK

The use of CHP is not recommended for this development in light of the new carbon factors and future version of the Building Regulations which favour electrically driven heating systems.

COMMUNAL HEATING AND COOLING

The design team have undergone through several design exercises to explore the possibility of having communal heating strategy for the scheme. The architects and MEP consultants have estimated the associated plant space requirements to accommodate a communal plantroom and it has not been deemed feasible to incorporate communal plantroom. The issue with having communal Air Source Heat Pumps serving the entire development is that there is limited roof space, and the acoustic attenuation requirements for large, communal ASHP require significant plant space which is simply not available in this refurbishment scheme. Communal boilers serving the development would also require large plant space and are against the general direction of policy, where renewable technology should be included in some form on site. In light of the new carbon factors, some form of electric driven heating system should be incorporated on site given than the roof orientation and pitch, together the concerns on the alterations of the character of the building, make PVs an unsuitable strategy for the building.

INDIVIDUAL HEATING

The project being of a refurbishment nature has many site constraints which limit any alteration to the

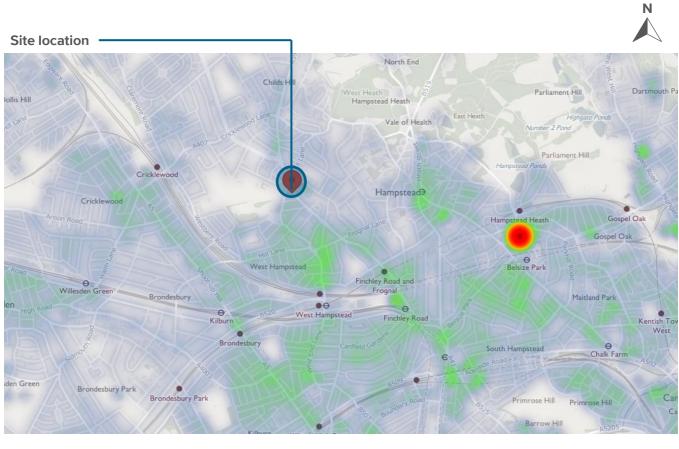


551-557 Finchley Road Page 22 of 34 character of the building. The design team and client's aspiration is to maximise the renewable provision onsite and as a result have been able to design in the following heating strategy. High efficiency gas boilers have been proposed to provide heating and hot water for the non-domestic portion and for 11 of the 15 units due to site limitations. Air source heat pumps (ASHP) require more plant space, noise attenuation measures and should be properly ventilated. In order to achieve the maximum carbon reduction on-site, the 4 lower ground maisonette units will be serviced with highlyefficient individual ASHP.

BE CLEAN CO2 EMISSIONS

As there are no existing or proposed heat networks highlighted as in close proximity to the site, no connection to a 'Clean' supply of energy is deemed feasible and consequently there are no emission savings at this stage.





Proposed Heat Networks Existing Heat Networks

Figure 5: Excerpt from the London Heat Map. Existing district networks outlined in red, proposed networks in orange.



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BE GREEN – USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified air source heat pumps as suitable technologies for the development. The regulated carbon saving achieved in this step of the Energy Hierarchy is 6.4% over the site wide baseline level with SAP10 emission factors.

RENEWABLE TECHNOLOGIES FEASIBILITY STUDY

Methods of generating on-site renewable energy (Green) were assessed, once Lean and Clean measures were taken into account.

The development of 551-557 Finchley Road will benefit from an energy efficient building fabric which will reduce the energy consumption of the proposed development in the first instance. A range of renewable technologies were subsequently considered including:

- Biomass;
- Ground/water source heat pumps;
- Air source heat pump;
- Wind energy;
- Photovoltaic panels, and,
- Solar thermal panels.

In determining the appropriate renewable technology for the site, the following factors were considered:

- CO₂ savings achieved;
- Site constraints; and
- Any potential visual impacts.

RENEWABLE ENERGY APPRAISAL SUMMARY

The table below summarises the factors taken into account in determining the appropriate renewable technologies for this project. This includes estimated capital cost, lifetime, level of maintenance and level of impact on external appearance. The final column indicates the feasibility of the technology in relation to the site conditions (10 being the most feasible and 0 being infeasible). It is important to note that the information provided is indicative and based upon early project stage estimates.

The feasibility study demonstrates that ASHP would be the most feasible renewable technology for the proposed 551-557 Finchley Road development. Detailed assessments for the proposed technologies can be found in the following sections.



Table 3. Summary of renewable technologies feasibility study

		Comments	Lifetime	Maintenance	Impact on external appearance	Site feasibility
Biomass		Not adopted -burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20 yrs.	High	High	1
PV		Not adopted - PV panels mounted on the pitched roof would significantly alter the appearance and character of the building and output would be minimal due to pitch and orientation	25 yrs.	Low	Med	3
Solar thermal		Not adopted - Solar thermal array mounted on the pitched roof would significantly alter the appearance and character of the building.	25 yrs.	Low	Med	3
GSHP		Not adopted -the installation of ground loops requires significant space, additional time at the beginning of the construction process and very high capital costs.	20 yrs.	Med	Low	2
ASHP		Adopted – The improvement of the efficiencies of the ASHP in the Green stage will further reduce the carbon emissions of the building.	20 yrs.	Med	Med	5
Wind	KI	Not adopted - Wind turbines located at the site will require significant space which is not available.	25 yrs.	Med	High	1



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DETAILED ASSESSMENT OF AIR SOURCE HEAT PUMPS

Air source heat pumps (ASHPs) employ the same technology as ground source heat pump (GSHPs). However, instead of using heat exchangers buried in the ground, heat is extracted from the external ambient air.

The efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result, ASHPs tend to have a lower COP than GSHPs. This is due to the varying levels of air temperature throughout the year when compared to the relatively stable ground temperature. The lower the difference between internal and external air temperature, the more efficient the system.

ASHP is considered a suitable technology for the development for the following reasons:

- It is a high efficiency system that can cater for the space heating and cooling of the most energy-intensive areas of the proposed development;
- Requires less capital cost than GSHP and other renewable technologies;
- It can be integrated with the proposed ventilation strategy; and,
- It is simple to install when compared to other renewable technologies.

The ASHP will be implemented for the 4 lower ground maisonette units where space is available in the courtyards to install and sufficiently attenuate acoustically the system if required

The table below summarises the technical data for the proposed ASHP and estimated CO_2 savings from the application of this technology. In total the ASHP technology would produce regulated CO_2 savings of 6.4% for the development.

Table 4: Summary of technical/operational data and estimated \mbox{CO}_2 savings for ASHP

ASHP for domestic spaces			
COP heating	1.7		
Carbon intensity of electricity	0.233	kgCO ₂ /kWh	
Proportion of domestic space heating and hot water met by ASHP**	100	%	
Energy met by ASHP	18,978	kWh/yr.	
Energy used by ASHP	11,163	kWh/yr.	
Total CO ₂ savings	3.5	t/yr.	
Regulated baseline CO ₂ emissions	55.2	t/yr.	
Total baseline CO ₂ emissions	65.1	t/yr.	
% Regulated CO ₂ reduction*	6.4	%	
% Total CO ₂ reduction*	5.4	%	

* % reduction from site baseline

** For the 4 maisonette units utilising ASHP



Figure 6: Outdoor units of ASHP



BE GREEN CO₂ EMISSIONS

Following the measures adopted at Lean stage, further savings can be obtained through the incorporation of the proposed ASHP. The incorporation of the renewable technologies will further reduce CO2 emissions by a further 6.4% (3.5 tonnes per annum) across the whole site.

Shortfall from the 20% reduction set out in the Camden Planning Guidance: Energy efficiency and adaptation is due to the limitations including:

Photovoltaic panels were deemed unsuitable since the building has a pitched roof with limited space for panels and panels would lead to alteration of the character of the building which is undesirable considering the project is a refurbishment by nature.

ASHP's were implemented where feasible, with high efficiencies. Individual ASHP were specified for 4 no. units on the lower ground floor.



CONCLUSIONS

Following the implementation of the three-step Energy Hierarchy, the cumulative CO_2 savings on site are estimated at 55.1% for the domestic part and 36.2% for the non-domestic part of the development, against a pre-refurbishment baseline. The regulated CO_2 savings for the site as a whole are 52.1% with SAP10 emission factors.

ON SITE CO₂ SAVINGS

By implementing the three step Energy Hierarchy as detailed in the previous sections, the Regulated CO_2 emissions for the development have been reduced against a pre-refurbishment baseline through on-site measures alone by:

Cumulative Regulated CO ₂ Savings (SAP 10)			
	%	t/yr	
Domestic	55.1	25.5	
Non-domestic	36.2	3.2	
Site wide	52.1	28.7	

Overall, the proposed development has been designed to be in line with energy policies set out by the GLA and the London Borough of Camden which demonstrates the client and the design team's commitment to enhancing sustainability of the scheme.

A zero-carbon target for major new-build residential developments has been in place for London since October 2016 and applies to major new-build non-residential developments on final publication of the New London Plan. For the scheme to be considered major, either the new-build residential portion is to be more than 10 units or the new-build non-residential portion is to be greater than 1000sqm. Due to the refurbishment nature of the development, this is not deemed applicable.

The scheme exceeds the London Plan requirement of on-site carbon reduction of 35%.

The development has also been designed in line with Camden Planning Guidance: Energy efficiency and adaptation where feasible. The shortfall from 20% reduction from low and zero carbon technologies is due to spatial limitations. The project being of a refurbishment nature has some site constraints which limit any alteration to the character of the building. Individual gas boilers have been proposed to provide heating and hot water the non-domestic and the majority of the domestic development. Air source heat pumps (ASHP) have been utilised where possible to maximise on-site carbon reduction, the 4 lower ground maisonette units will be serviced with highly-efficient individual ASHP.

Photovoltaic panels were not considered in the development as these would alter the character of the building. Hence the development is not able to meet the 20% carbon savings from renewables.

However, high-performance thermal envelope and passive design measures have been implemented and the carbon savings through demand reduction measures alone exceeds the new efficiency target set by the GLA of 15% for non-domestic and 10% for domestic developments.

The tables in the following pages summarise the implementation of the Energy Hierarchy for the proposed scheme and detail the CO_2 emissions and savings against the baseline scheme for each step of the hierarchy; as well as the savings achieved through carbon offset.

Separate tables are presented for the domestic and non-domestic parts of the development; as well as for the site as a whole.



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DOMESTIC CUMULATIVE SAVINGS

Table 5: CO₂ emissions after each step of the Energy Hierarchy for the domestic part of the development

	Carbon dioxide emissions for domestic buildings (tonnes CO2 per annum)			
	Regulated Unregulated			
Baseline	46.3	8.3		
After energy demand reduction	24.3	8.3		
After heat network/CHP	24.3	8.3		
After renewable energy	20.8	8.3		

Table 6: Regulated CO₂ savings from each stage of the Energy Hierarchy for the domestic part of the development

	Regulated domestic carbon dioxide savings		
	Tonnes CO₂ per annum	% over baseline	
Savings from energy demand reduction	22.0	47.5%	
Savings from heat network/CHP	0.0	0.0%	
Savings from renewable energy	3.5	7.6%	
Cumulative on site savings	25.5	55.1%	
Cumulative for offset payments	623.4 tonnes over 30 years		

NON-DOMESTIC CUMULATIVE SAVINGS

Table 7: CO₂ emissions after each step of the Energy Hierarchy for the non-domestic part of the development

	Carbon dioxide emissions (tonnes CO ₂	for non-domestic buildings per annum)			
	Regulated	Unregulated			
Baseline	8.9	1.6			
After energy demand reduction	5.7	1.6			
After heat network/CHP	5.7	1.6			
After renewable energy	5.7	1.6			

Table 8: Regulated CO₂ savings from each stage of the Energy Hierarchy for the non-domestic part of the development

	Regulated non-domestic	carbon dioxide savings
	Tonnes CO ₂ per annum	% over baseline
Savings from energy demand reduction	3.2	36.2%
Savings from heat network/CHP	0.0	0.0%
Savings from renewable energy	0.0	0.0%
Cumulative on site savings	3.2	36.2%



SITE-WIDE CUMULATIVE SAVINGS

Table 9: Site wide regulated CO_2 emissions and savings

	Total regulated emissions (tonnes CO ₂ /year)	Regulated CO ₂ savings (tonnes CO ₂ /year)	Percentage saving (%)
Baseline	55.2		
Be Lean	30.0	25.2	45.7%
Be Clean	30.0	0.0	0.0%
Be Green	26.5	3.5	6.4%
Total		28.7	52.1%



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APPENDIX A – SAP RESULTS

The table below lists a sample of the typical flats that were modelled using SAP methodology, the TER and DER outputs and the % CO₂ reduction achieved after the Be Lean, Be Clean and Be Green measures have been applied.

The results from these 6 flats were extrapolated over the entire development, in order to predict the energy consumption and carbon dioxide emissions for the domestic spaces of the Development.

The following pages show the DER/TER FSAP2012 worksheets for a sample flat at the Be Lean and Be Green stages. The SAP outputs for all sample flats are available on request.

SAP		TED	Be Lea	an	Be Gre			
Ref No.	Unit (kgCO ₂ /m²/y		DER % CO ₂ (kgCO ₂ /m ² /yr) reduction		DER (kgCO ₂ /m²/yr)	% CO ₂ reduction	Overheating Risk	
1	LG1	57.99	43.57	24.9%	49.90	14.0%	Not Significant	
2	LG2	66.32	46.71 29.6%		52.25	21.2%	Not Significant	
3	1A	63.77	48.68	23.7%	48.68	23.7%	Not Significant	
4	2A	69.04	51.49	25.4%	51.49	25.4%	Not Significant	
5	ЗА	75.66	51.91 31.4%		51.91	31.4%	Not Significant	
6	4B	84.83	53.12	37.4%	53.12	37.4%	Not Significant	



				User D	etails:							
Assessor Name: Software Name:												
			Pi	operty /	Address	: LG1 Ba	aseline					
Address :	, Londo	on										
1. Overall dwelling dim	ensions:									Volume(m ³)		
_	Area(m ²) Av. Height(m)											
Basement												
Ground floor				4	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)	
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ (4)												
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)	
2. Ventilation rate:									•		-	
21 Voltalation rate.	ma		condar	у	other		total			m ³ per hour		
Number of chimneys	hea	ting h	eating 0] + [0] = [0	x 4	40 =	0	(6a)	
Number of open flues			0	」 + -	0	」 に ヿ = Г	0	x2	20 =	0](6b)	
Number of intermittent f	ans	<u> </u>	•		•		0	x ^	10 =	0](7a)	
Number of passive vent							0	x ^	10 =	0	(7b)	
Number of flueless gas							0	x 4	40 =	0	(7c)	
										anges per hou	Jr Jr	
Infiltration due to chimne If a pressurisation test has	7					continue fr	0 om (9) to (÷ (5) =	0	(8)	
Number of storeys in	the dw <mark>ellir</mark>	ng (ns)								0	(9)	
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)	
Structural infiltration:	0.25 for st	eel or timber f	rame or	0.35 for	r masonr	ry constr	uction			0	(11)	
if both types of wall are deducting areas of open			oonding to	the greate	er wall are	a (after						
If suspended wooden	floor, ente	er 0.2 (unseale	ed) or 0.	1 (seale	ed), else	enter 0			[0	(12)	
If no draught lobby, er	∩ter 0.05,	else enter 0								0	(13)	
Percentage of window	vs and doo	ors 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	, q50, exp	ressed in cub	ic metre	s per ho	our per so	quare m	etre of e	nvelope	area	15	(17)	
If based on air permeab	ility value,	then (18) = [(17	7) ÷ 20]+(8), otherwi	se (18) = (16)				0.75	(18)	
Air permeability value appli		urisation test has	been don	e or a deg	gree air pe	rmeability	is being us	sed			-	
Number of sides shelter	ed				(20) 1	[0 07E v (4	0)]			2	(19)	
Shelter factor					(20) = 1 -		9)] =		ļ	0.85	(20)	
Infiltration rate incorpora	-				(21) = (18)) x (20) =				0.64	(21)	
Infiltration rate modified		<u> </u>	i				-					
Jan Feb		Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind s	· · · · · · · · · · · · · · · · · · ·					i			,			
(22)m= 5.1 5	4.9 4	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7			

Wind F	actor (22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infilt	ration rat	e (allow	ing for sl	nelter ar	nd wind s	peed) =	: (21a) x	(22a)m					
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75		
			-	rate for a	he appl	icable ca	se	•	•		•		· 	
		al ventila		ondix N (C	23h) - (23)	a) × Fmv (e	auation (I	N5)) othe	nviso (23k	(232)			0	
						for in-use fa) = (20a)			0	
			-	-	-	at recove				2b)m + (23b) v [·	1 _ (23c)	0	(23c)
(24a)m=												1 - (230)	- 100j	(24a)
	_			-	-	heat rec	-				-	-	i	· · · · ·
(24b)m=	· · · · · ·										0	0		(24b)
			I tract ver		ı or positiv	ve input v	ı ventilatio	n from o	utside	<u> </u>	ļ		ł	
i	if (22b)	m < 0.5 >	< (23b), †	then (24	c) = (23l	o); otherv	vise (24	c) = (22k	o) m + 0	.5 × (23b) 			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	l	(24c)
,					•	ve input v erwise (2				0.5]				
(24d) <mark>m=</mark>	0.83	0.82	0.8	0.75	0.73	0.68	0.68	0.67	0.7	0.73	0.76	0.78		(24d)
Effe	ctive ai	r change	rate - ei	nter (24a) or (24	b) or (240	c) or (24	ld) in box	(25)					
(25)m=	0.83	0.82	0.8	0.75	0.73	0.68	0.68	0.67	0.7	0.73	0.76	0.78		(25)
3 He	at losse	es and he	eat loss	naramet	er ·									
ELEN		Gros		Openir		Net Ar	ea	U-val	ue	AXU		k-value	-	AXk
		area			η ²	A ,n		W/m2		(W/		kJ/m²∙ł		kJ/K
Doo <mark>rs</mark>						1.98	x	3	=	5.94				(26)
Windo	ws Typ	e 1				4.33	x1	/[1/(3.1)+	0.04] =	11.94				(27)
Windo	ws Typ	e 2				1.92	x1	/[1/(3.1)+	0.04] =	5.3				(27)
Windo	ws Typ	e 3				0.64	x1	/[1/(3.1)+	0.04] =	1.77				(27)
Floor T	Гуре 1					30	x	0.25	=	7.5				(28)
Floor T	Гуре 2					37.4	x	0.73	=	27.302				(28)
Walls ⁻	Type1	48.	6	4.48	3	44.12	<u>x</u>	0.55	=	24.27	ו ר		$\neg $	(29)
Walls ⁻	Type2	32.	8	17.3	2	15.48	5 X	0.35	=	5.42	ז ר		7 7	(29)
Walls ⁻	ТуреЗ	8.6	3	0		8.6	x	0.55	=	4.73	īĒ		F F	(29)
Walls -	Type4	3.1	 I	1.98	3	1.12	×	0.55		0.62	i F		ΞĒ	(29)
Walls -	Туре5	13.	3	0		13.3	×	0.28	=	3.72	i F		Ξ F	(29)
Total a	area of	elements				173.8	3	•		•	L		∟	(31)
		d roof wind eas on both				alue calcula titions	ated using	g formula 1	/[(1/U-vali	ue)+0.04] a	as given in	paragraph	1 3.2	

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	139.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design approximate where the details of the construction are not known in	provincely the indirative values of TMD in Table 1f		-

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

can be ι	used inste	ad of a dei	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						26	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								_
Total fa	abric he	at loss							(33) +	(36) =			165.62	(37)
Ventila	Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	81.92	80.65	79.41	73.59	72.5	67.42	67.42	66.48	69.38	72.5	74.7	77.01		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	247.54	246.27	245.03	239.21	238.12	233.04	233.04	232.1	235	238.12	240.32	242.63		
Heat lo		meter (H		′m²K						Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	239.2	(39)
(40)m=	2.25	2.24	2.23	2.18	2.17	2.12	2.12	2.11	2.14	2.17	2.19	2.21		
(10)	2.20	2.21	2.20	2.10	2.17	2.12	2.12	2			Sum(40)1.		2.18	(40)
Numbe	er of day	/s in mor	nth (Tab	le 1a)						lionago				
	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 ener	rav reau	rement:								kWh/ye	ear:	
													1	
		ipancy, I		[1 oyp	(0 0002		- 12 0)2)] + 0.0	012 v /	TEA 12		81		(42)
	A £ 13.		T 1.70 X	[i - evh	(-0.0003	743 X (11	A - 13.5,)z)] + 0.0	013 X (II A -13.	.9)			
								(25 x N)				6.34		(43)
		al average litres p <mark>e</mark> r j				-	7	o achieve	a water us	se target o	f			
normore														
Hot wot	Jan	Feb	Mar	Apr Apr	May Vd m fa	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
(44)m=	116.97	112.72	108.47	104.21	99.96	95.71	95.71	99.96	104.21	108.47	112.72	116.97		
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	m x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1276.09	(44)
(45)m=	173.47	151.72	156.56	136.49	130.97	113.01	104.72	120.17	121.61	141.72	154.7	168		
										Total = Su	m(45) ₁₁₂ =		1673.15	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)	to (61)					
(46)m=	26.02	22.76	23.48	20.47	19.65	16.95	15.71	18.03	18.24	21.26	23.21	25.2		(46)
	storage		includir		olor or M		storago	within co	mayas	col		4.4.0	1	(47)
-							-	within sa		501		110		(47)
	•	-			-) litres in	(47) mbi boile	ars) ente	ər 'O' in (47)			
	storage		not wate			notantai	10003 00							
	-	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b			• •					0		(49)
		m water			ear			(48) x (49)	=			10		(50)
		urer's de	-	-		or is not					·	10		(00)
		age loss			e 2 (kWl	h/litre/da	ay)				0.	08]	(51)
	•	eating s		on 4.3									1	
		from Tal		0								03		(52)
I empe	erature f	actor fro	m I able	∠b							0.	78		(53)

•••		om water (54) in (5	-	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		71 71		(54) (55)
Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)ı	m	L			. ,
(56)m=	208.01	187.88	208.01	201.3	208.01	201.3	208.01	208.01	201.3	208.01	201.3	208.01		(56)
		s dedicate	l d solar sto	rage, (57)	I m = (56)m	x [(50) – (I [H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	208.01	187.88	208.01	201.3	208.01	201.3	208.01	208.01	201.3	208.01	201.3	208.01		(57)
Primar	ry circuit	loss (ar	nual) fro	om Table	e 3			-		-		0		(58)
Primar	ry 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	a cylinde	r thermo	stat)			
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(59)
Combi	i 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	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)	m
(62)m=	509.85	455.55	492.94	462.02	467.35	356.23	356.04	371.49	364.82	478.11	480.23	504.38		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	KH (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)	-			l	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	509.85	455.55	492.94	462.02	467.35	356.23	356.04	371.49	364.82	478.11	480.23	504.38		
								Outp	out from wa	ater heate	r <mark>(annual)</mark> ₁	12	5299.01	(64)
Hea <mark>t g</mark>	j <mark>ain</mark> s fro	m water	heating.	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (<mark>59)m</mark>]	
(65)m=	160.38	143.21	15 <mark>4.76</mark>	144.77	146.25	71.11	69.47	74.61	73.97	149.82	150.83	158.56		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table {	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts								-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	-	_	_		
(67)m=	60.93	54.12	44.01	33.32	24.91	21.03	22.72	29.53	39.64	50.33	58.75	62.63		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	404.88	409.08	398.49	375.95	347.5	320.76	302.9	298.7	309.28	331.82	360.27	387.01		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5				
(69)m=	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7		(69)
Pumps	s and fa	ns gains	(Table &	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)							•	-			
(72)m=	215.57	213.11	208.01	201.07	196.57	98.76	93.38	100.28	102.73	201.38	209.48	213.12		(72)
Total i	internal	gains =	:			(66))m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	792.34	787.28	761.48	721.31	679.95	551.52	529.96	539.48	562.62	694.5	739.47	773.73		(73)
6. So	lar gains	5:	•	•	•	•	•		•					

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)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.76	x	0.7	=	66.19	(78)
South 0.9x	0.77	x	1.92	x	76.57	x	0.76	x	0.7	=	108.4	(78)
South 0.9x	0.77	x	1.92	x	97.53	x	0.76	x	0.7	=	138.08	(78)
South 0.9x	0.77	x	1.92	x	110.23	×	0.76	x	0.7	=	156.06	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.76	x	0.7	=	162.62	(78)
South 0.9x	0.77	x	1.92	x	110.55	x	0.76	x	0.7	=	156.5	(78)
South 0.9x	0.77	x	1.92	x	108.01	×	0.76	x	0.7	=	152.91	(78)
South 0.9x	0.77	x	1.92	x	104.89	x	0.76	x	0.7	=	148.5	(78)
South 0.9x	0.77	x	1.92	x	101.89	x	0.76	x	0.7	=	144.24	(78)
South 0.9x	0.77	x	1.92	x	82.59	×	0.76	x	0.7	=	116.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	×	0.76	x	0.7	=	78.45	(78)
South 0.9x	0.77	x	1.92	x	40.4	x	0.76	x	0.7	=	57.19	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.76	x	0.7	=	8.68	(79)
Southwest0.9x	0.77	x	0.64	x	62.67		0.76	x	0.7	=	14.79	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.76	x	0.7	=	20.23	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.76	х	0.7	=	25.07	(79)
Southwest0.9x	0.77	x	0.64	x	119.01		0.76	x	0.7	=	28.08	(79)
Southwest _{0.9x}	0.77	x	0.64	х	118.15		0.76	x	0.7	=	27.88	(79)
Southwest0.9x	0.77	x	0.64	x	113.91		0.76	x	0.7	=	26.88	(79)
Southwest0.9x	0.77	x	0.64	×	104.39		0.76	x	0.7	=	24.63	(79)
Southwest <mark>0.9x</mark>	0.77	x	0.64	x	92.85		0.76	x	0.7	=	21.91	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.76	x	0.7	=	16.34	(79)
Southwest0.9x	0.77	x	0.64	x	44.07		0.76	x	0.7	=	10.4	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.76	x	0.7	=	7.43	(79)
West 0.9x	0.77	x	4.33	x	19.64	x	0.76	x	0.7	=	125.41	(80)
West 0.9x	0.77	x	4.33	x	38.42	x	0.76	x	0.7	=	245.33	(80)
West 0.9x	0.77	x	4.33	x	63.27	×	0.76	x	0.7	=	404.03	(80)
West 0.9x	0.77	x	4.33	x	92.28	x	0.76	x	0.7	=	589.25	(80)
West 0.9x	0.77	x	4.33	x	113.09	x	0.76	x	0.7	=	722.15	(80)
West 0.9x	0.77	x	4.33	x	115.77	x	0.76	x	0.7	=	739.25	(80)
West 0.9x	0.77	x	4.33	x	110.22	x	0.76	x	0.7	=	703.8	(80)
West 0.9x	0.77	x	4.33	x	94.68	×	0.76	x	0.7	=	604.55	(80)
West 0.9x	0.77	x	4.33	x	73.59	x	0.76	x	0.7	=	469.9	(80)
West 0.9x	0.77	x	4.33	x	45.59	×	0.76	x	0.7	=	291.11	(80)
West 0.9x	0.77	x	4.33	×	24.49	×	0.76	x	0.7	=	156.37	(80)
West 0.9x	0.77	x	4.33	x	16.15	×	0.76	x	0.7	=	103.13	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m		_	_
(83)m=	200.28	368.52	562.34	770.38	912.86	923.63	883.59	777.68	636.05	424.37	245.23	167.75	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	992.63	1155.8	1323.82	1491.7	1592.8	1475.15	1413.55	1317.16	1198.68	1118.87	984.7	941.48	(84)

7. Me	an inter	nal temp	oerature	(heating	season)								
							from Tal	ble 9, Th	1 (°C)			1	21	(85)
-		•	• •	living are		-		ŗ	()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.97	0.93	0.87	0.77	0.63	0.68	0.86	0.95	0.98	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.76	18.98	19.38	19.92	20.4	20.74	20.9	20.87	20.57	19.98	19.29	18.75		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.87	19.88	19.88	19.91	19.92	19.94	19.94	19.94	19.93	19.92	19.91	19.9		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.96	0.92	0.83	0.69	0.51	0.56	0.81	0.94	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to ⁻	7 in Tabl	le 9c)				
(90)m=	17.83	18.06	18.45	19	19.46	19.78	19.9	19.88	19.64	, 19.07	18.39	17.83		(90)
									1	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	18.22	18.45	18.84	19.39	19.86	20.18	20.32	20.3	20.03	19.46	18.77	18.22		(92)
Ap <mark>ply</mark>	adjustn	nent to t	he mear	n internal	temper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	18.22	18.45	18.84	19. <mark>3</mark> 9	19.86	2 <mark>0.18</mark>	20.32	20.3	20.03	19.46	18.77	18.22		(93)
8. Spa	ace hea	ւ <mark>ting re</mark> qu	uirement											
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a														
the ut	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l Utilisa		tor for g			Iviay	Jun	Jui	Aug		000	NOV	Dee		
(94)m=	0.98	0.97	0.95	0.91	0.83	0.71	0.56	0.61	0.81	0.93	0.97	0.99		(94)
Usefu	I gains,	hmGm	, W = (94	ا 4)m x (8	4)m			I		<u></u>				
(95)m=	976.72	1126.06	1263.04	1356.83	, 1317.75	1049.02	785.95	797.59	975.52	1041.23	959.85	928.64		(95)
Month	nly aver	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
1		1	r	· · ·	-	1		x [(93)m	<u> </u>	r				
· · /				2509.22				905.82		2109.24		3401.68		(97)
		î		i		í –		24 x [(97	1	1		4000.04		
(98)m=	1836.96	1485.43	1310.61	829.72	464.41	0	0	0	0	794.6	1328.35			
_								lota	ll per year	(kWh/year) = Sum(9)	8)15,912 =	9890.02	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								90.07	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	g micro-C	CHP)					
•	e heatir on of sp	-	at from s	econdar	v/supple	mentarv	system						0	(201)
	-			nain syst		,, ,	- ,	(202) = 1	– (201) =				1	(202)
				main syst	. ,				02) × [1 –	(203)] =			1	(204)
			•	ing syste									81	(206)
	-			ementar		a svster	յ. %						0	(208)
			.,		,	5 5,51011	., ,.						<u> </u>	(====)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	,)	-				-	-		
	1836.96	1485.43	1310.61	829.72	464.41	0	0	0	0	794.6	1328.35	1839.94		
(211)m				00 ÷ (20				1					7	(211)
	2267.86	1833.86	1618.03	1024.35	573.35	0	0		0 II (kWh/yea	980.98	1639.93			
Snoo	o hootin	a fuel (e	ooondor	v) L/M/6/	month			TOLA	ii (KVVII/yea	ar) =Sum(2	211) _{15,1012}	2	12209.9	(211)
•		g luei (s [.])1)] } x 1		y), kWh/ 18)	month									
(215)m=		0	0	0	0	0	0	0	0	0	0	0]	
								Tota	il (kWh/yea	ar) =Sum(2	215) _{15,1012}	_	0	(215)
	heating													
Output	509.85	ater hea 455.55	ter (calc 492.94	ulated a	20VE) 467.35	356.23	356.04	371.49	364.82	478.11	480.23	504.38	1	
Efficier	ncy of w	ater hea								_			81	(216)
(217)m=	81	81	81	81	81	81	81	81	81	81	81	81		(217)
		heating,											-	
	1 = (64) 629.45	m x 100 562.4) ÷ (217) 608.57	m 570.4	576.98	439.79	439.56	458.63	450.4	590.25	592.88	622.69	1	
								Tota	l II = Sum(2	19a) ₁₁₂ =	1		6541.99	(219)
	I totals									k	Wh/year		kWh/year	-
Space heating fuel used, main system 1														
Water	heating	fuel use	d										6541.99	
Electric	city for p	oumps, fa	ans and	electric	keep-hot	t								
centra	al heatin	ig pump:										120		(230c)
Tota <mark>l e</mark>	electricity	/ for the	above,	<mark>kWh/</mark> yea	r			sum	of (230a).	<mark>(2</mark> 30g) =			120	(231)
Electric	city for li	ghting											430.44	(232)
10a. I	⁻ uel cos	ts - indiv	/idual he	eating sy	stems:									-
						Fu	el			Fuel P	rice		Fuel Cost	
							/h/year			(Table			£/year	
Space	heating	- main s	system 1			(21	1) x			3.4	8	x 0.01 =	424.9	(240)
Space	heating	- main s	system 2	2		(21:	3) x			0		x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			6.6	51	x 0.01 =	0	(242)
Water	heating	cost (oth	ner fuel)			(219	9)			3.4	8	x 0.01 =	227.66	(247)
Pumps	s, fans a	nd elect	ric keep·	-hot		(23	1)			13.	19	x 0.01 =	15.83	(249)
(if off-p	eak tari	ff, list ea	ich of (2	30a) to (230g) se	eparately	/ as app	licable a	nd apply			ding to	Table 12a	_
• •	/ for ligh		X	, (0,	(23			,	13.		x 0.01 =	56.77	(250)
Additio	nal star	nding cha	arges (T	able 12)									120	(251)
Appen	dix Q ite	ems: rep	eat lines	; (253) ai	nd (254)	as need	ded							
••		y cost		. ,	. ,		50)(254)	=					845.17	(255)
11a. S	SAP rati	ng - indi	vidual h	eating sy	vstems									

Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(255) x	(256)] ÷ [(4) + 45.0] =		2.29	(257)
SAP rating (Section 12)			68.01	(258)
12a. CO2 emissions – Individual heating syste	ems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x	0.216 =	2637.34	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	1413.07	(264)
Space and water heating	(261) + (262) + (263) + (26	4) =	4050.41	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	62.28	(267)
Electricity for lighting	(232) x	0.519 =	223.4	(268)
Total CO2, kg/year		sum of (265)(271) =	4336.09	(272)
CO2 emissions per m ²		(272) ÷ (4) =	39.49	(273)
El rating (section 14)			62	(274)
13a. Primary Energy				
Space heating (main system 1)	Energy kWh/year (211) x	Primary factor	P. Energy kWh/year	(261)
Space heating (secondary)	(215) x	3.07 =	0	(263)
Energy for water heating	(219) x	1.22 =	7981.23	(264)
Space and water heating	(261) + (262) + (263) + (26	4) =	22877.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	368.4	(267)
Electricity for lighting	(232) x	0 =	1321.44	(268)
'Total Primary Energy		sum of (265)(271) =	24567.15	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	223.74	(273)

				User D	etails:						
Assessor Name: Software Name:	Stroma	a FSAP 201			Softwa	a Num are Ver : LG1 Ba	sion:		Versio	n: 1.0.5.7	
Address :	, Londo	on									
1. Overall dwelling dim	ensions:										
				Area	a(m²)	I	Av. Hei	ight(m)		Volume(m ³)	-
Basement				6	67.4	(1a) x	2	2.8	(2a) =	188.72	(3a)
Ground floor				4	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA = (1a)+(1b)+((1c)+(1d)+(1e))+(1r	I) 1	09.8	(4)					_
Dwelling volume	298.96	(5)									
2. Ventilation rate:		-									
	mai heat		condar eating	у	other		total			m ³ per hour	
Number of chimneys		0 +	0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues		0 +	0	ī + Ē	0] = [0	x 2	20 =	0	(6b)
Number of intermittent f	ans	L_					4	x 1	10 =	40] (7a)
Number of passive vent	S						0	x 1	10 =	0	(7b)
							_	x 4	40 =	0	(7c)
Number of flueless gas fires 0 $\times 40 =$ Air change Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 40 $\div (5) =$											
If a pressurisation test has						continue fre	40 om (9) to (÷ (5) =	0.13	(8)
Number of storeys in			., ,							0	(9)
Additional infiltration								[(9)-	1]x0.1 =	0	(10)
Structural infiltration:	0.25 for ste	eel or timber f	rame or	0.35 for	r masonr	y constr	uction			0	(11)
if both types of wall are deducting areas of oper			oonding to	the great	er wall are	a (after					
If suspended wooden	• ·		ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
lf no draught lobby, e	nter 0.05, e	else enter 0								0	(13)
Percentage of window	vs and doo	ors draught sti	ripped							0	(14)
Window infiltration						x (14) ÷ 1	1			0	(15)
Infiltration rate						+ (11) + (1	, , ,	``		0	(16)
Air permeability value				•		•	etre of e	nvelope	area	5	(17)
If based on air permeab Air permeability value appl	•						is haina us	bod	l	0.38	(18)
Number of sides shelter			been don			inicability	s being at	500	[2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ating shelte	er factor			(21) = (18)) x (20) =				0.33	(21)
Infiltration rate modified	for monthl	ly wind speed									
Jan Feb	Mar A	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	peed from	Table 7									
(22)m= 5.1 5	4.9 4	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	te (allow	ing for sl	nelter an	d wind s	peed) =	(21a) x	(22a)m			-		
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	quation (I	N5)) , othe	erwise (23b	o) = (23a)			0	
						or in-use fa				, , ,			0	
a) lf	balance	ed mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)		(===)
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	overy (N	ч ИV) (24t)m = (2	1 2b)m + (23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilatio	on from o	outside				•	
i	if (22b)n	n < 0.5 >	× (23b), †	then (24	c) = (23k	o); otherv	vise (24	c) = (22	b) m + 0	.5 × (23t) 	i	1	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
						ve input v erwise (24				0.5]				
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effe	<mark>ctiv</mark> e air	change	rate - ei	nter (24a) or (24k	o) or (240	c) or (24	d) in bo	x (25)					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. He	at losse	s and he	eat loss	paramet	er: 🧹									
ELEN		Gro		Openin m	gs	Net Are A ,n		U-val W/m2		A X U (W/		k-value kJ/m²·I		A X k kJ/K
Doo <mark>rs</mark>						1.98	X	1	=	1.98				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(1.4)+	0.04] =	5.74				(27)
Windo	ws Type	92				1.92	x1	/[1/(1.4)+	- 0.04] =	2.55				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(1.4)+	- 0.04] =	0.85				(27)
Floor 7	Гуре 1					30	x	0.13	=	3.9				(28)
Floor 7	Гуре 2					37.4	x	0.13	=	4.862	i F		Ξ F	(28)
Walls -	Type1	48.	6	4.48	;	44.12	x	0.18	=	7.94	ו ר		ΞĒ	(29)
Walls	Type2	32.	8	17.3	2	15.48	x	0.18	=	2.79	- i		- -	(29)
Walls	ТуреЗ	8.6	6	0		8.6	x	0.18	=	1.55	T I		ΞĒ	(29)
Walls -	Type4	3.1	1	1.98	3	1.12	x	0.18	=	0.2	i F		- -	(29)
Walls ⁻	Туре5	13.	3	0		13.3	x	0.18	=	2.39	i F		ΞĒ	(29)
Total a	area of e	elements	s, m²			173.8		-			I			(31)
* for win	dows and	roof wind	lows, use e	effective wi	ndow U-va	alue calcula	ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	paragraph	ז 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) =	54.52	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not know	n precisely the indicative values of TMP in Table 1f	<u>-</u>	-

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

can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	Thermal bridges : S (L x Y) calculated using Appendix K													(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			70.77	(37)
Ventila	tion hea	at loss ca	alculated	monthl	ý				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.86	57.53	57.21	55.68	55.4	54.07	54.07	53.82	54.58	55.4	55.97	56.58		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	128.63	128.3	127.97	126.45	126.16	124.83	124.83	124.59	125.34	126.16	126.74	127.34		
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	126.44	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16		
Numbe	er of day	/s in moi	nth (Tab	le 1a)		1				Average =	Sum(40)1.	12 /12=	1.15	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
4. Water heating energy requirement:														
4. Water heating energy requirement: kWh/year:														
		upancy,		14 ovo	(0 0003	ио у (тг	- 120		012 v /	TEA 42		81		(42)
	A > 13. A £ 13.		+ 1.70 X	li - exp	(-0.0003	949 X (11	-A - 13.9)2)] + 0.0	JU 13 X (IFA - 13.	9)			
Annua	l averag	je hot wa						(25 x N)				1.02		(43)
				usage by . r day (<mark>all</mark> w		-	7	to achieve	a water us	se target o	f			
normore												_	1	
Listwet	Jan	Feb	Mar	Apr ach month	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
				1						1				
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
lf instan	tanoous v	ator hoati	ng at pain	f uso (no	hot wator	r storago)	ontor 0 in	boxes (46,		Total = Su	m(45) ₁₁₂ =		1589.49	(45)
				· · ·									1	(10)
(46)m= Water	0 storage	0 loss:	0	0	0	0	0	0	0	0	0	0		(46)
	0		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150]	(47)
-		. ,		ink in dw			-						1	
		•			•			mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:											_	
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Tempe	erature f	actor fro	m Table	2b								0]	(49)
			-	, kWh/ye				(48) x (49)	=			0]	(50)
				cylinder l om Tabl								0	1	(51)
		leating s				n/nu 6/08	•y)					0]	(51)
	•	from Ta										0]	(52)
Tempe	erature f	actor fro	m Table	2b								0]	(53)

•••		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	. , .		for each	month			((56)m = (55) × (41)	m		-		
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contain	s dedicate	l d solar sto	nage, (57)	I m = (56)m	x [(50) – (H11)] ÷ (50	0), else (5	1 7)m = (56)	n where (H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
	•						(58) ÷ 36 ter heatir	• •		r thormo	etat)			
(110) (59)m=												0		(59)
			for oook	month	(61)m -	(60) + 20	SE v (41)							
(61)m=						$(60) \div 30$	65 × (41)	0	0	0	0	0		(61)
			_		_		-			-		-	(50) m + (61)	
(62)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	(02)III = 97.04	98.2	114.44	124.92	135.66	(59)m + (61) I	(62)
							ve quantity							(02)
							, see Ap			r contribut	ION IO WAIE	er neating)		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	Į					1		1			
(64)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		
								Outp	out from wa	ater heate	r (annual)₁	12	1351.07	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m]	
(65)m=	<mark>3</mark> 5.02	30.63	<u>31</u> .61	27.55	26.44	22.81	21.14	24.26	24.55	28.61	31.23	33.91		(65)
in <mark>clu</mark>	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated in	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	, also se	ee Table	5				
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.g. ev	vaporatic	on (nega	tive valu	es) (Tab	ole 5)							-	
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)											
(72)m=	47.07	45.58	42.48	38.27	35.54	31.69	28.42	32.61	34.1	38.45	43.38	45.58		(72)
Total i	internal	gains =				(66))m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	407.91	406.51	392.28	368.69	343.53	320.21	305.65	309.75	322.38	346.11	373.46	395.14		(73)
6. So	lar gains	S:												

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9	0.77	x	1.92	x	46.75	×	0.63	x	0.7	=	54.87	(78)
South 0.9	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9	0.77	x	1.92	x	97.53	×	0.63	x	0.7	=	114.46	(78)
South 0.9	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9	0.77	x	0.64	x	62.67]	0.63	x	0.7	=	12.26	(79)
Southwest0.9	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Southwest0.9	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest0.9	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9	(0.7 <mark>7</mark>	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9	0.77	x	0.64	x	104. <mark>3</mark> 9		0.63	x	0.7	=	20.42	(79)
Southwest0.9	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9	0.77	x	0.64	x	31.49]	0.63	x	0.7	=	6.16	(79)
West 0.9	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9	0.77	x	4.33	x	38.42	×	0.63	x	0.7	=	203.37	(80)
West 0.9	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9	0.77	x	4.33	×	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9	0.77	x	4.33	x	113.09	×	0.63	x	0.7	=	598.62	(80)
West 0.9	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9	0.77	x	4.33	×	94.68	×	0.63	x	0.7	=	501.14	(80)
West 0.9	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9	0.77	x	4.33	x	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9	0.77	x	4.33	×	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month		_	(83)m = S	um(74)m .	(82)m			
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	Total gains – internal and solar (84)m = (73)m + (83)m , watts												
(84)m=	573.94	712	858.43	1007.3	1100.24	1085.85	1038.1	954.41	849.63	697.89	576.74	534.2	(84)

7.1010	ean inter	nal temp	perature	(heating	season)								
Temp	perature	during h	neating p	periods in	n the livii	ng area	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=	1	1	0.99	0.95	0.86	0.69	0.52	0.58	0.84	0.98	1	1		(86)
Mean	n interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.66	19.84	20.14	20.51	20.81	20.95	20.99	20.98	20.87	20.46	19.99	19.63		(87)
Temp	berature	durina h	neating p	periods ir	n rest of	dwellina	from Ta	ble 9. Tl	h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Litilis	ation fac	tor for a	ains for	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	1	0.98	0.94	0.81	0.6	0.4	0.46	0.77	0.97	1	1		(89)
		l tompor	Iin	the reat	of dwalli	na T2 (f			Tin Tohl					
(90)m=	18.72	18.9	ature in	19.57	19.83	19.95	19.97	19.97	19.9	19.53	19.06	18.7		(90)
(00)=	10.12	10.0	10.2	10.01	10.00	10.00	10.01	10.01			g area ÷ (4		0.42	(91)
	• .							<i></i>			. .	, 	0.42	(
	r	· · · ·	ature (fo	1	1		1	,	, 	40.00	40.45	40.00		(92)
(92)m=	19.12	19.3	19.6	19.97	20.24	20.38	20.4	20.4	20.31	19.92	19.45	19.09		(92)
(93)m=	19.12	19.3	he mear	19.97	20.24	20.38	20.4	20.4	20.31	19.92	19.45	19.09		(93)
			uirement		20.24	20.30	20.4	20.4	20.31	19.92	19.45	19.09		(00)
					re obtain	ed at st	en 11 of	Table 9	o so tha	t Ti m=('	76)m an	d re-calc	ulate	
			or gains					Tuble of	5, 65 tha		- c) c		ulato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>is</mark> a	ation for	tor for a	ains, hm											
	ation fac	tor for g						-						
(94)m=		0.99	0.98	0.94	0.83	0.63	0.45	0.51	0.8	0.97	1	1		(94)
Usefu	1 ul gains,	0.99		0.94		0.63	0.45	0.51	0.8	0.97	1	1		(94)
Usefu (95)m=	1 JI gains, 572.88	0.99 hmGm 708.13	0.98 , W = (94 843.12	0.94 4)m x (8 944.49	4)m 908.25	687.9	0.45	0.51 489.25	0.8	0.97 676.43	1 574.29	1 533.51		(94) (95)
Usefu (95)m= Monti	1 ul gains, 572.88 hly avera	0.99 hmGm 708.13 age exte	0.98 , W = (94 843.12 ernal tem	0.94 4)m x (8- 944.49 perature	4)m 908.25 e from Ta	687.9 able 8	469.66	489.25	676.53	676.43	574.29	533.51		(95)
Usefu (95)m= Monti (96)m=	1 Jul gains, 572.88 hly avers 4.3	0.99 hmGm 708.13 age exte 4.9	0.98 , W = (94 843.12 ernal tem 6.5	0.94 4)m x (8- 944.49 perature 8.9	4)m 908.25 e from Ta 11.7	687.9 able 8 14.6	469.66 16.6	489.25 16.4	676.53 14.1	676.43 10.6	I		1	
Usefu (95)m= Month (96)m= Heat	1 J gains, 572.88 hly avera 4.3 loss rate	0.99 hmGm 708.13 age exte 4.9 e for mea	0.98 , W = (94 843.12 ernal tem 6.5 an intern	0.94 4)m x (8 944.49 perature 8.9 nal tempo	4)m 908.25 e from Ta 11.7 erature,	687.9 able 8 14.6 Lm , W =	469.66 16.6 =[(39)m 2	489.25 16.4 x [(93)m	676.53 14.1 - (96)m	676.43 10.6	574.29 7.1	533.51 4.2		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76	4)m 908.25 e from Ta 11.7 erature, 1077.99	687.9 able 8 14.6 Lm , W = 721.02	469.66 16.6 =[(39)m 474.56	489.25 16.4 x [(93)m 498.18	676.53 14.1 - (96)m 778.38	676.43 10.6] 1176.41	574.29 7.1 1565.14	533.51		(95)
Usefu (95)m= Montil (96)m= Heat (97)m= Spac	1 J gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97)	676.53 14.1 - (96)m 778.38)m - (95	676.43 10.6] 1176.41)m] x (4	574.29 7.1 1565.14 1)m	533.51 4.2 1896.21		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76	4)m 908.25 e from Ta 11.7 erature, 1077.99	687.9 able 8 14.6 Lm , W = 721.02	469.66 16.6 =[(39)m 474.56	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4030.61	(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4930.61	(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4930.61 44.91	(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1J gains,572.88hly avera4.3loss rate1905.69e heatin991.61e heatinpace co	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require oling req	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1 JI gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61 e heatin ulated fo	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require r June,	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in quiremer	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² nt August.	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 ² /year	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 $=[(39)m = 474.56$ $th = 0.02$ 0	489.25 16.4 x [(93)m 498.18 24 x [(97 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9	533.51 4.2 1896.21 1013.85 8) ₁₅₉₁₂ =		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac	1 JI gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require r June, C Feb	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² t August. Apr	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28 2/year <u>See Tal</u> May	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m 2 474.56 th = 0.02 0	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov	533.51 4.2 1896.21 1013.85 8)15.912 =		(95) (96) (97)
Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200 Calcu Heat	1 JI gains, 572.88 hly averation 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan loss rate Joss rate	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar liculated	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m² ht August. Apr using 29	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 2/year See Tal May 5°C inter	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota Aug and exte	676.53 14.1 - (96)m 778.38)m - (95 0 I per year Sep ernal ten	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov e from T	533.51 4.2 1896.21 1013.85 8)15912 = Dec able 10)		(95) (96) (97) (98) (99)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200)m=	1 JI gains, 572.88 hly averation 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan loss rate 0	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 0 ling rec r June, C Feb e Lm (ca 0	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar loculated 0	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² t August. Apr	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28 2/year <u>See Tal</u> May	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov	533.51 4.2 1896.21 1013.85 8)15.912 =		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200)m=	1 JI gains, 572.88 hly averation 4.3 Ioss rate 1905.69 e heatin 991.61 e heatin 1905.69 e heatin 991.61 loss rate Jan loss rate 0 ation fact	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar loculated 0	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m² ht August. Apr using 29	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 2/year See Tal May 5°C inter	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota Aug and exte	676.53 14.1 - (96)m 778.38)m - (95 0 I per year Sep ernal ten	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov e from T	533.51 4.2 1896.21 1013.85 8)15912 = Dec able 10)		(95) (96) (97) (98) (99)

Usefu	l loss, h	nmLm (W	Vatts) =	(100)m x	(101)m									
(102)m=	0	0	0	0	0	1050.05	872.68	873.47	0	0	0	0]	(102)
Gains	(solar	gains ca	lculated	for appli	cable w	eather re	egion, se	e Table	10)				_	
(103)m=	0	0	0	0	0	1379.35	1321.11	1225.3	0	0	0	0		(103)
		<i>g require</i> zero if (dwelling,	continue	ous (kW	(h) = 0.0	24 x [(10	03)m – (102)m]	x (41)m	
(104)m=	0	0	0	0	0	237.09	333.63	261.76	0	0	0	0]	
L									Total	= Sum(104)	=	832.49	(104)
Cooled fraction $f C = cooled area \div (4) =$ 1Intermittency factor (Table 10b)1														
Intermi	ttency f	actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	l = Sum((104)	=	0	(106)
Space cooling requirement for month = $(104)m \times (105) \times (106)m$														
(107)m=	0	0	0	0	0	59.27	83.41	65.44	0	0	0	0		
														(107)
														(108)
8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)														
Fabric	Energ	y Efficier	псу						(99) ·	+ (108) =	=		46.8	(109)
Targe	t Fabri	c Energ	y Efficie	ency (TF	EE)								53.82	(109)
			-											

Assessor Name: Software Name:Stroma FSAP 2012Stroma Number: Software Version:Version:1.0.5.7Property Address:LG1 BaselineAddress:
Address :, LondonI. Overall dwelling dimensions:Area(m2)Av. Height(m)Volume(m3)Basement 67.4 $(1a) \times 2.8$ $(2a) =$ 188.72 $(3a)$ Ground floor 42.4 $(1b) \times 2.6$ $(2b) =$ 110.24 $(3b)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 109.8 (4) Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ 298.96 (5) C. Ventilation rate:main heatingsecondary heatingothertotalm³ per hourNumber of chimneys $0 + 0 + 0 =$ $0 \times 40 =$ 0 $(6a)$ Number of open flues $0 + 0 + 0 =$ $0 \times 20 =$ 0 (b) Number of passive vents $0 \times 10 =$ 0 $(7a)$ Number of flueless gas fires $0 \times 40 =$ 0 $(7c)$
A. Overall dwelling dimensions:Area(m²)Av. Height(m)Volume(m³)Basement 67.4 $(1a) \times 2.8$ $(2a) =$ 188.72 $(3a)$ Ground floor 42.4 $(1b) \times 2.6$ $(2b) =$ 110.24 $(3b)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 109.8 (4) Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ 298.96 (5) 2. Ventilation rate: Number of chimneys 0 $+$ 0 $x 40 =$ 0 $(6a)$ Number of passive vents 0 $x 10 =$ 0 $(6a)$ Number of passive vents 0 $x 40 =$ 0 $(6b)$ Number of flueless gas fires 0 $x 40 =$ 0 $(6a)$ 0 $x 40 =$ 0 $(6b)$ Number of passive vents 0 $x 40 =$ 0 $(7b)$ 0 $x 40 =$ 0 $(6a)$ 0 $x 40 =$ 0 $(6b)$ 0 $x 40 =$ 0 $(7b)$ 0 x
Area(m²) BasementAv. Height(m) 2.8 Volume(m³) 188.72 Ground floor 67.4 $(1a) \times 2.8$ $(2a) =$ 188.72 $(3a)$ Ground floor 42.4 $(1b) \times 2.6$ $(2b) =$ 110.24 $(3b)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 109.8 (4) $(3a)+(3c)+(3c)+(3c)+(3c)+(3c)+(3c)+(3c)+(3c$
Basement 67.4 (1a) x 2.8 (2a) = 188.72 (3a) Ground floor 42.4 (1b) x 2.6 (2b) = 110.24 (3b) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 109.8 (4) Dwelling volume $(3a)+(3c)+(3d)+(3e)+(3n) = 298.96$ (5) 2. Ventilation rate: Number of chimneys $0 + 0 + 0 = 0$ $x 40 = 0$ (6a) Number of open flues $0 + 0 + 0 = 0$ $x 20 = 0$ (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires 0 $x 40 = 0$ (7c)
Ground floor 42.4 (1b) x 2.6 (2b) = 110.24 (3b)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 109.8 (4)Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 298.96$ (5) 2. Ventilation rate: m^3 per hour heating heating 0 + 0 + 0 = 0 x 40 = 0 (6a)Number of chimneys 0 + 0 + 0 = 0 x 20 = 0 (6b)Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b)Number of intermittent fans 4 x 10 = 40 (7a)Number of flueless gas fires 0 x 40 = 0 (7c)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 109.8(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =298.96Owelling volume(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =298.96Number of chimneysOthertotalm³ per hourNumber of chimneys0+0(a)Number of chimneysO*O(a)Number of open fluesO*O(a)Number of intermittent fans•O*O*Number of passive ventsO*O*O*O*O*O*O**Number of chimneysO**O**O*****Number of open fluesO**O*O*O*

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	peed) =	(21a) x	(22a)m				-	
	0.96	0.94	0.92	0.83	0.81	0.71	0.71	0.69	0.75	0.81	0.85	0.88		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable cas	se							(220)
				endix N. (2	² 3b) = (23a	a) × Fmv (e	guation (I	N5)), othe	rwise (23ł	(23a) = (23a)			0	(23a) (23b)
						or in-use fa				<i>(200)</i>			0	(230) (23c)
			-	-	-	at recove				2b)m + (23b) x [⁻	1 – (23c)	_	(200)
(24a)m=		0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	overy (N	и V) (24t)m = (2	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	ntilation of	or positiv	ve input v	entilatio	on from a	outside		•			
i	if (22b)r	n < 0.5 >	< (23b), t	then (24	c) = (23k	o); otherw	/ise (24	c) = (22t	o) m + 0	.5 × (23t) 	i		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
						ve input v erwise (24				0.51				
(24d) <mark>m=</mark>	<u> </u>	0.94	0.92	0.84	0.83	0.75	+u)m = 0.75	0.5 + [(2	0.78	0.5]	0.86	0.89		(24d)
· /						o) or (24c				0.00	0.00	0.00		()
(25)m=	0.96	0.94	0.92	0.84	0.83	0.75	0.75	0.74	0.78	0.83	0.86	0.89	i 👘	(25)
											I			
				paramet							_			
ELEN		Gro: area	ss (m²)	Openin m	-	Net Are A ,m		U-val W/m2		A X U (W/	K)	k-value kJ/m²·ł		A X k kJ/K
Doo <mark>rs</mark>						1.98	×	3		5.94				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(3.1)+	0.04] =	11.94	=			(27)
Windo	ws Type	e 2				1.92	x1	/[1/(3.1)+	0.04] =	5.3	=			(27)
Windo	ws Type	e 3				0.64	x1	/[1/(3.1)+	0.04] =	1.77	=			(27)
Floor T	Гуре 1					30	×	0.25	=	7.5	ו ד			(28)
Floor T	Гуре 2					37.4	×	0.73	=	27.302	ו ה		i F	(28)
Walls -	Type1	48.	6	4.48	3	44.12	×	0.55		24.27	i F		i F	(29)
Walls -	Туре2	32.	8	17.3	2	15.48	×	0.35	=	5.42	i F		\exists	(29)
Walls -	Туре3	8.6	3	0		8.6	×	0.55	=	4.73	i F		i F	(29)
Walls -	Type4	3.1	 I	1.98	3	1.12	×	0.55	=	0.62	i F		Ξ F	(29)
Walls -	Type5	13.	3	0		13.3	x	0.28	=	3.72	= i		\dashv	(29)
Total a	area of e	elements	s, m²			173.8	=							(31)
* for win	dows and	l roof wind	lows, use e	effective wi	indow U-va	alue calcula	nted using	formula 1	/[(1/U-valu	ue)+0.04] a	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) =	139.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not known r		-	

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	<						26	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			165.62	(37)
Ventila	tion hea	at loss ca	alculated	monthl	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	94.58	92.83	91.1	83.01	81.5	74.45	74.45	73.15	77.17	81.5	84.56	87.76		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	260.2	258.45	256.72	248.63	247.12	240.07	240.07	238.77	242.79	247.12	250.18	253.38		
				(-	Sum(39)1	12 /12=	248.63	(39)
		· · ·	HLP), W/	i						= (39)m ÷			1	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
Number of days in month (Table 1a)													2.26	(40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec														
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$														(41)
													1	
4 \M/2	iter heat	ting ener	rgy requ	irement [.]								kWh/ye	ear.	
vvc			igy icqu	noment.										
		ipancy,			(ио (т г					2.	81]	(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	549 X (11	-A -13.9)2)] + 0.0	0013 X (IFA -13.	9)			
			ater usag	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		106	5.34	1	(43)
								to achieve	a water us	se target o			1	
not more	e that 125	litres per j	person pe	r day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	116.97	112.72	108.47	104.21	99.96	95.71	95.71	99.96	104.21	108.47	112.72	116.97		
-		1 - 1 1				100		T (0000			m(44) ₁₁₂ =		1276.09	(44)
			r		-						ables 1b, 1		1	
(45)m=	173.47	151.72	156.56	136.49	130.97	113.01	104.72	120.17	121.61	141.72	154.7	168		
lf instan	taneous w	ater heati	na at point	of use (no	hot water	r storage).	enter 0 in	boxes (46,		Fotal = Su	m(45) ₁₁₂ =		1673.15	(45)
	0	0	0	0	0	0	0	0		0	0	0	1	(46)
(46)m= Water	storage		0	0	0	0	0	0	0	0	0	0		(40)
	-		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		110]	(47)
If comr	nunity h	eating a	ind no ta	ink in dw	velling, e	nter 110) litres in	(47)					1	
		-			-			mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				(0]	(48)
Tempe	erature f	actor fro	m Table	2b							(0		(49)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=		(0		(50)
				ylinder l										
				om Tabl	e 2 (kW	h/litre/da	ay)				(0	J	(51)
	•	leating s from Ta	ee secti ble 22	un 4.3								0	1	(52)
			m Table	2b								0		(52) (53)
											L	0	J	

•		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	loss cal	,	for each	month			((56)m = (55) × (41)r	m		0	l	(00)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(56)
	_	-	-	-	-	-		-	7)m = (56)	-	-	-	l lix H	()
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	: loss (ar	nual) fro	om Table	9 3							0		(58)
	•	loss cal	,			59)m = ((58) ÷ 36	65 × (41)	m				1	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i 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)r	n
(62)m=	147.45	128.96	133.08	116.02	111.32	96.06	89.02	102.15	103.37	120.46	131.5	142.8		(62)
Solar DI	HW input	calculated	using App	endix G or	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 \	WWHRS	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=	147.45	128.96	133.08	116.02	111.32	96.06	89.02	102.15	103.37	120.46	131.5	142.8		
								Outp	out from wa	ater heate	r (annual)₁	12	1422.18	(64)
Hea <mark>t g</mark>	j <mark>ain</mark> s fro	m water	heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59)</mark> m]	
(65)m=	<mark>3</mark> 6.86	32.24	33.27	29	27.83	24.02	22 .25	25.54	25.84	30.12	32.87	35.7		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	<mark>or ho</mark> t w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	<u>olic gair</u>	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5	-	_		
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5	-			
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table \$	5a)									_	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. ev	vaporatic	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)										_	
(72)m=	49.55	47.98	44.72	40.28	37.41	33.36	29.91	34.32	35.89	40.48	45.66	47.98		(72)
Total i	internal	gains =				(66)	m + (67)m	n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m	_	
(73)m=	410.39	408.91	394.52	370.71	345.4	321.88	307.15	311.47	324.17	348.14	375.74	397.54		(73)
6. So	lar gains	S:												

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)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.76	x	0.7	=	66.19	(78)
South 0.9x	0.77	x	1.92	×	76.57	×	0.76	x	0.7	=	108.4	(78)
South 0.9x	0.77	x	1.92	×	97.53	×	0.76	x	0.7	=	138.08	(78)
South 0.9x	0.77	x	1.92	×	110.23	×	0.76	x	0.7	=	156.06	(78)
South 0.9x	0.77	x	1.92	x	114.87	×	0.76	x	0.7	=	162.62	(78)
South 0.9x	0.77	x	1.92	x	110.55	×	0.76	x	0.7	=	156.5	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.76	x	0.7	=	152.91	(78)
South 0.9x	0.77	x	1.92	x	104.89	x	0.76	x	0.7	=	148.5	(78)
South 0.9x	0.77	x	1.92	×	101.89	×	0.76	x	0.7	=	144.24	(78)
South 0.9x	0.77	x	1.92	x	82.59	x	0.76	x	0.7	=	116.92	(78)
South 0.9x	0.77	x	1.92	×	55.42	×	0.76	x	0.7	=	78.45	(78)
South 0.9x	0.77	x	1.92	x	40.4	x	0.76	x	0.7	=	57.19	(78)
Southwest0.9x	0.77	x	0.64	×	36.79]	0.76	x	0.7	=	8.68	(79)
Southwest0.9x	0.77	x	0.64	x	62.67		0.76	x	0.7	=	14.79	(79)
Southwest0.9x	0.77	x	0.64	×	85.75]	0.76	x	0.7	=	20.23	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.76	х	0.7	=	25.07	(79)
Southwest _{0.9x}	0.77	x	0.64	x	119.01		0.76	x	0.7	=	28.08	(79)
Southwest _{0.9x}	0.77	x	0.64	x	118.15		0.76	x	0.7	=	27.88	(79)
Southwest _{0.9x}	0.77	x	0.64	x	113.91		0.76	x	0.7	=	26.88	(79)
Southwest _{0.9x}	0.77	x	0.64	×	104.39		0.76	x	0.7	=	24.63	(79)
Southwest _{0.9x}	0.77	x	0.64	x	92.85		0.76	x	0.7	=	21.91	(79)
Southwest0.9x	0.77	x	0.64	x	69.27]	0.76	x	0.7	=	16.34	(79)
Southwest0.9x	0.77	x	0.64	×	44.07		0.76	x	0.7	=	10.4	(79)
Southwest0.9x	0.77	x	0.64	×	31.49]	0.76	x	0.7	=	7.43	(79)
West 0.9x	0.77	x	4.33	x	19.64	×	0.76	x	0.7	=	125.41	(80)
West 0.9x	0.77	x	4.33	×	38.42	×	0.76	x	0.7	=	245.33	(80)
West 0.9x	0.77	x	4.33	x	63.27	x	0.76	x	0.7	=	404.03	(80)
West 0.9x	0.77	x	4.33	x	92.28	x	0.76	x	0.7	=	589.25	(80)
West 0.9x	0.77	x	4.33	×	113.09	×	0.76	x	0.7	=	722.15	(80)
West 0.9x	0.77	x	4.33	×	115.77	×	0.76	x	0.7	=	739.25	(80)
West 0.9x	0.77	x	4.33	×	110.22	×	0.76	x	0.7	=	703.8	(80)
West 0.9x	0.77	x	4.33	×	94.68	×	0.76	x	0.7	=	604.55	(80)
West 0.9x	0.77	x	4.33	×	73.59	x	0.76	x	0.7	=	469.9	(80)
West 0.9x	0.77	x	4.33	×	45.59	×	0.76	x	0.7	=	291.11	(80)
West 0.9x	0.77	x	4.33	×	24.49	×	0.76	x	0.7	=	156.37	(80)
West 0.9x	0.77	x	4.33	×	16.15	×	0.76	x	0.7	=	103.13	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m			
(83)m=	200.28	368.52	562.34	770.38	912.86	923.63	883.59	777.68	636.05	424.37	245.23	167.75	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													-
(84)m=	610.67	777.43	956.86	1141.09	1258.26	1245.51	1190.73	1089.15	960.22	772.51	620.97	565.29	(84)

7. Me	an inter	nal temp	oerature	(heating	season)								
				` Ŭ		,	from Tab	ole 9. Th	1 (°C)				21	(85)
•		-	• •	living are		-			. (0)					
Othise	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.97	0.92	0.83	0.71	0.76	0.92	0.98	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ps 3 to 7	r in Tabl	e 9c)					
(87)m=	18.39	18.62	19.05	19.65	20.19	20.64	20.85	20.81	20.43	19.71	18.97	18.39		(87)
Temp	erature	durina h	eating p	eriods ir	n rest of	dwellina	from Ta	ble 9. T	h2 (°C)			-		
(88)m=	19.1	19.11	19.12	19.16	19.17	19.21	19.21	19.22	19.2	19.17	19.15	19.14		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.87	0.71	0.49	0.56	0.84	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (fe	ollow ste	eps 3 to 3	7 in Tabl	le 9c)				
(90)m=	16.83	17.07	17.5	18.12	18.64	19.05	19.18	19.17	18.89	18.2	17.45	16.86		(90)
									1	fLA = Livin	g area ÷ (4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) × T2			I		
(92)m=	17.49	17.73	18.15	18.77	19.3	19.72	19.89	19.86	, 19.54	1 <mark>8.84</mark>	18.1	17.51		(92)
Apply	v adjustn	nent to tl	he mear	interna	l temper	ature fro	m Table	4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	17.49	17.73	18.15	18.77	19.3	1 <mark>9.72</mark>	19.89	19.86	19.54	18.84	18.1	17.51		(93)
8. Sp	ace hea	ting requ	uirement											
						ed at ste	ep 1 <mark>1 of</mark>	Table 9	o, so tha	t Ti <mark>,m=(</mark>	76)m an	d re-calc	ulate	
the ut	tilisation			using Ta	able 9a							i		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	I I	
		tor for g												
(94)m=	0.99	0.99	0.98	0.95	0.88	0.75	0.59	0.65	0.86	0.97	0.99	1	I	(94)
	<u> </u>	i	i È	4)m x (84	<u>,</u>					I				(05)
(95)m=	607.61	769.36	934.85	1078.9	1106.11	937.13	698.68	703.2	826.14	747.22	615.69	563.1	I	(95)
	r –	r	1	perature	1	1	1		1	1	1	,		(22)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	I	(96)
		-	r	· ·	r	r	=[(39)m : I		r , ,	ŕ – – –	1			(07)
(97)m=				2452.97				827.04	1321.01		2750.87	3372.31	I	(97)
(98)m=		g require 1711.17	1530.59	989.33	573.64		th = 0.02	<u>4 x [(97</u>)m – (95 0	958.53	1)m 1537.34	2090.05		
(50)11-	2101.00	17 11.17	1000.00	000.00	070.04	0	0		l per year			I	11491.7	(98)
Snac	o hoatin	a require	amont in	kWh/m²	2/voar					(,	- /	104.66	(99)
					/year								104.00	
		oling rec				ala 10h								
Calcu	Jan	Feb	Mar	August. Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat			I		,							able 10)		
(100)m=	-	0	0	0	0	· · · · ·	1776.54	1	1	0	0	0		(100)
		tor for lo	ss hm	I			<u>.</u>	I	I	<u> </u>	ļ	<u>.</u>		
(101)m=	0	0	0	0	0	0.61	0.69	0.65	0	0	0	0		(101)

Usefu	l loss, h	mLm (W	/atts) = ((100)m x	: (101)m									
(102)m=	0	0	0	0	0	1368.54	1225.04	1174.16	0	0	0	0		(102)
Gains	(solar g	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)			•	•	
(103)m=	0	0	0	0	0	1565.68	1499.26	1382.5	0	0	0	0		(103)
				r month, : 3 × (98		lwelling,	continuo	ous (kW	'h) = 0.0.	24 x [(1(03)m – ([102)m].	x (41)m	
(104)m=	0	0	0	0	0	141.94	204.02	155	0	0	0	0		
										= Sum(=	500.96	(104)
Cooled fractionf C = cooled area ÷ (4) =Intermittency factor (Table 10b)													1	(105)
		i	i	i									1	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
					(((Total	l = Sum((104)	=	0	(106)
· · ·	-	· · ·	i	i		× (105)					i		1	
(107)m=	0	0	0	0	0	35.48	51.01	38.75	0	0	0	0		_
									Total	= Sum(107)	=	125.24	(107)
Space	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)) ÷ (4) =			1.14	(108)
8f. Fab	ric Ene	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) ·	+ (108) =	=		105.8	(109)
			I											

					User D	etails:							
Assessor Name: Software Name:	Str	oma FS	AP 201			Strom Softwa	are Ver	sion:		Versio	n: 1.0.5.7		
Address :	Lo	ondon		Р	roperty.	Address	LGT Ba	aseline					
1. Overall dwelling d	,												
					Area	a(m²)		Av. He	ight(m)		Volume(m ³)		
Basement							(1a) x		2.8	(2a) =	188.72	(3a)	
Ground floor						42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)	
Total floor area TFA =	= (1a)+(1l	b)+(1c)+((1d)+(1e)+(1r	ı) <u> </u>	09.8	(4)			-		-	
Dwelling volume							(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)	
		main heating		econdar eating	у	other		total			m ³ per hour		
Number of chimneys	ſ	0] + [0	+	0] = [0	x 4	40 =	0	(6a)	
Number of open flues	Γ	0	<u> </u> + [0	<u> </u> + [0	- =	0	x 2	20 =	0	(6b)	
Number of intermitten	t fans							0	x ′	10 =	0	(7a)	
Number of passive ve	ents						L L	0	x ′	10 =	0	(7b)	
Number of flueless ga	as fires							0	X 4	40 =	0	(7c)	
										Air ch	anges per hou	ır.	
Infiltration due to chim								0		÷ (5) =	0	(8)	
If a pressurisation test h Number of storeys				ed, procee	d to (17), e	otherwise o	continue fr	om (9) to ((16)		0		
Additional infiltration)						[(9)·	-1]x0.1 =	0	(9) (10)	
Structural infiltration	า: 0.25 fo	r steel or	timber f	frame or	0.35 fo	r masoni	ry constr	uction		1	0	(11)	
if both types of wall a				ponding to	the great	er wall are	a (after					-	
deducting areas of op If suspended wood	• /	•		ed) or 0.	1 (seale	ed). else	enter 0				0	(12)	
If no draught lobby,				,	(,,					0	(13)	
Percentage of wind	ows and	doors dr	aught st	ripped							0	(14)	
Window infiltration						0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)	
Infiltration rate						(8) + (10)					0	(16)	
Air permeability val		•					•	etre of e	envelope	area	15	(17)	
If based on air perme Air permeability value ap	•							is heina u	sed		0.75	(18)	
Number of sides shelt		roodinoatio		been den		groo un po	inicability	io boilig at	300		2	(19)	
Shelter factor						(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)	
Infiltration rate incorpo	orating sh	nelter fac	tor			(21) = (18) x (20) =				0.64	(21)	
Infiltration rate modifie	1	<u> </u>				i	i	i	i	i	I		
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind		· · · · ·				i	i	i	i	i	I		
(22)m= 5.1 5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7			

Wind F	Factor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	te (allow	ing for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m		-	-		
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N5)) , othe	rwise (23t	o) = (23a)			0	
			• • • •	iency in %	, ,	, ,				, , ,			0	
a) If	balance	ed mech	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)		(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mech	anical ve	entilation	without	heat rec	covery (I	u MV) (24t)m = (2	1 2b)m + (23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from o	outside				•	
	if (22b)r	n < 0.5 >	× (23b), t	then (24	c) = (23b	o); other	wise (24	c) = (22	b) m + 0	.5 × (23t) 	i	,	
(24c)m=		0	0	0	0	0	0	0	0	0	0	0]	(24c)
				iole hous m = (22l						0.51				
(24d) <mark>m=</mark>	, <i>,</i> ,	0.82	0.8	0.75	0.73	0.68	0.68	0.5 + [(2	0.7	0.3	0.76	0.78		(24d)
` ´				nter (24a					<u> </u>					
(25)m=	0.83	0.82	0.8	0.75	0.73	0.68	0.68	0.67	0.7	0.73	0.76	0.78		(25)
	-												1	
		s and he Gro:		paramet Openin		Net Ar	200	U-val		AXU		k-value		AXk
ELEN			(m²)	r	-	A,r		W/m2		(W/	K)	kJ/m²·ł		kJ/K
Doo <mark>rs</mark>						1.98	×	3	=	5.94				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(3.1)+	0.04] =	11.94				(27)
Windo	ws Type	e 2				1.92	x1	/[1/(3.1)+	0.04] =	5.3				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(3.1)+	0.04] =	1.77				(27)
Floor 7	Type 1					30	x	0.25	=	7.5	[ΠГ	(28)
Floor 7	Туре 2					37.4	x	0.73	=	27.302	2		- -	(28)
Walls	Type1	48.	6	4.48	3	44.12	2 X	0.55	=	24.27	T T		ΞĒ	(29)
Walls	Type2	32.	8	17.3	2	15.48	3 X	0.35	=	5.42	īĒ		ΞĒ	(29)
Walls	Туре3	8.6	3	0		8.6	x	0.55	=	4.73	īĒ		ΞĒ	(29)
Walls [·]	Type4	3.1	1	1.98	3	1.12	x	0.55	=	0.62	i F		Ξ F	(29)
Walls	Type5	13.	3	0		13.3	×	0.28	=	3.72	i F		ΞĒ	(29)
Total a	area of e	elements	s, m²			173.8	3	•			L			(31)
* for win	ndows and	l roof wind	lows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1	1/[(1/U-val	ue)+0.04] a	as given in	paragraph	1 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) =	139.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not known	precisely the indicative values of TMP in Table 1f		-

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridge	əs : S (L	x Y) cal	culated u	using Ap	pendix l	K						26	(36)
if details	of therma	al bridging	are not kri	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			165.62	(37)
Ventila	tion hea	at loss ca	alculated	monthl	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	81.92	80.65	79.41	73.59	72.5	67.42	67.42	66.48	69.38	72.5	74.7	77.01		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	247.54	246.27	245.03	239.21	238.12	233.04	233.04	232.1	235	238.12	240.32	242.63		
				/			•			-	Sum(39)1.	12 /12=	239.2	(39)
		· · · · ·	HLP), W/	1	0.47	0.40		0.44		= (39)m ÷		0.04	1	
(40)m=	2.25	2.24	2.23	2.18	2.17	2.12	2.12	2.11	2.14	2.17	2.19	2.21		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	2.18	(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	4. Water heating energy requirement: kWh/year:													
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) (42)														(42)
	A £ 13.		+ 1.70 X	li - exh	(-0.0003	049 X (11	-A -13.9)2)] + 0.0	JU13 X (IFA -13.	9)			
			ater usag	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		106	6.34		(43)
								to achieve	a water us	se ta <mark>rget</mark> o	f			
notmore			berson per	r day (all w						i				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot Wate	er usage li		r day for ea	acn month	Va,m = 1a	ctor from	Table 1c x	(43)						
(44)m=	116.97	112.72	108.47	104.21	99.96	95.71	95.71	99.96	104.21	108.47	112.72	116.97		_
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D) Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1276.09	(44)
(45)m=	173.47	151.72	156.56	136.49	130.97	113.01	104.72	120.17	121.61	141.72	154.7	168		
											m(45) ₁₁₂ =	:	1673.15	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46,						
(46)m=	26.02	22.76	23.48	20.47	19.65	16.95	15.71	18.03	18.24	21.26	23.21	25.2		(46)
	storage												1	
-		. ,		• •			-	within sa	ame ves	sel		110		(47)
	•	-			-) litres in			or (0) in (47)			
	storage		not wate	er (unis in	iciudes i	nstantar	leous co	mbi boil	ers) ente	er U in (47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0]	(48)
			m Table			(0		(49)
				_~ , kWh/y∉	ar			(48) x (49)	-					(50)
			-	cylinder l		or is not		(40) X (40)	_		ļ	10		(30)
,				om Tabl							0.	08		(51)
	•	-	ee secti	on 4.3										
		from Ta									1.	03		(52)
Tempe	erature f	actor fro	m Table	2b							0.	78		(53)

0.		m water (54) in (5	•	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		71		(54) (55)
	. ,	. , .		for each	month			((56)m = (55) × (41)ı	m	0.	11		(00)
(56)m=	208.01	187.88	208.01	201.3	208.01	201.3	208.01	208.01	201.3	208.01	201.3	208.01		(56)
												m Append	ix H	(00)
(57)m=	208.01	187.88	208.01	201.3	208.01	201.3	208.01	208.01	201.3	208.01	201.3	208.01		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	3							0		(58)
	-					59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	ter heatir	ng and a	cylinde	r thermo	stat)		_	
(59)m=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38		(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	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)	m
(62)m=	509.85	455.55	492.94	462.02	467.35	356.23	356.04	371.49	364.82	478.11	480.23	504.38		(62)
Solar DI	HW input	calculated	using App	endix G o	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 \	WWHRS	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=	509.85	455.55	492.94	462.02	467.35	356.23	356.04	371.49	364.82	478.11	480.23	504.38		
								Outp	out from wa	ater heate	r (annual)₁	12	5299.01	(64)
Hea <mark>t g</mark>	lains fro	m water	heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59)</mark> m]	
(65)m=	160.38	143.21	15 <mark>4.76</mark>	144.77	146.25	71.11	69.47	74.61	73.97	149.82	150.83	158.56		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Ini	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts				-				-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated in	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5				
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5		-		
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fai	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	Table 5)											
(72)m=	215.57	213.11	208.01	201.07	196.57	98.76	93.38	100.28	102.73	201.38	209.48	213.12		(72)
Total i	internal	gains =	:		•	. (66)	m + (67)m	- n + (68)m +	⊦ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	576.41	574.04	557.81	531.49	504.56	387.29	370.61	377.42	391.01	509.04	539.57	562.67		(73)
6. So	lar gains	5:	•	•	•	•	•	•	•	•				

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.76	x	0.7	=	66.19	(78)
South 0.9x	0.77	x	1.92	x	76.57	x	0.76	x	0.7	=	108.4	(78)
South 0.9x	0.77	x	1.92	x	97.53	x	0.76	x	0.7	=	138.08	(78)
South 0.9x	0.77	x	1.92	x	110.23	x	0.76	x	0.7	=	156.06	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.76	x	0.7	=	162.62	(78)
South 0.9x	0.77	x	1.92	x	110.55	x	0.76	x	0.7	=	156.5	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.76	x	0.7	=	152.91	(78)
South 0.9x	0.77	x	1.92	x	104.89	x	0.76	x	0.7	=	148.5	(78)
South 0.9x	0.77	x	1.92	x	101.89	x	0.76	x	0.7	=	144.24	(78)
South 0.9x	0.77	x	1.92	x	82.59	x	0.76	x	0.7	=	116.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	x	0.76	x	0.7	=	78.45	(78)
South 0.9x	0.77	x	1.92	x	40.4	x	0.76	x	0.7	=	57.19	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.76	x	0.7	=	8.68	(79)
Southwest0.9x	0.77	x	0.64	x	62.67		0.76	x	0.7	=	14.79	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.76	x	0.7	=	20.23	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.76	x	0.7	=	25.07	(79)
Southwest _{0.9x}	0.77	x	0.64	x	119.01		0.76	x	0.7	=	28.08	(79)
Southwest _{0.9x}	0.77	x	0.64	x	118.15		0.76	x	0.7	=	27.88	(79)
Southwest _{0.9x}	0.77	x	0.64	x	113.91		0.76	x	0.7	=	26.88	(79)
Southwest _{0.9x}	0.77	x	0.64	×	104. <mark>3</mark> 9		0.76	x	0.7	=	24.63	(79)
Southwest0.9x	0.77	x	0.64	x	92.85		0.76	x	0.7	=	21.91	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.76	x	0.7	=	16.34	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.76	x	0.7	=	10.4	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.76	x	0.7	=	7.43	(79)
West 0.9x	0.77	x	4.33	x	19.64	x	0.76	x	0.7	=	125.41	(80)
West 0.9x	0.77	x	4.33	x	38.42	x	0.76	x	0.7	=	245.33	(80)
West 0.9x	0.77	x	4.33	x	63.27	x	0.76	x	0.7	=	404.03	(80)
West 0.9x	0.77	x	4.33	x	92.28	x	0.76	x	0.7	=	589.25	(80)
West 0.9x	0.77	x	4.33	x	113.09	x	0.76	x	0.7	=	722.15	(80)
West 0.9x	0.77	x	4.33	x	115.77	x	0.76	x	0.7	=	739.25	(80)
West 0.9x	0.77	x	4.33	x	110.22	x	0.76	x	0.7	=	703.8	(80)
West 0.9x	0.77	x	4.33	x	94.68	x	0.76	x	0.7	=	604.55	(80)
West 0.9x	0.77	x	4.33	x	73.59	x	0.76	x	0.7	=	469.9	(80)
West 0.9x	0.77	x	4.33	×	45.59	x	0.76	x	0.7	=	291.11	(80)
West 0.9x	0.77	x	4.33	×	24.49	x	0.76	x	0.7	=	156.37	(80)
West 0.9x	0.77	x	4.33	x	16.15	x	0.76	x	0.7	=	103.13	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	200.28	368.52	562.34	770.38	912.86	923.63	883.59	777.68	636.05	424.37	245.23	167.75	(83))
Total g	Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	776.69	942.56	1120.15	1301.88	1417.42	1310.92	1254.2	1155.11	1027.06	933.41	784.8	730.43	(84))

7. Me	an inter	nal temp	perature	(heating	season)								
				` ·		, 	from Ta	ble 9, Th	1 (°C)				21	(85)
•		tor for g	•••			0		,	()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.95	0.89	0.81	0.68	0.73	0.9	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)					
(87)m=	18.61	18.84	19.25	19.81	20.32	20.69	20.87	20.84	20.49	19.87	19.16	18.6		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.87	19.88	19.88	19.91	19.92	19.94	19.94	19.94	19.93	19.92	19.91	19.9		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	e 9a)						
(89)m=	0.99	0.99	0.98	0.94	0.86	0.74	0.56	0.62	0.86	0.96	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	le 9c)	-	-		
(90)m=	17.68	17.91	18.32	18.9	19.39	19.74	19.88	19.87	19.57	18.96	18.25	17.69		(90)
							•		1	fLA = Livin	ig area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	llina) = f	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	18.07	18.3	18.71	19.28	19.78	20.14	20.3	20.28	, 19.96	19.35	18.63	18.07		(92)
Apply	v adjustr	nent to t	he mear	interna	l temper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	18.07	18.3	18.71	19. <mark>28</mark>	19.78	2 <mark>0.14</mark>	20.3	20.28	19.96	19.35	18.63	18.07		(93)
8. Sp	ace hea	iting requ	uiremeni											
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>		tor for g						19						
(94)m=	0.99	0.98	0.97	0.93	0.86	0.76	0.61	0.66	0.86	0.95	0.99	0.99		(94)
Usefu	ul gains,	hmGm	, W = (94	4)m x (8	4)m									
(95)m=	770.12	928.01	1085.35	1213.41	1217.85	989.79	759.39	761.73	880.8	890.21	773.69	725.36		(95)
	<u> </u>	age exte	1		e from Ta	able 8	i		i		i	·	I	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		e for mea 3301.03		· ·	· · · ·	· · · · · · · · · · · · · · · · · · ·	· · ·	x [(93)m	r ` ´ ´ ´	<u> </u>	0774 00	2205 04	l	(97)
								899.96 24 x [(97	1377.91		2771.99	3365.91		(37)
(98)m=		1594.67		914.48	525.57				0	886.97	1438.77	1964.56		
(00)					020101	Ĵ	, in the second		l per year				10707.2	(98)
Space	o hoatin	g require	omont in	k\//b/m2	2/voar					(,(-	- /	97.52	(99)
•		• •			•								97.52	(33)
			nts – Ind	vidual h	eating s	ystems i	ncluding	g micro-C	HP)					
•	e heatiı ion of sp	n g: bace hea	at from s	econdar	y/supple	mentary	v system	1					0	(201)
Fracti	ion of sp	bace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	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	ing syste	em 1								81	(206)
Efficie	ency of a	seconda	ry/suppl	ementar	y heatin	g systen	n, %						0	(208)
												l		1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space				alculate					[[1				
	1963.22	1594.67	1418.96	914.48	525.57	0	0	0	0	886.97	1438.77	1964.56		
(211)m			1	00 ÷ (20	<u> </u>								1	(211)
	2423.72	1968.73	1751.8	1128.99	648.85	0	0	0	0	1095.02		2425.39		7
•		6 1 (lota	ii (KVVN/yea	ar) =Sum(2	277) _{15,1012}	=	13218.76	(211)
•		g fuel (s)1)] } x 1		y), kWh/)8)	month									
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
	heating													-
Output	from w 509.85	ater hea 455.55	ter (calc 492.94	ulated a	bove) 467.35	356.23	356.04	371.49	364.82	478.11	480.23	504.38	1	
Efficier		ater hea		402.02	407.00	000.20	000.04	071.40	004.02	470.11	400.20	004.00	81	(216)
(217)m=	-	81	81	81	81	81	81	81	81	81	81	81		(217)
Fuel fo	r water	heating,	kWh/m	onth						1			1	
(219)m (219)m=		m x 100) ÷ (217) 608.57	m 570.4	576.98	439.79	439.56	458.63	450.4	590.25	592.88	622.69	1	
(213)11-	029.45	502.4	000.57	570.4	570.90	439.19	439.50		l = Sum(2		392.00	022.03	6541.99	(219)
Ann <mark>ua</mark>	I totals									k	Wh/year	•	kWh/year	
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								13 <mark>218.76</mark>]
Wat <mark>er</mark>	heating	fuel use	d										65 <mark>41.99</mark>]
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								-
centra	al heatin	ig pump	:									120		(230c)
Total e	lectricity	y for the	above, l	kWh/yea	r			sum	of (230a).	<mark>(2</mark> 30g) =			120	(231)
Electric	city for li	ighting											430.44	(232)
12a. (CO2 em	issions ·	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHP	þ					7
							ergy			Emice	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	r
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	2855.25	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	1413.07	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + ((264) =	L			4268.32] (265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23 ⁻	1) x			0.5	19	=	62.28	_ (267)
	city for li						2) x			0.5		=	223.4] (268)
	:02, kg/								sum o	of (265)(2			4554](272)
	•	Emissi	on Rate	•					(272)	÷ (4) =			41.48	(273)
	ng (secti													(274)
	9 (3601	(+)											60	(214)

			User [Details:								
Assessor Name: Software Name:	Stroma FS/			Softwa	a Num are Ver	sion:		Versio	n: 1.0.5.7			
	l e a de a		Property	Address	: LG1 Ba	aseline						
Address : 1. Overall dwelling dime	, London											
T. Overall dwelling dime	11510115.		Aro	o(m²)		Av. Hei	ight(m)		Volume(m ³)			
Basement				a(m²) 67.4	(1a) x		2.8	(2a) =	188.72	(3a)		
] 				
Ground floor				42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)		
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n) -	109.8	(4)							
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)		
	main heating	seconda heating		other		total			m ³ per hour			
Number of chimneys] + [0] = [0	x 4	40 =	0	(6a)		
Number of open flues	0] +	= + F	0] = [0	x2	20 =	0](6b)		
Number of intermittent far	ns					4	x ^	10 =	40](7a)		
Number of passive vents						0	x ^	10 =	0	(7b)		
						_		40 =		(7c)		
Number of flueless gas fires												
Infiltration due to chimney	· · · · · · · · · · · · · · · · · · ·					40		÷ (5) =	0.13	(8)		
If a pressurisation test has be			ed to (17),	otherwise	continue fr	om (9) to ((16)					
Number of storeys in the Additional infiltration	ie uw <mark>einny</mark> (ns)					[(9)-	-1]x0.1 =	0	(9) (10)		
Structural infiltration: 0.	.25 for steel or	timber frame o	or 0.35 fo	r mason	rv constr	uction	[(0)	1100.1 -	0	(11)		
if both types of wall are pr					•				•	J``		
deducting areas of openin				ad) alaa	ontor O							
If suspended wooden f If no draught lobby, ent		,	J. I (Seale	eu), eise	enter U				0	(12)		
Percentage of windows									0	(13) (14)		
Window infiltration		augin sinpped		0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)		
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)		
Air permeability value,	q50, expresse	d in cubic metr	es per ho	our per s	quare m	etre of e	nvelope	area	5	(17)		
If based on air permeabili			•	•	•		•		0.38	(18)		
Air permeability value applies	s if a pressurisatio	n test has been do	one or a de	gree air pe	rmeability	is being us	sed			-		
Number of sides sheltere	d			() ·					2	(19)		
Shelter factor					[0.075 x (1	9)] =			0.85	(20)		
Infiltration rate incorporat	•			(21) = (18) x (20) =				0.33	(21)		
Infiltration rate modified for monthly wind speed												
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Monthly average wind sp									I			
(22)m= 5.1 5	4.9 4.4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7				

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				-	
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se	-	-		-		- 	(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	auation (N5)) . othe	rwise (23t	o) = (23a)			0	
						or in-use fa				, , ,			0	
a) If	balance	ed mech	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	-	(200)
(24a)m=		0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	overy (l	u MV) (24t)m = (2	- 2b)m + (23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from o	outside	-	-	-		
i	if (22b)r	n < 0.5 >	< (23b), 1	then (240	c) = (23k	o); otherv	vise (24	c) = (22	b) m + 0	.5 × (23b) 	,		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
						ve input v erwise (24				0.51				
(24d)m=	<u> </u>	0.58	0.58	0.56	0.56	0.55	0.55	0.5 + [(2	0.55	0.56	0.57	0.57		(24d)
ì í						o) or (240			<u> </u>					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
		s and ne Gros		paramete Oponin		Net Are	00	U-val		AXU		k-value		AXk
ELEN		area		Openin m	-	A ,n		W/m2		(W/		kJ/m²·l		kJ/K
Doo <mark>rs</mark>						1.98	×	1	=	1.98				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(1.4)+	0.04] =	5.74				(27)
Windo	ws Type	e 2				1.92	x1	/[1/(1.4)+	0.04] =	2.55				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(1.4)+	0.04] =	0.85				(27)
Floor T	Гуре 1					30	x	0.13	=	3.9				(28)
Floor T	Гуре 2					37.4	x	0.13	=	4.862			- -	(28)
Walls -	Type1	48.	6	4.48		44.12	x	0.18	=	7.94			- -	(29)
Walls -	Туре2	32.	8	17.3	2	15.48	x	0.18	=	2.79			ΞĒ	(29)
Walls -	ТуреЗ	8.6	3	0		8.6	x	0.18	=	1.55	T i		Ξ Γ	(29)
Walls -	Туре4	3.1	1	1.98		1.12	x	0.18	=	0.2	T i		\exists \vdash	(29)
Walls -	Туре5	13.	3	0		13.3	x	0.18	=	2.39	i F		Ξ Γ	(29)
Total a	area of e	elements	s, m²			173.8								(31)
* for win	dows and	l roof wind	lows, use e	effective wi	ndow U-va	alue calcula	ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	paragraph	n 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) =	54.52	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not known i	precisely the indicative values of TMP in Table 1f		-

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

can be ι	n be used instead of a detailed calculation. nermal bridges : S (L x Y) calculated using Appendix K [16.25] (36)													
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						16.25	(36)
if details	of therma	al bridging	are not kri	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			70.77	(37)
Ventila	tion hea	at loss ca	alculated	monthl	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.86	57.53	57.21	55.68	55.4	54.07	54.07	53.82	54.58	55.4	55.97	56.58		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	128.63	128.3	127.97	126.45	126.16	124.83	124.83	124.59	125.34	126.16	126.74	127.34		
Heat lo	oss para	meter (F	HLP), W	/m²K			•			Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	126.44	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16	1	
(10)											Sum(40)1.	-	1.15	(40)
Numbe	er of day	vs in moi	nth (Tab	le 1a)						lioiago				
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			-				-						-	
4. Water heating energy requirement: kWh/year:														
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) (42)														(42)
	A £ 13.9		1.107		(0.0000		10.0	/2/] • 0.0	,010 x (,			
								(25 x N)				1.02		(43)
				usage by : ^r day (all w				to achieve	a water us	se target o	t			
										0.1		Du		
Hot wate	Jan er usage i	Feb	Mar day for e	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
	-			-			90.92	94.96	00	103.04	107.08	111.13		
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99				1010.00	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
										Fotal = Su	m(45) ₁₁₂ =		1589.49	(45)
lf instant	taneous w	ater heatii	ng at point	of use (no	hot water	· storage),	enter 0 in	boxes (46,) to (61)				1	
(46)m=	24.72 storage	21.62	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94		(46)
	•		includir	ng any so	olar or W	/WHRS	storage	within sa	me ves	sel		150	1	(47)
0		,		0 1) litres in			001		150		(47)
	•	-			-			ombi boil	ers) ente	er '0' in (47)			
	storage			(,			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	17		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energy	/ lost fro	m water	· storage	, kWh/ye	ear			(48) x (49)	=		0.	63		(50)
				cylinder l									1	
				om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
	•	eating s from Ta	ee secti	on 4.3									1	
			m Table	2b								0 0		(52) (53)
.				-							L'	~	1	(00)

		om water (54) in (5	-	e, kWh/yo	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	. , .		for each	month			((56)m = ((55) × (41)ı	m				
(56)m=	19.51	17.62	19.51	18.88	19.51	18.88	19.51	19.51	18.88	19.51	18.88	19.51		(56)
If cylind	er contain	s dedicate	d solar sto	nage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	n where (H11) is fro	m Append	ix H	
(57)m=	19.51	17.62	19.51	18.88	19.51	18.88	19.51	19.51	18.88	19.51	18.88	19.51		(57)
Prima	v circuit	loss (ar	nual) fro	om Table	e 3		-					0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatir	ng and a	a cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	loss 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=	207.56	182.76	191.5	171.06	167.19	148.75	142.26	156.93	156.92	177.41	188.36	202.36		(62)
Solar DI	HW input	calculated	using App	endix G o	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)
Outpu	t from w	ater hea	ter				-				-			
(64)m=	207.56	182.76	191.5	171.06	167.19	148.75	142.26	156.93	156.92	177.41	188.36	202.36		
								Outp	out from wa	ater heate	r (annual)₁	12	2093.05	(64)
Hea <mark>t g</mark>	l <mark>ain</mark> s fro	m water	heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59)</mark> m]	
(65)m=	<mark>8</mark> 9.01	78.83	83.67	76.23	75.58	68.81	67.29	72.17	71.52	78.98	81.98	87.28		(65)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	<u>olic gair</u>	is (Table	<u>e 5), Wat</u>	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	-	_	-		
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated in	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	_	-		
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5				
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. ev	vaporatio	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (1	able 5)										-	
(72)m=	119.64	117.3	112.46	105.87	101.59	95.57	90.45	97.01	99.34	106.16	113.86	117.31		(72)
Total i	internal	gains =				(66)	m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	483.48	481.24	465.26	439.29	412.58	387.09	370.68	377.15	390.62	416.82	446.94	469.87		(73)
6. So	lar gains	S:												

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9>	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9>	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9>	0.77	x	1.92	x	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9>	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9>	0.77	x	1.92	x	110.55	x	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9>	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9>	0.77	x	1.92	x	55.42	x	0.63	x	0.7	=	65.03	(78)
South 0.9>	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9>	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9>	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9>	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Southwest0.9	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Sout <mark>hwest_{0.9},</mark>	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9	(0.7 <mark>7</mark>	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9	0.77	x	0.64	x	104.3 <mark>9</mark>		0.63	x	0.7	=	20.42	(79)
Sout <mark>hwest</mark> 0.9>	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9>	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9>	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9>	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9>	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9>	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	488.46	(80)
West 0.9>	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9>	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9>	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9>	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9>	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9>	0.77	x	4.33	×	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9>	0.77	x	4.33	×	24.49	x	0.63	x	0.7	=	129.63	(80)
West 0.9>	0.77	x	4.33	×	16.15	x	0.63	x	0.7	=	85.49	(80)

Solar g	Solar gains in watts, calculated for each month(83)m = Sum(74)m(82)m												
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	Total gains – internal and solar (84)m = (73)m + (83)m , watts												
(84)m=	649.5	786.72	931.41	1077.9	1169.29	1152.74	1103.13	1021.81	917.87	768.6	650.22	608.93	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
							from Ta	ble 9, Th	1 (°C)				21	(85)
-		tor for g	• •			-				_	_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.49	0.55	0.81	0.97	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)					
(87)m=	19.72	19.91	20.2	20.56	20.83	20.96	20.99	20.99	20.9	20.52	20.05	19.69		(87)
Temp	erature	during h	eating p	eriods in	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.92	0.78	0.57	0.38	0.43	0.73	0.96	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	le 9c)				
(90)m=	18.24	18.51	18.94	19.45	19.8	19.95	19.97	19.97	19.89	19.4	18.73	18.2		(90)
									1	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	18.87	19.1	19.47	19.92	20.24	20.38	20.4	20.4	20.31	19.87	19.29	18.83		(92)
Ap <mark>ply</mark>	adjustr	nent to t	he mear	n interna	l temper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	1 <mark>8.87</mark>	19.1	19.47	19.92	20.24	<mark>2</mark> 0.38	20.4	20.4	20.31	19.87	19.29	18.83		(93)
		ting requ												
		mean i <mark>nt</mark> factor fo				ied at st	ep 11 of	Table 9	b, so tha	it Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>		tor for g										Į		
(94)m=	1	0.99	0.97	0.92	0.8	0.6	0.43	0.48	0.76	0.95	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m									
(95)m=	647.27	779.75	907.54	992.44	933.26	694.67	470.87	491.61	697.22	733.98	645.26	607.38		(95)
		age exte	1	perature	1	1	i		i		i	i	1	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	· · · · · · · · · · · · · · · · · · ·	r	r	· · · ·	1	1	<u>, , , , , , , , , , , , , , , , , , , </u>	x [(93)m	r í í	ř – – – – – – – – – – – – – – – – – – –		4000 50		(07)
(97)m=		1822.03					474.65	498.35	778.82	1170	1544.4	1863.56		(97)
Space (98)m=	912.57	g require 700.42	559.72	288.81	107.08		n = 0.02	24 x [(97)m – (95 0	324.4	647.38	934.6		
(50)11-	512.07	100.42	000.12	200.01	107.00	0	Ŭ		l per year				4474.96	(98)
Snoo	o hootin	g require	omont in	k\//b/m	hoor			1010	in por your	(1111) Joan) – O um(0	C /15,912 -		(99)
		• •											40.76	(99)
	ergy rec e heatii		nts – Ind	ividual h	eating s	ystems i	ncluding	y micro-C	CHP)					
		bace hea	at from s	econdar	y/supple	mentary	v system						0	(201)
Fracti	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	– (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.5	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g systen	า, %						0	(208)
	Efficiency of secondary/supplementary heating system, %											1		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space					d above)		001	Aug	Ocp	000		Dee	, KWIII/yCC	A 1
	912.57	700.42	559.72	288.81	107.08	0	0	0	0	324.4	647.38	934.6		
(211)m	n = {[(98)m x (20	94)]}x 1	00 ÷ (20)6)									(211)
	976.01	749.11	598.63	308.89	114.52	0	0	0	0	346.95	692.38	999.57		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	Ē	4786.06	(211)
•				y), kWh/	month									
1			00 ÷ (20	1	0	0		0	0			0		
(215)m=	0	0	0	0	0	0	0	0 Tota	0 I (kWh/vea	0	0 215) _{15,1012}	0	0	(215)
Wator	heating							, ota	. (0	
			ter (calc	ulated al	bove)									
e arp ar	207.56	182.76	191.5	171.06	167.19	148.75	142.26	156.93	156.92	177.41	188.36	202.36		
Efficier	ncy of w	ater hea	iter										79.8	(216)
(217)m=	88.31	88.06	87.51	86.2	83.66	79.8	79.8	79.8	79.8	86.4	87.85	88.39		(217)
		•	kWh/m											
(219)m (219)m=		m x 100 207.55) ÷ (217) 218.83	m 198.44	199.84	186.41	178.27	196.66	196.64	205.32	214.42	228.94		
()	200.00				100101				I = Sum(2				2466.36	(219)
Annua	I totals									k	Wh/year		kWh/year	
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								4786.06]
Water	heating	fuel use	d										2466.36	ī
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t								4
		ig pump										30		(230c)
		an-assis										45		(230e) ¬
Total e	lectricity	y for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electric	city for li	ighting											430.44	(232)
12a. (CO2 em	issions -	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHF)					
						Fn	ergy			Fmiss	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	ır
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	1033.79	(261)
Space	heating	(second	darv)			(21	5) x			0.5		=	0	(263)
	heating	,	<i>,</i>			(219	9) x			0.2		=	532.73](264)
	•	ter heati	na) + (262) ·	+ (263) + (264) =	0.2				-
			-	a la atria l				. (200) . (_	1566.52	(265)
			ans and	electric	keep-ho		1) x			0.5	19	=	38.93	(267)
Electric	city for li	ighting				(232	2) x			0.5		=	223.4	(268)
Total C	CO2, kg/	/year							sum o	f (265)(2	271) =		1828.84	(272)

TER =

16.66

(273)

				User D	etails:						
Assessor Name: Software Name:	Stroma	FSAP 201			Strom Softwa	are Vei	sion:		Versio	n: 1.0.5.7	
			P	roperty <i>i</i>	Address	: LG1 Le	an				
Address :	, Londoi	n									
1. Overall dwelling dim	ensions:										
				Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	_
Basement				6	67.4	(1a) x	2	2.8	(2a) =	188.72	(3a)
Ground floor				2	12.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA = (*	1a)+(1b)+(1	c)+(1d)+(1e)+(1n	i) 1	09.8	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:									•		-
	mair		econdar	у	other		total			m ³ per hour	
Number of chimneys	heat		eating 0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues		+ [0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ans						0	×	10 =	0	(7a)
Number of passive vent	s					Г	0	x ^	10 =	0	(7b)
Number of flueless gas	fires						0	X 4	40 =	0	(7c)
										anges per hou	_
Infiltration due to chimne If a pressurisation test has						continue fr	0 om (9) to (÷ (5) =	0	(8)
Number of storeys in								,		0	(9)
Additional infiltration								- [(9)·	-1]x0.1 =	0	(10)
Structural infiltration: (0.25 for ste	el or timber f	rame or	0.35 for	masoni	y constr	uction		·	0	(11)
if both types of wall are p deducting areas of open			oonding to	the great	er wall are	a (after					-
If suspended wooden			ed) or 0.	1 (seale	d), else	enter 0				0	(12)
lf no draught lobby, ei	nter 0.05, e	lse enter 0								0	(13)
Percentage of window	vs and door	s draught st	ripped						·	0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =	i	0	(16)
Air permeability value	, q50, expre	essed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	15	(17)
If based on air permeab	ility value, t	hen (18) = [(1	7) ÷ 20]+(8	3), otherwi	se (18) = ((16)				0.75	(18)
Air permeability value appli	ies if a pressu	risation test has	been don	e or a deg	gree air pe	rmeability	is being us	sed			_
Number of sides shelter	ed				()					2	(19)
Shelter factor					(20) = 1 -		9)] =			0.85	(20)
Infiltration rate incorpora	-				(21) = (18) x (20) =				0.64	(21)
Infiltration rate modified	for monthly	wind speed								1	
Jan Feb	Mar A	pr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	peed from	Table 7									
(22)m= 5.1 5	4.9 4.	4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infilt	ration ra	te (allow	ing for s	nelter ar	nd wind s	peed) =	: (21a) x	(22a)m					
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75		
		<i>èctive air</i> al ventila	-	rate for	the appl	icable ca	se		-		-		0.5	(22.0)
				endix N (2	23b) = (23	a) × Fmv (e	equation (N5)) othe	rwise (23h	(23a) = (23a)			0.5	(23a) (23b)
						for in-use fa) (200)			0.5	(230) (23c)
			-	-	-	at recove				2h)m + (23h) x [1 – (23c)	58.65 	(230)
(24a)m=			0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96	. 100]	(24a)
		 ed mech	anical ve	L entilatior	u without	t heat rec	overv (I	1 MV) (24t						
(24b)m=		0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole I	house ex	tract ver	ntilation	ı or positiv	ve input v	ventilatio	on from o	outside	1	<u> </u>	<u> </u>		
í	if (22b)	m < 0.5 :	× (23b),	then (24	c) = (23l	b); otherv	vise (24	c) = (22	o) m + 0	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
						ve input v erwise (24				0.5]				
(24d)m=	· /	0	0	0	0	0	0		0	0	0	0		(24d)
	<u> </u>	r change	rate - e	nter (24a	u) or (24	b) or (240	c) or (24	d) in bo	(25)					
(25)m=	1.02	1	0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96		(25)
2 40	ot looo	es and h		noromot	or									
ELEN		Gro		Openir		Net Are	ea	U-val	ue	AXU		k-value	<u>.</u>	AXk
			(m²)		ι90 1 ²	A ,n		W/m2		(W/	K)	kJ/m²·ł		kJ/K
Doo <mark>rs</mark>						1.98	x	1.8	=	3.564				(26)
Windo	ws Typ	e 1				4.33	x1	/[1/(1.6)+	0.04] =	6.51				(27)
Windo	ws Typ	e 2				1.92	x1	/[1/(1.6)+	0.04] =	2.89				(27)
Windo	ws Typ	e 3				0.64	x1	/[1/(1.6)+	0.04] =	0.96				(27)
Floor 7	Гуре 1					30	x	0.1	=	3				(28)
Floor 7	Гуре 2					37.4	x	0.25	=	9.35	- i		7	(28)
Walls	Type1	48	.6	4.48	3	44.12	x	0.55	=	24.27	i F		7	(29)
Walls -	Type2	32	.8	17.3	2	15.48	x	0.15	=	2.32	i F		$\exists \square$	(29)
Walls	ТуреЗ	8.0	6	0		8.6	×	0.55		4.73	i F		- -	(29)
Walls	Type4	3.	1	1.98	3	1.12	×	0.55		0.62	i F		- -	(29)
Walls	Туре5	13	.3	0		13.3	×	0.15	=	2	i F		\exists	(29)
Total a	area of	elements	s, m²			173.8					L			(31)
		d roof wind eas on both				alue calcula		g formula 1	/[(1/U-val	ue)+0.04] a	as given in	paragraph	3.2	

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	82.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design association are not known	procisely the indicative values of TMP in Table 1f	-	-

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

can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix I	K						26	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								_
	abric he								(33) +	(36) =			108.62	(37)
Ventila	ation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	100.59	99.01	97.44	89.58	88.01	80.15	80.15	78.57	83.29	88.01	91.15	94.3		(38)
Heat tr	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	209.21	207.64	206.07	198.21	196.63	188.77	188.77	187.2	191.92	196.63	199.78	202.92		
								<u>. </u>	,	Average =	Sum(39)1.	12 /12=	197.81	(39)
Heat lo	oss para	meter (H	HLP), W	/m²K			i		(40)m	= (39)m ÷	· (4)		1	
(40)m=	1.91	1.89	1.88	1.81	1.79	1.72	1.72	1.7	1.75	1.79	1.82	1.85		_
Numbe	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	1.8	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
										ļ			1	
1 \//	tor hoo	ting ene		iromont:								kWh/ye	oor	
4. 000	ater nea	ung ener	igy iequ	nement.								KVVII/ye	ear.	
		upancy,										81		(42)
	A > 13. A £ 13.		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0)013 x (IFA -13.	.9)			
			ater usad	ae in litre	es per da	v Vd.av	erage =	(25 x N)	+ 36		101	1.02	1	(43)
Redu <mark>ce</mark>	the annua	al avera <mark>ge</mark>	hot water	usage by a	5% if the a	welling is	designed a	to achieve		se target o				x - y
not more	e that 125	litres per	person pel	r day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		_
Enorm	contont of	bot water	upped and	aulated ma	onthly _ 1	100 v Vd r	т v рт v Г)Tm / 2600			$m(44)_{112} =$		1212.28	(44)
	r	1				r		0Tm / 3600			-		1	
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
lf instan	taneous v	vater heati	ng at point	of use (no	hot water	^r storage),	enter 0 in	boxes (46,		l otal = Su	m(45) ₁₁₂ =	=	1589.49	(45)
(46)m=	24.72	21.62	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94	1	(46)
	storage		22.01	10.40	10.00	10.1	14.52	17.12	17.00	20.2	22.00	20.04		(10)
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		110]	(47)
If com	munity h	neating a	and no ta	ink in dw	velling, e	nter 110) litres in	(47)						
Otherv	vise if no	o stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	ər '0' in (47)			
	storage													
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
			-	, kWh/ye				(48) x (49)	=			0]	(50)
,				cylinder I com Tabl								0	1	(54)
		leating s				.,	4 Y)					0]	(51)
	•	from Ta										0]	(52)
Tempe	erature f	actor fro	m Table	2b								0]	(53)

		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =	0			(54) (55)
	. ,	. , .	,	for each	month			((56)m = (55) × (41)r	m		0		(55)
(56)m=		0			0	0	0	0	0	0	0	0		(56)
	-	-	-	-	-	-	-	-	7)m = (56)	-	-	-	ix H	(00)
(57)m=	0	0	0	0	0		0	0	0	0	0	0		(57)
						-		-		-		0		(58)
	•	•	,	om Table for each		59)m – ((58) <u>-</u> 36	5 🗸 (41)	m			0		(30)
	•					,	. ,	• •	ı cylindeı	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	Iculated	for each	, month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	50.96	46.03	50.96	48.82	48.39	44.84	46.33	48.39	48.82	50.96	49.32	50.96		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	' (59)m + (61)m	
(62)m=	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		(62)
Solar DI	HW input	calculated	using App	endix G or	· 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 \	WWHRS	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=	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		
								Outp	out from wa	ater heate	r (annual)₁	12	2174.27	(64)
Hea <mark>t g</mark>	l <mark>ain</mark> s fro	m water	heating,	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m]	
(65)m=	67.53	59.43	<mark>62</mark> .19	55.32	53.47	46.91	44.66	50.06	50.62	57.51	61.2	65.81		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table §	5 and 5a):									
Metab	<u>olic gair</u>	s (Table	<u>5), Wat</u>	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82		(66)
Lightin	ig gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	60.93	54.12	44.01	33.32	24.91	21.03	22.72	29.53	39.64	50.33	58.75	62.63		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), alsc	see Tal	ble 5	-	-		
(68)m=	404.88	409.08	398.49	375.95	347.5	320.76	302.9	298.7	309.28	331.82	360.27	387.01		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)	, also se	e Table	5	-	-		
(69)m=	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7		(69)
Pumps	s and fa	ns gains	(Table s	5a)	-	-			-		-	-		
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)											
(72)m=	90.77	88.44	83.59	76.83	71.86	65.15	60.03	67.28	70.3	77.29	84.99	88.45		(72)
Total i	internal	gains =				(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	670.55	665.61	640.07	600.08	558.24	520.91	499.62	509.48	533.2	573.42	617.98	652.06		(73)
6. So	lar gains	S:												

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)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9x	0.77	x	1.92	x	76.57	×	0.63	x	0.7	=	89.86	(78)
South 0.9x	0.77	x	1.92	×	97.53	×	0.63	x	0.7	=	114.46	(78)
South 0.9x	0.77	x	1.92	x	110.23	×	0.63	x	0.7	=	129.37	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9x	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9x	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9x	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9x	0.77	x	1.92	x	82.59	×	0.63	x	0.7	=	96.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9x	0.77	x	1.92	x	40.4	×	0.63	x	0.7	=	47.41	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9x	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.63	Х	0.7	=	20.78	(79)
Southwest0.9x	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest _{0.9x}	0.77	x	0.64	х	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9x	0.77	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9x	0.77	x	0.64	×	104.39		0.63	x	0.7	=	20.42	(79)
Southwest0.9x	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9x	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9x	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9x	0.77	x	4.33	x	63.27	×	0.63	x	0.7	=	334.92	(80)
West 0.9x	0.77	x	4.33	x	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9x	0.77	x	4.33	x	115.77	×	0.63	x	0.7	=	612.8	(80)
West 0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9x	0.77	x	4.33	x	45.59	×	0.63	x	0.7	=	241.31	(80)
West 0.9x	0.77	x	4.33	×	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9x	0.77	x	4.33	x	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m		_	_
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													1
(84)m=	836.57	971.09	1106.22	1238.68	1314.95	1286.55	1232.06	1154.14	1060.45	925.2	821.26	791.12	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
							from Tal	ble 9, Th	1 (°C)				21	(85)
-		ctor for g	• •			-			~ ,					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.98	0.95	0.89	0.76	0.61	0.66	0.86	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	19	19.21	19.56	20.07	20.5	20.82	20.94	20.92	20.68	20.12	19.5	19.01		(87)
Temp	erature	during h	neating p	eriods in	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.4	19.41	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(88)
Utilisa	ation fac	ctor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.99	0.97	0.93	0.84	0.65	0.44	0.49	0.78	0.95	0.99	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)	•			
(90)m=	16.83	17.14	17.66	18.41	19	19.41	19.51	19.51	19.26	18.5	17.6	16.87		(90)
									1	fLA = Livin	ig area ÷ (4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) = f	LA x T1	+ (1 – fL	A) x T2					
(92)m=	17.75	18.01	18.47	19.11	19.63	20.01	20.12	20.11	19.87	1 <u>9.19</u>	18.41	17.78		(92)
Apply	v adjustr	nent to t	he mear	n interna	l temper	ature fro	m Table	e 4e, whe	ere appro	pri <mark>ate</mark>				
(93)m=	17.6	17.86	18.32	18.96	19.48	19.86	19.97	19.96	19.72	19.04	18.26	17.63		(93)
8. Sp	ace hea	ting requ	uire <mark>men</mark> i											
						ed at st	ep 11 of	Table 9	b, <mark>s</mark> o tha	t Ti <mark>,m=(</mark>	76)m an	d re-calo	culate	
the ut		factor fo				l		0	0.00	Ort	Neur	Dee	1	
Litilier	Jan Jan	Feb ctor for g	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.98	0.96	0.92	0.84	0.68	0.49	0.54	0.79	0.94	0.98	0.99		(94)
		hmGm				0.00	0.10	0.01	0.10	0.01	0.00	0.00		
(95)m=	827.04	952.43	• <u>`</u>	1141.77	<u>, </u>	869.28	607.43	626.62	839.01	871.05	806.04	783.73		(95)
	nly aver	I age exte	rnal tem	perature	i e from Ta	able 8							l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al temp	erature,	Lm,W:	- =[(39)m	x [(93)m	– (96)m]			1	
(97)m=	2782.53	2691.87	2434.88	1994.73	1529.91	993.09	635.35	666.12	1077.73	1659.11	2229.24	2725		(97)
Space	e heatin	g require	1	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	<u> </u>		-	
(98)m=	1454.88	1168.9	1018.55	614.13	319.51	0	0	0	0	586.32	1024.71	1444.3		
								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	7631.3	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								69.5	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	g micro-C	CHP)					
•	e heatii	ng: bace hea	t from a	oconder	v/cupple	montor	(aveter							(201)
	-					mentary	system		(201) -				0	
		bace hea		-	. ,			(202) = 1		(000)]			1	(202)
		tal heati	-	-				(204) = (2	02) × [1 –	(203)] =			1	(204)
	-	main spa		• •									91.8	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g systen	า, %						0	(208)

ĺ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space			1	alculate			001	, lug	000	000	1101	000		
		1168.9	1018.55	r	319.51	0	0	0	0	586.32	1024.71	1444.3]	
(211)m	ı = {[(98)m x (20	04)] } x 1	00 ÷ (20)6)									(211)
	1584.84	1273.31	1109.53	668.99	348.05	0	0	0	0	638.69	1116.24			-
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	7	8312.96	(211)
•				y), kWh/	month									
= {[(98] (215)m=		01)]}x1	00 ÷ (20	08)	0	0	0	0	0	0	0	0	1	
(215)11=	0	0	0	0	0	0	0		-	-	215) _{15,1012}		0	(215)
Wator	heating									.,	7 15,1012	2	0	
	-	•	iter (calc	ulated al	bove)									
	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56]	
Efficier	ncy of w	ater hea	ater			_							82.5	(216)
(217)m=	90.48	90.37	90.13	89.53	88.31	82.5	82.5	82.5	82.5	89.38	90.17	90.5		(217)
			kWh/m											
(219)m (219)m=		210.41) ÷ (217) 221.55	m 199.37	195.7	184.49	176.75	197.04	199.21	207.65	217.69	232.65	1	
` ´								Tota	I = Sum(2'	19a) ₁₁₂ =			2480.96	(219)
Annua	I totals									k	Wh/year		kWh/year], ,
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								8 <mark>312.96</mark>]
Wat <mark>er</mark>	heating	fuel use	ed										2480.96]
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								1
				nced, ext			nput from	n outside	<i>.</i>			360.17	1	(230a)
		ig pump						in outorat				30]	(230c)
			· sted flue									45]	(230e)
				///h/voo	r			sum	of (230a).	(230a) -		40	405.47	(2306)
	-		above, i	kWh/yea	1			oum	01 (2000).	(2009) –			435.17	1.
	city for li												430.44	(232)
10a. H	-uel cos	sts - indiv	vidual he	eating sy	stems:									
						Fu				Fuel P			Fuel Cost	
							/h/year			(Table	12)		£/year	_
Space	heating	- main s	system 1			(217	1) x			3.4	8	x 0.01 =	289.29	(240)
Space	heating	- main s	system 2	2		(213	3) x			0		x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			13.	19	x 0.01 =	0	(242)
Water	heating	cost (ot	her fuel)			(219	9)			3.4	8	x 0.01 =	86.34	(247)
Pumps	, fans a	nd elect	ric keep	-hot		(23)	1)			13.	19	x 0.01 =	57.4	(249)
• •	eak tari v for ligh		ach of (2	30a) to (230g) se	eparately (232		licable a	nd apply	fuel pri 13.		ding to x 0.01 =	Table 12a 56.77	(250)
Additio	nal star	nding cha	arges (T	able 12)									120	(251)
Appen	dix Q ite	ems: rep	eat lines	; (253) ai	nd (254)	as need	ded							
		y cost		. ,	. ,		50)(254)	=					609.8	(255)

11a. SAP rating - individual heating systems				
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(255) x (256)	i)] ÷ [(4) + 45.0] =		1.65	(257)
SAP rating (Section 12)			76.92	(258)
12a. CO2 emissions – Individual heating systems	including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216 =	1795.6	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	535.89	(264)
Space and water heating	(261) + (262) + (263) + (2	64) =	2331.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	225.85	(267)
Electricity for lighting	(232) x	0.519 =	223.4	(268)
Total CO2, kg/year		sum of (265)(271) =	2780.74	(272)
CO2 emissions per m ²		(272) ÷ (4) =	25.33	(273)
El rating (section 14)			76	(274)
13a. Primary Energy				-
	Energy kWh/year	Primary factor	P. Energy kWh/year	7,
Space heating (main system 1)		1.22 =	10141.82	(261)
Space heating (secondary)	(215) x	3.07 =	0	(263)
Energy for water heating	(219) x	1.22 =	3026.78	(264)
Space and water heating	(261) + (262) + (263) + (2	64) =	13168.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	1335.98	(267)
Electricity for lighting	(232) x	0 =	1321.44	(268)
'Total Primary Energy		sum of (265)(271) =	15826.01	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	144.13	(273)

				User D	etails:								
Assessor Name: Software Name:	Stroma F	SAP 201			Strom Softwa Address	are Ver	sion:		Versio	n: 1.0.5.7			
Address :	, London		P	roperty .	Address	. LGT Le	an						
1. Overall dwelling dim													
				Area	a(m²)		Av. He	ight(m)		Volume(m ³)			
Basement						(1a) x		2.8	(2a) =	188.72	(3a)		
Ground floor				4	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)		
Total floor area TFA = (*	1a)+(1b)+(1c))+(1d)+(1e	e)+(1r	n) <u> </u>	09.8	(4)					-		
Dwelling volume	298.96	(5)											
2. Ventilation rate:													
	main heatin		econdar neating	У	other		total			m ³ per hour			
Number of chimneys		y + [0] + [0	=	0	x 4	40 =	0	(6a)		
Number of open flues	0	+	0	_ + _	0	- = [0	x2	20 =	0	(6b)		
Number of intermittent fa	ans			_		- T	4	x ^	10 =	40	(7a)		
Number of passive vent	s					Г	0	x ^	10 =	0	(7b)		
Number of flueless gas	fires					Г	0	× 4	40 =	0	(7c)		
Number of flueless gas fires 0 × 40 = 0 Air changes per													
Infiltration due to chimne							40		÷ (5) =	0.13	(8)		
If a pressurisation test has Number of storeys in t			ed, procee	d to (17), d	otherwise o	continue fr	om (9) to ((16)	ſ				
Additional infiltration	line dw <mark>eiling</mark> (115)						[(9)-	-1]x0.1 =	0	(9) (10)		
Structural infiltration: (0.25 for steel	or timber	frame or	0.35 fo	r masoni	ry constr	uction	(0)	.]	0	(11)		
if both types of wall are p			ponding to	the great	er wall are	a (after			I	-	J		
deducting areas of open If suspended wooden	•		led) or 0.	1 (seale	ed), else	enter 0			I	0	(12)		
If no draught lobby, er					,	00				0	(12)		
Percentage of window			tripped							0	(14)		
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)		
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)		
Air permeability value				•		•	etre of e	nvelope	area	5	(17)		
If based on air permeab							:	!		0.38	(18)		
Air permeability value appli Number of sides shelter		ation test has	s been aon	ie or a deg	gree air pe	rmeability	is being us	sea		2	(19)		
Shelter factor	00				(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)		
Infiltration rate incorporating shelter factor (21) = (18) x (20) =													
Infiltration rate modified for monthly wind speed													
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Monthly average wind s	peed from Ta	ble 7											
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7				

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	te (allow	ing for sl	nelter an	d wind s	peed) =	(21a) x	(22a)m			-		
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	quation (I	N5)) , othe	erwise (23b	o) = (23a)			0	
						or in-use fa				, , ,			0	
a) lf	balance	ed mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)		(===)
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	overy (N	ч ИV) (24t)m = (2	1 2b)m + (23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilatio	on from o	outside				•	
i	if (22b)n	n < 0.5 >	× (23b), †	then (24	c) = (23k	o); otherv	vise (24	c) = (22	b) m + 0	.5 × (23t) 	i	1	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
						ve input v erwise (24				0.5]				
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effe	<mark>ctiv</mark> e air	change	rate - ei	nter (24a) or (24k	o) or (240	c) or (24	d) in bo	x (25)					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. He	at losse	s and he	eat loss	paramet	er: 🧹									
ELEN		Gro		Openin m	gs	Net Are A ,n		U-val W/m2		A X U (W/		k-value kJ/m²·I		A X k kJ/K
Doo <mark>rs</mark>						1.98	X	1	=	1.98				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(1.4)+	0.04] =	5.74				(27)
Windo	ws Type	92				1.92	x1	/[1/(1.4)+	- 0.04] =	2.55				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(1.4)+	- 0.04] =	0.85				(27)
Floor 7	Гуре 1					30	x	0.13	=	3.9				(28)
Floor 7	Гуре 2					37.4	x	0.13	=	4.862	i F		Ξ F	(28)
Walls -	Type1	48.	6	4.48	;	44.12	x	0.18	=	7.94	ו ר		ΞĒ	(29)
Walls	Type2	32.	8	17.3	2	15.48	x	0.18	=	2.79	_ i		- -	(29)
Walls	ТуреЗ	8.6	6	0		8.6	x	0.18	=	1.55	T i		ΞĒ	(29)
Walls -	Type4	3.1	1	1.98	3	1.12	x	0.18	=	0.2	i F		- -	(29)
Walls ⁻	Туре5	13.	3	0		13.3	x	0.18	=	2.39	i F		ΞĒ	(29)
Total a	area of e	elements	s, m²			173.8		-			I			(31)
* for win	dows and	roof wind	lows, use e	effective wi	ndow U-va	alue calcula	ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	paragraph	ז 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) =	54.52	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not know	n precisely the indicative values of TMP in Table 1f	<u>-</u>	-

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

can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	hermal bridges : S (L x Y) calculated using Appendix K													(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			70.77	(37)
Ventila	ation hea	at loss ca	alculated	monthl	ý				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.86	57.53	57.21	55.68	55.4	54.07	54.07	53.82	54.58	55.4	55.97	56.58		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	128.63	128.3	127.97	126.45	126.16	124.83	124.83	124.59	125.34	126.16	126.74	127.34		
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	126.44	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16		
Numbe	er of day	/s in moi	nth (Tab	le 1a)		1				Average =	Sum(40)1.	12 /12=	1.15	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
							!			!			1	
4. Water heating energy requirement: kWh/year:														
		ipancy, I		. [4]	(0.0000	40 (тг	- 40.0		040/			81		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	649 X (11	-A -13.9)2)] + 0.0	JU13 X (IFA -13.	.9)			
			ater usag	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		10'	1.02		(43)
		-				-	7	to achieve	a water us	se ta <mark>rget o</mark>	f			
not more	e that 125	litres per j	person pe	r day (all w	ater use, I	not and co								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	l able 1c x	(43)		1				
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		_
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
										Total = Su	m(45) ₁₁₂ =	-	1589.49	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46,) to (61)	-			-	
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
	storage		ingludir		lor or M		otorogo	within or				_	1	(47)
-		. ,					-	within sa	ame ves	sei		0		(47)
	•	•		nk in dw r (this in	•			(47) mbi boil	ore) onto	ər 'O' in <i>(</i>	47)			
	storage		not wat	51 (till5 li		nstantai								
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
			m Table				• •					0		(49)
-				, kWh/ye	ear			(48) x (49)	=			0		(50)
			-	cylinder l		or is not						•	l	(/
		-		om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
	•	-	ee secti	on 4.3									1	·
		from Ta		2h								0		(52)
rempe	Fature	actor Iro	m Table	20								0		(53)

•••		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	. , .		for each	month			((56)m = (55) × (41)	m		-		
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contain	s dedicate	l d solar sto	nage, (57)	I m = (56)m	x [(50) – (H11)] ÷ (50	0), else (5	1 7)m = (56)	n where (H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
	•						(58) ÷ 36 ter heatir	• •		r thormo	etat)			
(110) (59)m=												0		(59)
			for oook	month	(61)m -	(60) + 20	SE v (41)							
(61)m=						$(60) \div 30$	65 × (41)	0	0	0	0	0		(61)
			_		_		-			-		-	(50) m + (61)	
(62)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	(02)III = 97.04	98.2	114.44	124.92	135.66	(59)m + (61) I	(62)
							ve quantity							(02)
							, see Ap			r contribut	ION IO WALE	er neating)		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	Į					1		1			
(64)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		
								Outp	out from wa	ater heate	r (annual)₁	12	1351.07	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m]	
(65)m=	<mark>3</mark> 5.02	30.63	<u>31</u> .61	27.55	26.44	22.81	21.14	24.26	24.55	28.61	31.23	33.91		(65)
in <mark>clu</mark>	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated in	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	, also se	ee Table	5				
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.g. ev	vaporatic	on (nega	tive valu	es) (Tab	ole 5)							-	
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)											
(72)m=	47.07	45.58	42.48	38.27	35.54	31.69	28.42	32.61	34.1	38.45	43.38	45.58		(72)
Total i	internal	gains =				(66))m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	407.91	406.51	392.28	368.69	343.53	320.21	305.65	309.75	322.38	346.11	373.46	395.14		(73)
6. So	lar gains	S:												

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9	0.77	x	1.92	x	46.75	×	0.63	x	0.7	=	54.87	(78)
South 0.9	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9	0.77	x	1.92	x	97.53	×	0.63	x	0.7	=	114.46	(78)
South 0.9	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9	0.77	x	0.64	x	62.67]	0.63	x	0.7	=	12.26	(79)
Southwest0.9	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Southwest0.9	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest0.9	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9	(0.7 <mark>7</mark>	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9	0.77	x	0.64	x	104. <mark>3</mark> 9		0.63	x	0.7	=	20.42	(79)
Southwest0.9	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9	0.77	x	0.64	x	31.49]	0.63	x	0.7	=	6.16	(79)
West 0.9	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9	0.77	x	4.33	x	38.42	×	0.63	x	0.7	=	203.37	(80)
West 0.9	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9	0.77	x	4.33	x	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9	0.77	x	4.33	x	113.09	×	0.63	x	0.7	=	598.62	(80)
West 0.9	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9	0.77	x	4.33	×	94.68	×	0.63	x	0.7	=	501.14	(80)
West 0.9	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9	0.77	x	4.33	x	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9	0.77	x	4.33	×	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month		_	(83)m = S	um(74)m .	(82)m			
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	Total gains – internal and solar (84)m = (73)m + (83)m , watts												
(84)m=	573.94	712	858.43	1007.3	1100.24	1085.85	1038.1	954.41	849.63	697.89	576.74	534.2	(84)

7.1010	ean inter	nal temp	perature	(heating	season)								
Temp	perature	during h	neating p	periods in	n the livii	ng area	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=	1	1	0.99	0.95	0.86	0.69	0.52	0.58	0.84	0.98	1	1		(86)
Mean	n interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.66	19.84	20.14	20.51	20.81	20.95	20.99	20.98	20.87	20.46	19.99	19.63		(87)
Temp	berature	durina h	neating p	periods ir	n rest of	dwellina	from Ta	ble 9. Tl	h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Litilis	ation fac	tor for a	ains for	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	1	0.98	0.94	0.81	0.6	0.4	0.46	0.77	0.97	1	1		(89)
		l tompor	Iin	the reat	of dwalli	na T2 (f			Tin Tohl					
(90)m=	18.72	18.9	ature in	19.57	19.83	19.95	19.97	19.97	19.9	19.53	19.06	18.7		(90)
(00)=	10.12	10.0	10.2	10.01	10.00	10.00	10.01	10.01			g area ÷ (4		0.42	(91)
	• •							<i></i>			. .	, 	0.42	(
	r	· · · ·	ature (fo	1	1		1	,	, 	40.00	40.45	40.00		(92)
(92)m=	19.12	19.3	19.6	19.97	20.24	20.38	20.4	20.4	20.31	19.92	19.45	19.09		(92)
(93)m=	19.12	19.3	he mear	19.97	20.24	20.38	20.4	20.4	20.31	19.92	19.45	19.09		(93)
			uirement		20.24	20.30	20.4	20.4	20.31	19.92	19.45	19.09		(00)
					re obtain	ed at st	en 11 of	Table 9	o so tha	t Ti m=('	76)m an	d re-calc	ulate	
			or gains					Tuble of	5, 65 tha		- c) c		ulato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>is</mark> a	ation for	tor for a	ains, hm											
	ation fac	tor for g						-						
(94)m=		0.99	0.98	0.94	0.83	0.63	0.45	0.51	0.8	0.97	1	1		(94)
Usefu	1 ul gains,	0.99		0.94		0.63	0.45	0.51	0.8	0.97	1	1		(94)
Usefu (95)m=	1 JI gains, 572.88	0.99 hmGm 708.13	0.98 , W = (94 843.12	0.94 4)m x (8 944.49	4)m 908.25	687.9	0.45	0.51 489.25	0.8	0.97 676.43	1 574.29	1 533.51		(94) (95)
Usefu (95)m= Monti	1 ul gains, 572.88 hly avera	0.99 hmGm 708.13 age exte	0.98 , W = (94 843.12 ernal tem	0.94 4)m x (8- 944.49 perature	4)m 908.25 e from Ta	687.9 able 8	469.66	489.25	676.53	676.43	574.29	533.51		(95)
Usefu (95)m= Monti (96)m=	1 Jul gains, 572.88 hly avers 4.3	0.99 hmGm 708.13 age exte 4.9	0.98 , W = (94 843.12 ernal tem 6.5	0.94 4)m x (8- 944.49 perature 8.9	4)m 908.25 e from Ta 11.7	687.9 able 8 14.6	469.66 16.6	489.25 16.4	676.53 14.1	676.43 10.6	I		1	
Usefu (95)m= Month (96)m= Heat	1 J gains, 572.88 hly avera 4.3 loss rate	0.99 hmGm 708.13 age exte 4.9 e for mea	0.98 , W = (94 843.12 ernal tem 6.5 an intern	0.94 4)m x (8 944.49 perature 8.9 nal tempo	4)m 908.25 e from Ta 11.7 erature,	687.9 able 8 14.6 Lm , W =	469.66 16.6 =[(39)m 2	489.25 16.4 x [(93)m	676.53 14.1 - (96)m	676.43 10.6	574.29 7.1	533.51 4.2		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76	4)m 908.25 e from Ta 11.7 erature, 1077.99	687.9 able 8 14.6 Lm , W = 721.02	469.66 16.6 =[(39)m 474.56	489.25 16.4 x [(93)m 498.18	676.53 14.1 - (96)m 778.38	676.43 10.6] 1176.41	574.29 7.1 1565.14	533.51		(95)
Usefu (95)m= Montil (96)m= Heat (97)m= Spac	1 J gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97)	676.53 14.1 - (96)m 778.38)m - (95	676.43 10.6] 1176.41)m] x (4	574.29 7.1 1565.14 1)m	533.51 4.2 1896.21		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76	4)m 908.25 e from Ta 11.7 erature, 1077.99	687.9 able 8 14.6 Lm , W = 721.02	469.66 16.6 =[(39)m 474.56	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4030.61	(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4930.61	(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4930.61 44.91	(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1J gains,572.88hly avera4.3loss rate1905.69e heatin991.61e heatinpace co	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require oling req	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1 JI gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61 e heatin ulated fo	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require r June,	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in quiremer	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² nt August.	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 ² /year	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 $=[(39)m = 474.56$ $th = 0.02$ 0	489.25 16.4 x [(93)m 498.18 24 x [(97 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9	533.51 4.2 1896.21 1013.85 8) ₁₅₉₁₂ =		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac	1 JI gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require oling rec r June, C Feb	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² t August. Apr	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28 2/year <u>See Tal</u> May	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m 2 474.56 th = 0.02 0	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov	533.51 4.2 1896.21 1013.85 8)15.912 =		(95) (96) (97)
Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200 Calcu Heat	1 JI gains, 572.88 hly averation 4.3 Ioss rate 1905.69 e heatin 991.61 e heatin Jan Ioss rate Ioss rate	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar liculated	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m² ht August. Apr using 29	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 2/year See Tal May 5°C inter	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota Aug and exte	676.53 14.1 - (96)m 778.38)m - (95 0 I per year Sep ernal ten	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov e from T	533.51 4.2 1896.21 1013.85 8)15912 = Dec able 10)		(95) (96) (97) (98) (99)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200)m=	1 JI gains, 572.88 hly averation 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan loss rate 0	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 0 ling rec r June, C Feb e Lm (ca 0	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar loculated 0	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² t August. Apr	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28 2/year <u>See Tal</u> May	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov	533.51 4.2 1896.21 1013.85 8)15.912 =		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200)m=	1 JI gains, 572.88 hly averation 4.3 loss rate 1905.69 e heatin 991.61 e heatin 1905.69 e heatin 991.61 loss rate Jan loss rate 0 ation fact	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar loculated 0	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m² ht August. Apr using 29	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 2/year See Tal May 5°C inter	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota Aug and exte	676.53 14.1 - (96)m 778.38)m - (95 0 I per year Sep ernal ten	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov e from T	533.51 4.2 1896.21 1013.85 8)15912 = Dec able 10)		(95) (96) (97) (98) (99)

Usefu	l loss, h	nmLm (W	Vatts) =	(100)m x	(101)m									
(102)m=	0	0	0	0	0	1050.05	872.68	873.47	0	0	0	0]	(102)
Gains	(solar	gains ca	lculated	for appli	cable w	eather re	egion, se	e Table	10)				_	
(103)m=	0	0	0	0	0	1379.35	1321.11	1225.3	0	0	0	0		(103)
		<i>g require</i> zero if (dwelling,	continue	ous (kW	(h) = 0.0	24 x [(10	03)m – (102)m]	x (41)m	
(104)m=	0	0	0	0	0	237.09	333.63	261.76	0	0	0	0]	
L									Total	= Sum(104)	=	832.49	(104)
Cooled fraction f C = cooled area ÷ (4) = 1 Intermittency factor (Table 10b) 1														
Intermi	ttency f	actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	l = Sum((104)	=	0	(106)
Space	cooling	requirer	ment for	month =	: (104)m	× (105)	× (106)r	n					-	
(107)m=	0	0	0	0	0	59.27	83.41	65.44	0	0	0	0		
									Total	= Sum(107)	=	208.12	(107)
Space	cooling	requirer	ment in k	kWh/m²/y	/ear				(107)) ÷ (4) =			1.9	(108)
8f. Fab	ric Ene	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) ·	+ (108) =	=		46.8	(109)
Targe	t Fabri	c Energ	y Efficie	ency (TF	EE)								53.82	(109)
			-											

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012			Strom Softwa	are Ver	sion:		Versio	n: 1.0.5.7	
	1		P	roperty <i>i</i>	Address	: LG1 Le	an				
Address :	, London										
1. Overall dwelling dimer	nsions:			A	- (A., 11a)/el	
Basement					a(m²)	(1a) x	Av. Hei		(2a) =	Volume(m ³)	(3a)
								2.8	ן נ י נ	188.72	1
Ground floor				2	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+	⊦(1n	I) 1	09.8	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:									-		-
	main heating		ondar: ating	у	other		total			m ³ per hour	
Number of chimneys] + [0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0		0] = [0	x 2	20 =	0] (6b)
Number of intermittent far	<u>เ</u>						4	x ^	10 =	40](7a)
Number of passive vents							0	x ^	10 =	0	(7b)
Number of flueless gas fir	es						0	x 4	40 =	0	(7c)
						L			Air ch	anges per hou]
Infiltration due to chimney							40		÷ (5) =	0.13	(8)
If a pressurisation test has be			proceed	d to (17), d	otherwise of	continue fr	om (9) to ((16)	I		٦
Number of storeys in th Additional infiltration	e dw <mark>eiling</mark> (ns	5)						[(0)]	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or	timber fr:	ame or	0 35 foi	r masoni	v constr	uction	[(9)	-1jx0.1 =	0	(10)
if both types of wall are pre						•	uction		l	0](,,)
deducting areas of openin											-
If suspended wooden fl		•	d) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent										0	(13)
Percentage of windows	and doors dr	aught strij	oped		0.25 - [0.2	$(\mathbf{x}(1\mathbf{A}) + 1)$	001 -			0	(14)
Window infiltration Infiltration rate					(8) + (10)		-	⊾ (15) —		0	(15)
Air permeability value, o	750 expresse	d in cubic	motro						area	0	(16)
If based on air permeabili				•	•	•		invelope	alea	15	(17) (18)
Air permeability value applies	-						is being us	sed		0.88](10)
Number of sides sheltered					,	,	J			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporati	ng shelter fac	tor			(21) = (18) x (20) =				0.75	(21)
Infiltration rate modified for	or monthly win	d speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Tabl	e 7									
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24 c) If whole house extract ventilation or positive input ventilation from outside	Wind Fa	actor (2	2a)m =	(22)m ÷	4										
0.96 0.94 0.92 0.83 0.81 0.71 0.71 0.69 0.75 0.81 0.85 0.88 Calculate effective air change rate for the applicable caseIf mechanical ventilation:If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)00(23a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100](24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24c) If whole house extract ventilation or positive input ventilation from outside	(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Calculate effective air change rate for the applicable caseIf mechanical ventilation:0(23If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)000	Adjuste	d infiltr	ation rate	e (allowi	ing for sl	nelter an	nd wind s	peed) =	(21a) x	(22a)m	·	-			
If mechanical ventilation: 0 (23) If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23) a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m = 0 0 0 0 0 0 0 (24b)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24b)m = (24b)m = (22b)m + (23b) (24b)m = (2								-	0.69	0.75	0.81	0.85	0.88		
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23 If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23 a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m = 0 0 0 0 0 0 0 (24 (24b)m = (22b)m + (23b)				-	rate for t	he appli	cable ca	se	-	-	-				(22.5)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23 a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					endix N (2	(23a) = (23a	a) x Fmv (e	equation (I	N5)) othe	rwise (23	(23a)		l T		
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$ (24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0											0) = (200)] I		
(24a)m= 0 </td <td></td> <td></td> <td></td> <td>-</td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td>(2h)m + (</td> <td>(23h) 🗸 [[,]</td> <td> 1 – (23c)</td> <td>-</td> <td>(230)</td>				-	-	-					(2h)m + ((23h) 🗸 [[,]	 1 – (23c)	-	(230)
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24 c) If whole house extract ventilation or positive input ventilation from outside	́ г			r	î .	i	i i	<u> </u>	1 / 1	ŕ	1	<u>, , -</u>	r í í	÷ 100]	(24a)
(24b)m= 0 </td <td>· · ·</td> <td>palance</td> <td></td> <td></td> <td></td> <td>without</td> <td>heat rec</td> <td>overv (N</td> <td>I</td> <td>I</td> <td></td> <td>(23b)</td> <td></td> <td></td> <td>· · · ·</td>	· · ·	palance				without	heat rec	overv (N	I	I		(23b)			· · · ·
c) If whole house extract ventilation or positive input ventilation from outside	, L				1	1	1	· · ·	<u> </u>	ŕ	,	<u> </u>	0		(24b)
	c) If v	vhole h	ouse ex	ract ver	ntilation of	r positiv	/e input \	ventilatio	n from (utside			I		
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)						-	-).5 × (23	c)			
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
 d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] 	,					•					0.51		<u> </u>		
		. ,		· · · ·	· ·		r Ì	· ·		<u>, </u>	-	0.86	0.89		(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	· · ·	tive air	change	rate - er			a) or (240	c) or (24	d) in bo	(25)			<u> </u>	_	
					· · ·	í t	r i	· · ·		1 /	0.83	0.86	0.89		(25)
														_	
3. Heat losses and heat loss parameter: ELEMENT Gross Openings Net Area U-value A X U k-value A X k							Not Ar						le velue		
ELEMENT Gross Openings Net Area U-value A X U k-value A X k area (m ²) m ² A ,m ² W/m2K (W/K) kJ/m ² ·K kJ/K	ELEM	ENI				-									
Doors 1.98 × 1.8 = 3.564 (26	Doo <mark>rs</mark>						1.98	×	1.8		3.564				(26)
Windows Type 1 $4.33 \times 1/[1/(1.6) + 0.04] = 6.51$ (27)	Window	vs Type	e 1				4.33	x1	/[1/(1.6)+	0.04] =	6.51				(27)
Windows Type 2 $1.92 \times 1/[1/(1.6) + 0.04] = 2.89$ (27)	Window	vs Type	2				1.92		/[1/(1.6)+	0.04] =	2.89				(27)
Windows Type 3 $0.64 \times 1/[1/(1.6) + 0.04] = 0.96$ (27)	Window	vs Type	93				0.64		/[1/(1.6)+	0.04] =	0.96				(27)
Floor Type 1 30 x 0.1 = 3 (28	Floor T	ype 1					30	×	0.1	=	3				(28)
Floor Type 2 37.4 × 0.25 = 9.35 (28	Floor T	ype 2					37.4	x	0.25		9.35	= i			(28)
	Walls T	ype1	48.6	6	4.48	3	44.12	<u>x</u>				= 1		\dashv	(29)
								_				= 1		\dashv	(29)
								_						4 1	(29)
								_				=		\exists	(29)
								_				╡╏		\exists	(29)
]		_	L		L	[(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				,			175.0	·							(0.)

** include the areas on both sides of internal walls and partitions

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	82.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not know	n precisely the indicative values of TMP in Table 1f		-

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						26	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								_
Total fa	abric he	at loss							(33) +	(36) =			108.62	(37)
Ventila	tion hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	94.58	92.83	91.1	83.01	81.5	74.45	74.45	73.15	77.17	81.5	84.56	87.76		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	203.21	201.45	199.73	191.64	190.12	183.08	183.08	181.77	185.79	190.12	193.19	196.39		
		!							/	Average =	Sum(39)1.	12 /12=	191.63	(39)
Heat lo	oss para	ameter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	(4)		1	
(40)m=	1.85	1.83	1.82	1.75	1.73	1.67	1.67	1.66	1.69	1.73	1.76	1.79		
Numbe	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1	12 /12=	1.75	(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								I			1	
1 \//-	tor hoa	ting ene	rav roqui	romont:								kWh/ye	aar:	
4. 000	lier nea		igy iequ	i ement.								K V V I // y d	.	
		upancy,							/ -		2.	81		(42)
	A > 13. A £ 13.		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0)013 x (IFA -13.	9)			
			ater usad	ae in litre	es per da	v Vd.av	erage =	(25 x N)	+ 36		101	1.02		(43)
Redu <mark>ce</mark>	the annua	al avera <mark>ge</mark>	hot water	usage by a	5% if the a	welling is	designed t	o achieve		se target o				()
not more	e that 125	litres per	person pei	[•] day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		
_								- (m(44) ₁₁₂ =		1212.28	(44)
Energy (content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x L)Tm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1	
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		_
lf instan	tanaous v	vator hoati	na at noint	of use (no	hot water	r storage)	ontor 0 in	boxes (46)		Total = Su	m(45) ₁₁₂ =	-	1589.49	(45)
			· ·					. ,	. ,				1	(40)
(46)m= Water	0 storage	0	0	0	0	0	0	0	0	0	0	0		(46)
	-		includir	a anv so	olar or W	/WHRS	storage	within sa	me ves	sel		110		(47)
-				nk in dw			-						l	
	•	-			-			mbi boil	ers) ente	er '0' in (47)			
	storage			,					,	,	,			
a) If m	anufact	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=			0		(50)
b) If m	anufact	turer's de	eclared o	ylinder l	oss fact	or is not	known:							
		-		om Tabl	e 2 (kW	h/litre/da	ıy)				(0		(51)
	•	neating s		on 4.3									1	(m=)
		from Ta		2h								0		(52)
rempe	aiure I	actor fro	III Table	20								0	J	(53)

•		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	loss cal	,	for each	month			((56)m = (55) × (41)r	m		0	l	(00)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(56)
	-	-	-	-	-	-		-	7)m = (56)	-	-	-	l lix H	()
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	: loss (ar	nual) fro	om Table	9 3							0		(58)
	•	loss cal	,			59)m = ((58) ÷ 36	65 × (41)	m				1	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i 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)r	n
(62)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		(62)
Solar DI	HW 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 \	WWHRS	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=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		
								Outp	out from wa	ater heate	r (annual)₁	12	1 <mark>3</mark> 51.07	(64)
Hea <mark>t g</mark>	j <mark>ain</mark> s fro	m water	heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59)</mark> m]	
(65)m=	3 <mark>5.02</mark>	30.63	31.61	27.55	26.44	22.81	21.14	24.26	24.55	28.61	31.23	3 <mark>3.91</mark>		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	<mark>or ho</mark> t w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	<u>olic gair</u>	ns (Table	e 5), Wat	ts									_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5			-		
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5	-			
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)	, also se	e Table	5	-			
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table \$	5a)									_	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. e\	vaporatic	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)										_	
(72)m=	47.07	45.58	42.48	38.27	35.54	31.69	28.42	32.61	34.1	38.45	43.38	45.58		(72)
Total i	internal	gains =				(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m	_	
(73)m=	407.91	406.51	392.28	368.69	343.53	320.21	305.65	309.75	322.38	346.11	373.46	395.14		(73)
6. So	lar gain:	S:												

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)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9x	0.77	x	1.92	x	76.57	×	0.63	x	0.7	=	89.86	(78)
South 0.9x	0.77	x	1.92	x	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9x	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9x	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9x	0.77	x	1.92	x	104.89	×	0.63	x	0.7	=	123.1	(78)
South 0.9x	0.77	x	1.92	x	101.89	×	0.63	x	0.7	=	119.57	(78)
South 0.9x	0.77	x	1.92	×	82.59	×	0.63	x	0.7	=	96.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9x	0.77	x	1.92	×	40.4	×	0.63	x	0.7	=	47.41	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest _{0.9x}	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.63	x	0.7	=	20.78	(79)
Southwest _{0.9x}	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest0.9x	0.77	x	0.64	x	118.15		0.63	x	0.7	=	2 <mark>3.11</mark>	(79)
Southwest _{0.9x}	0.77	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	x	0.64	x	104.3 <mark>9</mark>		0.63	x	0.7	=	20.42	(79)
Southwest0.9x	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9x	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9x	0.77	x	4.33	x	19.64	×	0.63	x	0.7	=	103.96	(80)
West 0.9x	0.77	x	4.33	×	38.42	×	0.63	x	0.7	=	203.37	(80)
West 0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9x	0.77	x	4.33	x	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9x	0.77	x	4.33	x	113.09	×	0.63	x	0.7	=	598.62	(80)
West 0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9x	0.77	x	4.33	×	110.22	×	0.63	x	0.7	=	583.41	(80)
West 0.9x	0.77	x	4.33	×	94.68	×	0.63	x	0.7	=	501.14	(80)
West 0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9x	0.77	x	4.33	x	45.59	×	0.63	x	0.7	=	241.31	(80)
West 0.9x	0.77	x	4.33	×	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9x	0.77	x	4.33	×	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	gains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m			
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	ains – ii	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	573.94	712	858.43	1007.3	1100.24	1085.85	1038.1	954.41	849.63	697.89	576.74	534.2	(84)

	ean inter	nal tem	perature	(heating	season)								
			neating p				from Tab	ole 9. Th	1 (°C)				21	(85)
•		•	ains for l			-		,	(-)					`
Canot	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.93	0.82	0.68	0.74	0.92	0.99	1	1		(86)
Mear	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ps 3 to 7	in Table	e 9c)				I	
(87)m=	18.86	19.07	19.44	19.97	20.42	20.78	20.92	20.9	20.61	20	19.38	18.88		(87)
Temr		durina h	neating p	eriods ir	n rest of	dwelling	from Ta	ble 9 Tl	n2 (°C)					
(88)m=	19.43	19.45	19.46	19.51	19.52	19.56	19.56	19.57	19.55	19.52	19.5	19.48		(88)
l Itilis:	ation fac	tor for a	ains for I	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.96	0.89	0.72	0.5	0.57	0.85	0.98	1	1		(89)
		l I tompor	ature in	the rest	of dwalli	na T2 (f		\sim	7 in Tabl					
(90)m=	17.54	17.76	18.13	18.69	19.12	19.46	19.55	19.54	19.32	18.73	18.1	17.59		(90)
(/									f		g area ÷ (4		0.42	(91)
N 4					- ···-	() () () () () () () () () () () () () (. (4 6	A) T O					
		· · · ·	ature (fo	19.23			I	+ (1 – TL 20,12		10.07	18.64	10.14		(92)
(92)m=	18.1	18.31	18.68		19.67	20.02	20.13		19.87	19.27	18.64	18.14		(92)
			he mear						· · ·	· ·	19.64	10.14		(93)
(93)m=	18.1	18.31	18.68	19.23	19.67	20.02	20.13	20.12	19.87	19.27	18.64	18.14		(93)
		ting requ			un abtair			Table O		• T :	70)			
			ernal ter or gains			ied at ste	эрттог	Table 90	o, so tha	t 11,m=((6)m an	a re-calc	ulate	
	Jan	Feb	Mar	Apr	May	lup	Jul	Aug	Sen	Oct	Nov	Dec		
					IVIAV	Jun	Jul	I AUU I	Sep					
Utilis	ation fac				Iviay	Jun	Jui	Aug	Sep	Oci	NOV	200		
Utilis: (94)m=	ation fac		ains, hm		0.89	0.75	0.58	0.64	0.87	0.98	0.99	1		(94)
(94)m=	1	tor for g	ains, hm 0.98	0.96	0.89									(94)
(94)m=	1	tor for g	ains, hm	0.96	0.89									(94) (95)
(94)m= Usefu (95)m=	1 JI gains, 572.17	0.99 hmGm 707.21	ains, hm 0.98 , W = (94	1: 0.96 4)m x (84 963.44	0.89 4)m 980.48	0.75 818.29	0.58	0.64	0.87	0.98	0.99	1		
(94)m= Usefu (95)m=	1 JI gains, 572.17	0.99 hmGm 707.21	ains, hm 0.98 , W = (94 844.49	1: 0.96 4)m x (84 963.44	0.89 4)m 980.48	0.75 818.29	0.58	0.64	0.87	0.98	0.99	1		
(94)m= Usefu (95)m= Mont (96)m=	1 Jul gains, 572.17 hly avera 4.3	tor for g 0.99 hmGm 707.21 age exte 4.9	ains, hm 0.98 , W = (94 844.49 ernal tem	1: 0.96 4)m x (8- 963.44 perature 8.9	0.89 4)m 980.48 e from Ta 11.7	0.75 818.29 able 8 14.6	0.58 600.69 16.6	0.64 609.86 16.4	0.87 738.7 14.1	0.98 680.47 10.6	0.99 573.58	1 532.97		(95)
(94)m= Usefu (95)m= Mont (96)m= Heat	1 Jul gains, 572.17 hly avera 4.3	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern	1: 0.96 4)m x (8- 963.44 perature 8.9	0.89 4)m 980.48 e from Ta 11.7	0.75 818.29 able 8 14.6	0.58 600.69 16.6	0.64 609.86 16.4	0.87 738.7 14.1 – (96)m	0.98 680.47 10.6	0.99 573.58 7.1	1 532.97		(95)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m=	1 Jal gains, 572.17 hly avera 4.3 loss rate 2803.67	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26	0.89 4)m 980.48 9 from Ta 11.7 erature, 1515.7	0.75 818.29 able 8 14.6 Lm , W = 992.19	0.58 600.69 16.6 =[(39)m 2 646.1	0.64 609.86 16.4 x [(93)m 675.52	0.87 738.7 14.1 - (96)m 1071.36	0.98 680.47 10.6] 1648.66	0.99 573.58 7.1 2229.01	1 532.97 4.2		(95) (96)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m=	1 J gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26	0.89 4)m 980.48 9 from Ta 11.7 erature, 1515.7	0.75 818.29 able 8 14.6 Lm , W = 992.19	0.58 600.69 16.6 =[(39)m 2 646.1	0.64 609.86 16.4 x [(93)m 675.52	0.87 738.7 14.1 - (96)m 1071.36	0.98 680.47 10.6] 1648.66	0.99 573.58 7.1 2229.01	1 532.97 4.2		(95) (96)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m= Spac	1 J gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 r each n	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m	1 532.97 4.2 2736.72 1639.59	8864.57	(95) (96)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require 1340.63	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 or each n 731.39	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59	8864.57 80.73	(95) (96) (97)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24 e heatin	tor for g 0.99 hmGm 707.21 age exter 4.9 e for mea 2702.2 g require 1340.63	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29	1: 0.96 4)m x (8- 963.44 perature 8.9 nal temper 1979.26 or each n 731.39 kWh/m ²	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59		(95) (96) (97)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1JI gains,572.17hly avera4.3loss rate2803.67e heatin1660.24e heatinpace co	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require 1340.63 g require oling req	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29	1: 0.96 4)m x (84 963.44 1963.44 1979.26 1979.26 1979.26 or each n 731.39 kWh/m ² nt	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\ 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59		(95) (96) (97)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1JI gains,572.17hly avera4.3loss rate2803.67e heatin1660.24e heatinpace co	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require 1340.63 g require oling req	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29	1: 0.96 4)m x (84 963.44 1963.44 1979.26 1979.26 1979.26 or each n 731.39 kWh/m ² nt	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\ 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59		(95) (96) (97)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m=	1Jal gains,572.17hly avera4.3loss rate2803.67e heatin1660.24e heatinpace coJan	tor for g 0.99 hmGm 707.21 age exte 4.9 for mea 2702.2 g require 1340.63 g require oling rec r June, C	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29 ement in uiremer	i: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 r each n 731.39 kWh/m ² nt August. Apr	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2 ?/year <u>See Tal</u> May	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m : 646.1 th = 0.02 0 Jul perature	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0 Tota Aug	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0 1 per year	0.98 680.47 10.6] 1648.66)m] x (4 720.33 (kWh/year	0.99 573.58 7.1 2229.01 1)m 1191.91) = Sum(9 Nov	1 532.97 4.2 2736.72 1639.59 8)15.912 = Dec		(95) (96) (97) (98) (99)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24 e heatin pace coo Jlated fo Jan loss rate	tor for g 0.99 hmGm 707.21 age exte 4.9 for mea 2702.2 g require 1340.63 g require oling rec r June, C	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29 ement in uiremen July and Mar	i: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 r each n 731.39 kWh/m ² nt August. Apr	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2 ?/year <u>See Tal</u> May	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m : 646.1 th = 0.02 0	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0 Tota Aug	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0 1 per year	0.98 680.47 10.6] 1648.66)m] x (4 720.33 (kWh/year	0.99 573.58 7.1 2229.01 1)m 1191.91) = Sum(9 Nov	1 532.97 4.2 2736.72 1639.59 8)15.912 = Dec		(95) (96) (97)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (98)m= Later (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24 e heatin pace co Jlated fo Jan loss rate 0 ation fact	tor for g 0.99 hmGm 707.21 age exte 4.9 for mea 2702.2 g require 1340.63 g require oling rec r June, Feb e Lm (ca	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29 ement in uiremen July and Mar Iculated 0	1: 0.96 4)m x (8- 963.44 1963.44 1979.26 1979.26 1979.26 or each n 731.39 kWh/m ² t August. Apr using 25	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\ 398.2 2/year 2/year See Tal May 5°C inter	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m : 646.1 th = 0.02 0 Jul perature	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0 Tota Aug and exte	0.87 738.7 14.1 - (96)m 1071.36 0m - (95 0 1 per year Sep ernal ten	0.98 680.47 10.6] 1648.66)m] x (4 720.33 (kWh/year (kWh/year	0.99 573.58 7.1 2229.01 1)m 1191.91) = Sum(9 Nov e from T	1 532.97 4.2 2736.72 1639.59 8) _{15,912} = Dec able 10)		(95) (96) (97) (98) (99)

Useful	l loss, h	mLm (W	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0		1057.52	1024.53	0	0	0	0	7	(102)
Gains	(solar o	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)				-	
(103)m=	0	0	0	0	0	1379.35	1321.11	1225.3	0	0	0	0	7	(103)
						lwelling,	continuo	ous (kW	(h) = 0.02	24 x [(10)3)m – (102)m]	l x (41)m	
<u>`</u> г	04)m to	Ì	104)m <	: 3 × (98)m								-	
(104)m=	0	0	0	0	0	131.01	196.11	149.37	0	0	0	0		_
										= Sum(,	=	476.5	(104)
Cooled									f C =	cooled a	area ÷ (4	4) =	1	(105)
-		actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	= Sum(104)	=	0	(106)
· · ·	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n					_	
(107)m=	0	0	0	0	0	32.75	49.03	37.34	0	0	0	0		
									Total	= Sum(107)	=	119.12	(107)
Space of	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)	÷ (4) =			1.08	(108)
8f. Fabi	ric Enei	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		81.82	(109)
													L	

					User D	etails:						
Assessor Name: Software Name:	Stro	oma FS	AP 201			Strom Softwa Address	are Ver	rsion:		Versio	n: 1.0.5.7	
Address :	, Lo	ndon			roperty	Ruarcoo	. LOT LO					
1. Overall dwelling dir												
					Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	
Basement					(67.4	(1a) x	2	2.8	(2a) =	188.72	(3a)
Ground floor					4	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA =	(1a)+(1t	o)+(1c)+(1d)+(1e)+(1r	ı) <u> </u>	09.8	(4)			-		-
Dwelling volume							(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:												J
2. Voltilation rate.		main		econdar	у	other		total			m ³ per hour	
Number of chimneys	Г	neating 0	ייי ח ר ר ר	eating 0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	L L	0		0] + [0] = [0	x 2	20 =	0] (6b)
Number of intermittent	fans L							0	x ^	10 =	0](7a)
Number of passive ver	nts							0	x ^	10 =	0	(7b)
Number of flueless gas										40 =		(7c)
								0		Air ch	o anges per hou	」 Jr
Infiltration due to chimi								0		÷ (5) =	0	(8)
Number of storeys in				a, procee	<i>a</i> io (17), i	olnerwise (continue in	om (9) to (10)		0	(9)
Additional infiltration		(/						[(9)	-1]x0.1 =	0	(10)
Structural infiltration:	0.25 fo	r steel or	timber f	frame or	0.35 fo	r masoni	ry constr	uction			0	(11)
if both types of wall are deducting areas of ope				ponding to	the great	er wall are	a (after					_
If suspended woode				ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, e	enter 0.0)5, else e	enter 0								0	(13)
Percentage of windo	ws and	doors dr	aught st	ripped							0	(14)
Window infiltration						0.25 - [0.2					0	(15)
Infiltration rate						(8) + (10)					0	(16)
Air permeability valu If based on air permea	•	-			•	•	•	etre of e	nvelope	area	15	(17)
Air permeability value app	-							is beina us	sed		0.75	(18)
Number of sides shelte						,,	,, <u>,</u>				2	(19)
Shelter factor						(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpo	-					(21) = (18) x (20) =				0.64	(21)
Infiltration rate modified						1.		_	i		I	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind				0.0				4.0	4-	4-	l	
(22)m= 5.1 5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (22a)m =	(22)m ÷	- 4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjust	ed infilt	ration ra	te (allow	ing for s	helter ar	nd wind s	speed) =	: (21a) x	(22a)m	•	•	-	-	
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75]	
		<i>ective air</i> al ventila	-	rate for	the appl	icable ca	se		-	-			- 	(220)
				endix N (2	23h) - (23	a) × Fmv (e	equation (N5)) othe	rwise (23ł	n) – (23a)			0.5	(23a)
			• • • •		, ,	for in-use f				5) = (200)			0.5	(23b)
			-	-	-	at recove				2h)m ± ((23h) v [1 _ (23c)	58.65	(23c)
(24a)m=			0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96]	(24a)
						heat rec]	
(24b)m=									0		0	0	ו	(24b)
		L house ex	tract ve	I ntilation	I or positiv	ve input v	l ventilatio	I on from (L outside		1	I	1	
,					•	b); otherv				.5 × (23l	b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
						ve input v erwise (2				0.51	1		1	
(24d) <mark>m=</mark>	<u> </u>	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive ai	r change	e rate - e	nter (24a	a) or (24	b) or (24	c) or (24	ld) in bo	x (25)					
(25)m=	1.02	1	0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96		(25)
2 140	ot loop			noromot	0.51									
ELEN		es and h Gro		Openir		Net Ar	00	U-val		AXU		k-value	<u>_</u>	AXk
ELCN			a (m²)		193 1 ²	A,r		W/m2		(W/		kJ/m ² ·l		kJ/K
Doo <mark>rs</mark>						1.98	×	1.8	=	3.564				(26)
Windo	ws Typ	e 1				4.33		/[1/(1.6)+	- 0.04] =	6.51				(27)
Windo	ws Typ	e 2				1.92	x1	/[1/(1.6)+	- 0.04] =	2.89				(27)
Windo	ws Typ	e 3				0.64		/[1/(1.6)+	- 0.04] =	0.96				(27)
Floor 7	Гуре 1					30	x	0.1	=	3				(28)
Floor 7	Гуре 2					37.4	×	0.25	=	9.35	= i		\exists	(28)
Walls -	Type1	48	.6	4.48	3	44.12	2 X	0.55		24.27			\dashv	(29)
Walls -	• •	32		17.3		15.48		0.15		2.32			\dashv	(29)
Walls -	• •	8.0		0		8.6	×	0.55		4.73			\exists	(29)
Walls	• •	3.		1.98		1.12		0.55		0.62			\dashv	(29)
Walls	• •													(29)
		elements		0		13.3		0.15	=	2	[
				offoctivo	indow I I v	173.8 alue calcul		a formula r	1/[/1/1/1	UD)+0 01	as aivon ir	naragraph	22	(31)
		as on both					นเฮน นงกไข	gionnuid	//(// U -val	u c/+ 0.04] (us yiven III	ραιαγιαρι	1 0.2	

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	82.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design approximate where the details of the construction are not known	providely the indicative values of TMD in Table 1f	-	-

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

can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						26	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			108.62	(37)
Ventila	ation hea	at loss ca	alculated	I monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	100.59	99.01	97.44	89.58	88.01	80.15	80.15	78.57	83.29	88.01	91.15	94.3		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	209.21	207.64	206.07	198.21	196.63	188.77	188.77	187.2	191.92	196.63	199.78	202.92		
Heat lo	oss para	Imeter (H	HP) W	′m²K						Average = = (39)m ÷	Sum(39)1.	12 /12=	197.81	(39)
(40)m=	1.91	1.89	1.88	1.81	1.79	1.72	1.72	1.7	1.75	1.79	1.82	1.85		
()											Sum(40)1		1.8	(40)
Numbe	er of day	/s in moi	nth (Tab	le 1a)										
	Jan	Feb	Mar	Apr	Мау	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 enei	rgy requ	rement:								kWh/ye	ear:	
													1	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) (42)														(42)
	A £ 13.		1.70 /		(0.0000		A 10.5	/2/] 1 0.0	, 10 10 x (11 A 10.	5)			
								(25 x N)				1.02		(43)
		al average litres per j						to achieve	a water us	se target o	f			
not more													1	
Hot wat	Jan er usage i	Feb n litres per	Mar day for ea	Apr ach month	May Vd m – fa	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
									00	400.04	407.00	444.40		
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13	4040.00	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	m x nm x D	0Tm / 3600			m(44) ₁₁₂ = ables 1b, 10		1212.28	
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
										Total = Su	m(45) ₁₁₂ =		1589.49	(45)
It instan		ater heatil	ng at point I	of use (no	hot water	· storage),	enter 0 in	boxes (46,) to (61)				1	
(46)m= Water	24.72 storage	21.62	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94		(46)
	-		includir	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		110		(47)
-		neating a					-					110		()
		-			-			ombi boil	ers) ente	er '0' in (47)			
	storage								,	· · · ·	,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
Tempe	erature f	actor fro	m Table	2b							(0		(49)
Energy	y lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=			0		(50)
,		urer's de											1	
		age loss			e 2 (kW	h/litre/da	ay)				(0		(51)
		eating s from Ta		un 4.3								0	1	(52)
		actor fro		2b								0		(52) (53)
											`	-	1	()

	•	om water (54) in (5	•	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54) (55)
	. ,	loss cal		for each	month			((56)m – (55) × (41)r	n		0		(55)
		· · · · ·	i	i		0							l	(56)
(56)m=	0 er contain:	0 s dedicate	0 d solar sto	0 rage (57)	0 = (56)m	0 x [(50) – (0 H11)] ∸ (5)	0 0) else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	lix H	(56)
-			r	- · ·										(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
	•	loss (an	,									0		(58)
	•	loss cal			`	,	,	. ,		r thormo	ctot)			
(110 (59)m=									cylinde			0		(59)
		_				_	_	_	Ŭ	•	•	Ŭ		()
		Iculated	1	r	,	、 <i>,</i>	, <i>,</i>		10.00	50.00	40.00	50.00		(61)
(61)m=	50.96	46.03	50.96	48.82	48.39	44.84	46.33	48.39	48.82	50.96	49.32	50.96		(61)
	· · · ·			<u> </u>				· /		-	. ,	<u> </u>	(59)m + (61)m I	
(62)m=	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		(62)
									if no solaו אר	r contributi	on to wate	er heating)		
(add a (63)m=		l lines if					, see Ap		•) 0	0	0	0		(63)
	-			0	0	0	0	0	0	0	0	0		(00)
(64)m=	215.76	ater hea	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		
(04)11-	213.70	130.10	199.09	170.49	172.01	152.2	143.02		out from wa				2174.27	(64)
	naine fro	m water	booting	k\//b/m	onth 0.2	5 / 10 95	x (45)m		n] + 0.8 ×					
(65)m=	67.53	59.43	62.19	55.32	53.47	46.91	x (45)m 44.66	50.06	50.62	57.51	+ (<i>37</i>)m	+ (59)m 65.81		(65)
														(00)
_	. ,				-	yinder is	s in the t	aweiling	or hot w	alerisii	om com	munity n	leating	
		ains (see	e rable :	and ba):									
Metab		is (Tahle												
(66)m-			5), Wat		May	lun	1.1	Aug	Sen	Oct	Nov	Dee		
(00)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(66)
	140.68	Feb 140.68	Mar 140.68	Apr 140.68	140.68	140.68	140.68	140.68	140.68					(66)
Lightir	140.68 ng gains	Feb 140.68 (calcula	Mar 140.68 ted in Ap	Apr 140.68 opendix	140.68 L, equat	140.68 ion L9 oi	140.68 r L9a), a	140.68 Iso see	140.68 Table 5	140.68	140.68	140.68		
Lightir (67)m=	140.68 ng gains 24.37	Feb 140.68 (calcula 21.65	Mar 140.68 ted in Ap 17.61	Apr 140.68 pendix 13.33	140.68 L, equat 9.96	140.68 ion L9 oi 8.41	140.68 r L9a), a 9.09	140.68 Iso see 11.81	140.68 Table 5 15.86	140.68 20.13				(66) (67)
Lightir (67)m= Applia	140.68 ng gains 24.37 nces ga	Feb 140.68 (calcula 21.65 ins (calc	Mar 140.68 ted in Ap 17.61 ulated ir	Apr 140.68 ppendix 13.33 Append	140.68 L, equat 9.96 dix L, eq	140.68 ion L9 or 8.41 uation L	140.68 r L9a), a 9.09 13 or L1:	140.68 Iso see 11.81 3a), also	140.68 Table 5 15.86 see Tal	140.68 20.13 ble 5	140.68 23.5	140.68 25.05		(67)
Lightir (67)m= Applia (68)m=	140.68 ng gains 24.37 nces ga 271.27	Feb 140.68 (calcula 21.65 ins (calc 274.08	Mar 140.68 ted in Ap 17.61 ulated ir 266.99	Apr 140.68 ppendix 13.33 Append 251.89	140.68 L, equat 9.96 dix L, eq 232.83	140.68 ion L9 of 8.41 uation L 214.91	140.68 r L9a), a 9.09 13 or L1 202.94	140.68 Iso see 11.81 3a), also 200.13	140.68 Table 5 15.86 see Tal 207.22	140.68 20.13 ble 5 222.32	140.68	140.68		
Lightir (67)m= Applia (68)m= Cookin	140.68 ng gains 24.37 nces ga 271.27 ng gains	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula	Mar 140.68 ted in Ap 17.61 ulated ir 266.99 ted in A	Apr 140.68 ppendix 13.33 Append 251.89 ppendix	140.68 L, equat 9.96 dix L, eq 232.83 L, equat	140.68 ion L9 of 8.41 uation L 214.91 ion L15	140.68 r L9a), a 9.09 13 or L1 202.94 or L15a)	140.68 Iso see 11.81 3a), also 200.13 , also se	140.68 Table 5 15.86 9 see Tal 207.22 9 Table	140.68 20.13 ole 5 222.32 5	140.68 23.5 241.38	140.68 25.05 259.3		(67) (68)
Lightir (67)m= Applia (68)m= Cookir (69)m=	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07	Mar 140.68 ted in Ap 17.61 ulated in 266.99 ted in A 37.07	Apr 140.68 ppendix 13.33 Append 251.89 ppendix 37.07	140.68 L, equat 9.96 dix L, eq 232.83	140.68 ion L9 of 8.41 uation L 214.91	140.68 r L9a), a 9.09 13 or L1 202.94	140.68 Iso see 11.81 3a), also 200.13	140.68 Table 5 15.86 see Tal 207.22	140.68 20.13 ble 5 222.32	140.68 23.5	140.68 25.05		(67)
Lightir (67)m= Applia (68)m= Cookir (69)m= Pumps	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fai	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains	Mar 140.68 ted in Ap 17.61 ulated ir 266.99 ted in A 37.07 (Table \$	Apr 140.68 ppendix 13.33 Append 251.89 ppendix 37.07 5a)	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07	140.68 ion L9 of 8.41 uation L 214.91 ion L15 37.07	140.68 r L9a), a 9.09 13 or L1: 202.94 or L15a) 37.07	140.68 Iso see 11.81 3a), also 200.13 , also se 37.07	140.68 Table 5 15.86 see Tal 207.22 ee Table 37.07	140.68 20.13 ble 5 222.32 5 37.07	140.68 23.5 241.38 37.07	140.68 25.05 259.3 37.07		(67) (68) (69)
Lightir (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fat 3	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains 3	Mar 140.68 ted in Ap 17.61 ulated in 266.99 ted in A 37.07 (Table \$ 3	Apr 140.68 opendix 13.33 Appendix 251.89 opendix 37.07 5a) 3	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07	140.68 ion L9 of 8.41 uation L 214.91 ion L15 37.07	140.68 r L9a), a 9.09 13 or L1 202.94 or L15a)	140.68 Iso see 11.81 3a), also 200.13 , also se	140.68 Table 5 15.86 9 see Tal 207.22 9 Table	140.68 20.13 ole 5 222.32 5	140.68 23.5 241.38	140.68 25.05 259.3		(67) (68)
Lightir (67)m= Applia (68)m= Cookin (69)m= Pumps (70)m= Losse	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fat 3 s e.g. ev	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains 3 raporatio	Mar 140.68 ted in Ap 17.61 ulated ir 266.99 ted in A 37.07 (Table \$ 3 n (nega	Apr 140.68 opendix 13.33 Appendix 251.89 ppendix 37.07 5a) 3 tive valu	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07 3 es) (Tab	140.68 ion L9 of 8.41 uation L 214.91 ion L15 37.07 3 le 5)	140.68 r L9a), a 9.09 13 or L1: 202.94 or L15a) 37.07 3	140.68 Iso see 11.81 3a), also 200.13 , also se 37.07 3	140.68 Table 5 15.86 see Tal 207.22 ee Table 37.07 3	140.68 20.13 ble 5 222.32 5 37.07 3	140.68 23.5 241.38 37.07 3	140.68 25.05 259.3 37.07 3		(67) (68) (69) (70)
Lightir (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losse (71)m=	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fai 3 s e.g. ev -112.54	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains 3 aporatio -112.54	Mar 140.68 ted in Ap 17.61 ulated in 266.99 ted in A 37.07 (Table \$ 3 on (nega -112.54	Apr 140.68 opendix 13.33 Appendix 251.89 opendix 37.07 5a) 3	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07	140.68 ion L9 of 8.41 uation L 214.91 ion L15 37.07	140.68 r L9a), a 9.09 13 or L1: 202.94 or L15a) 37.07 3	140.68 Iso see 11.81 3a), also 200.13 , also se 37.07	140.68 Table 5 15.86 see Tal 207.22 ee Table 37.07	140.68 20.13 ble 5 222.32 5 37.07	140.68 23.5 241.38 37.07	140.68 25.05 259.3 37.07 3		(67) (68) (69)
Lightir (67)m= Applia (68)m= Cookin (69)m= Pumps (70)m= Losse (71)m= Water	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fai 3 s e.g. ev -112.54 heating	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains 3 raporatio -112.54 gains (T	Mar 140.68 ted in Ap 17.61 ulated in 266.99 ted in A 37.07 (Table 5 an (nega -112.54 Table 5)	Apr 140.68 opendix 13.33 Appendix 251.89 ppendix 37.07 5a) 3 tive valu -112.54	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07 3 es) (Tab -112.54	140.68 ion L9 of 8.41 uation L 214.91 ion L15 37.07 3 le 5) -112.54	140.68 r L9a), a 9.09 13 or L1: 202.94 or L15a) 37.07 3 -112.54	140.68 Iso see - 11.81 3a), also 200.13 , also se 37.07 3 -112.54	140.68 Table 5 15.86 see Tal 207.22 ee Table 37.07 3	140.68 20.13 ole 5 222.32 5 37.07 3 -112.54	140.68 23.5 241.38 37.07 3 -112.54	140.68 25.05 259.3 37.07 3 -112.54		(67) (68) (69) (70) (71)
Lightir (67)m= Applia (68)m= Cookin (69)m= Pumps (70)m= Losse (71)m= Water (72)m=	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fat 3 s e.g. ev -112.54 heating 90.77	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains 3 aporatio -112.54 gains (T 88.44	Mar 140.68 ted in Ap 17.61 ulated in 266.99 ted in A 37.07 (Table 5 3 on (nega -112.54 Table 5) 83.59	Apr 140.68 opendix 13.33 Appendix 251.89 ppendix 37.07 5a) 3 tive valu	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07 3 es) (Tab	140.68 ion L9 of 8.41 214.91 ion L15 37.07 3 le 5) -112.54 65.15	140.68 r L9a), a 9.09 13 or L1: 202.94 or L15a) 37.07 3 -112.54 60.03	140.68 Iso see 11.81 3a), also 200.13 , also se 37.07 3 -112.54 67.28	140.68 Table 5 15.86 9 see Tal 207.22 9e Table 37.07 3 -112.54 70.3	140.68 20.13 ble 5 222.32 5 37.07 3 -112.54 77.29	140.68 23.5 241.38 37.07 3 -112.54 84.99	140.68 25.05 259.3 37.07 3 -112.54 88.45		(67) (68) (69) (70)
Lightir (67)m= Applia (68)m= Cookin (69)m= Pumps (70)m= Losse (71)m= Water (72)m=	140.68 ng gains 24.37 nces ga 271.27 ng gains 37.07 s and fail 3 s e.g. ev -112.54 heating 90.77	Feb 140.68 (calcula 21.65 ins (calc 274.08 (calcula 37.07 ns gains 3 raporatio -112.54 gains (T	Mar 140.68 ted in Ap 17.61 ulated in 266.99 ted in A 37.07 (Table 5 3 on (nega -112.54 Table 5) 83.59	Apr 140.68 opendix 13.33 Appendix 251.89 ppendix 37.07 5a) 3 tive valu -112.54	140.68 L, equat 9.96 dix L, eq 232.83 L, equat 37.07 3 es) (Tab -112.54	140.68 ion L9 of 8.41 214.91 ion L15 37.07 3 le 5) -112.54 65.15	140.68 r L9a), a 9.09 13 or L1: 202.94 or L15a) 37.07 3 -112.54 60.03	140.68 Iso see 11.81 3a), also 200.13 , also se 37.07 3 -112.54 67.28	140.68 Table 5 15.86 see Tal 207.22 ee Table 37.07 3	140.68 20.13 ble 5 222.32 5 37.07 3 -112.54 77.29	140.68 23.5 241.38 37.07 3 -112.54 84.99	140.68 25.05 259.3 37.07 3 -112.54 88.45		(67) (68) (69) (70) (71)

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9>	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9>	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9>	0.77	x	1.92	x	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9>	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9>	0.77	x	1.92	x	110.55	x	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9>	0.77	x	1.92	x	55.42	x	0.63	x	0.7	=	65.03	(78)
South 0.9>	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9>	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9>	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9>	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Southwest0.9	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Sout <mark>hwest_{0.9},</mark>	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9	(0.7 <mark>7</mark>	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9	0.77	x	0.64	x	104.39		0.63	x	0.7	=	20.42	(79)
Sout <mark>hwest</mark> 0.9>	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9>	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9>	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9>	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9>	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9>	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	488.46	(80)
West 0.9>	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9>	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9>	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9>	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9>	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9>	0.77	x	4.33	×	24.49	x	0.63	x	0.7	=	129.63	(80)
West 0.9>	0.77	x	4.33	×	16.15	x	0.63	x	0.7	=	85.49	(80)

Solar g	ains in	watts, ca	alculated	for eacl	n month			(83)m = S	um(74)m .	(82)m			
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	Total gains – internal and solar (84)m = (73)m + (83)m , watts												
(84)m=	620.64	757.86	902.54	1048.86	1139.57	1122.32	1072.71	992.08	888.84	739.73	621.36	580.06	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
							from Ta	ble 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=	1	1	0.99	0.97	0.92	0.81	0.68	0.73	0.91	0.98	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)	-	-	-		
(87)m=	18.84	19.05	19.42	19.94	20.4	20.77	20.92	20.89	20.6	19.99	19.35	18.85		(87)
Temp	erature	during h	neating p	periods in	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.4	19.41	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.96	0.88	0.71	0.49	0.55	0.84	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	le 9c)				
(90)m=	16.6	16.91	17.45	18.24	18.89	19.37	19.5	19.49	19.18	18.33	17.39	16.64		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	17.55	17.82	18.29	18.96	19.53	19.97	20.1	20.09	19.78	19.03	18.22	17.58		(92)
Ap <mark>ply</mark>	adjustn	nent to t	he mear	n interna	l temper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	17.4	17.67	18.14	18.81	19.38	19.82	19.95	19.94	19.63	18.88	18.07	17.43		(93)
8. Spa	ace hea	t <mark>ing re</mark> զա	uirement	:										
				mperatu using Ta		ied at st	ep 11 of	Table 9	b, so tha	it Ti,m=(76)m an	d re-calc	ulate	
the ut	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g			<u> </u>	- Curr		7,639			1101	200		
(94)m=	1	0.99	0.98	0.95	0.88	0.73	0.55	0.61	0.85	0.97	0.99	1		(94)
Usefu	ul gains,	hmGm	, W = (9 [,]	4)m x (8-	4)m									
(95)m=	617.69	750.62	883.28	993.55	998.96	822.27	592.25	604.54	754.23	715.22	616.24	577.94		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8	-							
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	r	r	1	· · ·	1	r	<u>, ,</u>	x [(93)m	– (96)m	ī — — —	1		1	
(97)m=	2740.3	2651.1		1965.08		984.56	632.53	662.11	1061.6		2191.97	2684.44		(97)
	r	<u> </u>		î .		r	i i i i i i i i i i i i i i i i i i i	24 x [(97	í t	ŕ	ŕ	4507.00		
(98)m=	1579.22	1277.12	1126.79	699.51	380.17	0	0	0	0	679.33	1134.53		0440.0	(98)
					. ,			TOTA	ll per year	(kwn/yea	r) = Sum(9	8)15,912 =	8443.9	
Space	e heatin	g require	ement in	kWh/m²	²/year								76.9	(99)
			nts – Ind	ividual h	eating s	ystems i	ncluding	g micro-C	CHP)					
•	e heatir ion of sp	-	at from s	econdar	v/supple	mentarv	v svstem						0	(201)
	-			nain syst		,	-,	(202) = 1	– (201) =				1	(202)
				main sys	. ,				02) × [1 –	(203)] =			1	(204)
			•	ing syste									91.8	(206)
	-			ementar		a svsten	า. %						0	(208)
			.,		,au	5 5,5101	.,						0	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space				alculate	,		Uui	/ lug	000	000	1101	000	l Room you	A1
	1579.22	1277.12	1126.79	699.51	380.17	0	0	0	0	679.33	1134.53	1567.23		
(211)m	n = {[(98)m x (20	04)]	00 ÷ (20)6)					-	-			(211)
	1720.29	1391.2	1227.44	761.99	414.12	0	0	0	0	740.01		1707.23		-
-								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	2	9198.14	(211)
•		Č (econdar 00 ÷ (20	y), kWh/ າຊາ	month									
(215)m=	0	0	00 ÷ (20	0	0	0	0	0	0	0	0	0		
			1					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	I												-
Output	from wa	ater hea 190.16	ter (calc 199.69	ulated a	00 ve) 172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56	l	
Efficier		ater hea		176.49	172.01	152.2	140.62	102.30	104.30	160.0	190.20	210.56	82.5	(216)
(217)m=		90.48	90.27	89.74	88.68	82.5	82.5	82.5	82.5	89.63	90.3	90.59		(217)
Fuel fo	r water	heating,	kWh/m	onth		I				I	I			
· ,		m x 100) ÷ (217) 221.22	m 198.89	194.88	184.49	176.75	197.04	199.21	207.06	217.37	232.43	l	
(219)m=	230.21	210.17	221.22	190.09	194.00	104.49	170.75		I = Sum(2)		217.37	232.43	2477.72	(219)
Ann <mark>ua</mark>	I totals										Wh/year		kWh/year	
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								9198.14]
Wat <mark>er</mark>	heating	fuel use	d										2477.72	1
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
me <mark>ch</mark>	anical v	entilatio	n - balar	nced, ext	ract or p	ositive i	nput from	n outside	e			360.17		(230a)
centra	al heatin	g pump	:									30		(230c)
boiler	with a f	an-assis	sted flue								•	45		(230e)
Total e	lectricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			435.17	(231)
Electric	city for li	ghting											430.44	(232)
12a. (CO2 em	issions ·	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHP						_
						En	ergy			Emiss	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	1986.8	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	535.19	(264)
Space	and wa	ter heati	ing			(26	1) + (262) -	+ (263) + (264) =				2521.99	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23 ⁻	1) x			0.5	19	=	225.85	(267)
Electric	city for li	ghting				(232	2) x			0.5	19	=	223.4	(268)
Total C	02, kg/	year							sum o	f (265)(2	271) =		2971.24	(272)
Dwelli	ng CO2	Emissi	on Rate	•					(272)	÷ (4) =			27.06	(273)
El ratir	ng (secti	on 14)											74	(274)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012			Stroma Softwa	are Ver	sion:		Versio	n: 1.0.5.7	
			Pi	operty <i>i</i>	Address:	LG1 Le	an				
Address :	, London										
1. Overall dwelling dime	nsions:										
				Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	-
Basement				6	67.4	(1a) x	2	2.8	(2a) =	188.72	(3a)
Ground floor				4	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+	(1d)+(1e)+	⊦(1n) 1	09.8	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:											-
	main heating		condar ating	у	other		total			m ³ per hour	
Number of chimneys		 +	0] + [0] = [0	x 4	= 0	0	(6a)
Number of open flues	0	<u> </u>	0	ī + Г	0	ī = Г	0	x 2	20 =	0	(6b)
Number of intermittent fai	ns					- F	4	x 1	0 =	40	(7a)
Number of passive vents						Γ	0	x 1	0 =	0	(7b)
Number of flueless gas fin	res					Ē	0	× 4	40 =	0	(7c)
									Air ch	anges per hou	ır
Infiltration due to chimney							40		+ (5) =	0.13	(8)
If a pressurisation test has be			, proceed	to (17), d	otherwise o	continue fr	om (9) to (16)	1		٦
Number of storeys in th Additional infiltration	ie aw <mark>eiling</mark> (na	5)						[(0)	11/0 1	0	(9)
Structural infiltration: 0.	25 for steel o	timbor fr	amo or	0 35 for	masonr	vconstr	uction	[(9)-	1]x0.1 =	0	(10)
if both types of wall are pr						•	uction			0	(11)
deducting areas of openin											-
If suspended wooden f		,	d) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent										0	(13)
Percentage of windows	s and doors dr	aught strip	pped		0.05 10.0		0.01			0	(14)
Window infiltration					0.25 - [0.2		-			0	(15)
Infiltration rate	50				(8) + (10)					0	(16)
Air permeability value,				•	•	•	etre of e	nvelope	area	5	(17)
If based on air permeabili	-						ia haina w	ad		0.38	(18)
Air permeability value applies Number of sides sheltere		on lest has b	een aon	e or a deg	gree all pei	meaning	is being us	seu	I	2	(19)
Shelter factor	u				(20) = 1 -	[0.075 x (1	9)] =			2 0.85	(13)
Infiltration rate incorporati	ing shelter fac	tor			(21) = (18)) x (20) =				0.33	(21)
Infiltration rate modified for	-									0.00	J,,
r	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	· · ·	e 7									
· · · · · · · · · · · · · · · · · · ·	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				-	
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se	-	-		-		- 	(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	auation (N5)) . othe	rwise (23t	o) = (23a)			0	
						or in-use fa				, , ,			0	
a) If	balance	ed mech	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	-	(200)
(24a)m=		0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	overy (l	u MV) (24t)m = (2	- 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	ntilation of	or positiv	ve input v	ventilatio	on from o	outside	-	-	-		
i	if (22b)r	n < 0.5 >	< (23b), 1	then (240	c) = (23k	o); otherv	vise (24	c) = (22	b) m + 0	.5 × (23b) 	,		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
						ve input v erwise (24				0.51				
(24d)m=	<u> </u>	0.58	0.58	0.56	0.56	0.55	0.55	0.5 + [(2	0.55	0.56	0.57	0.57		(24d)
ì í						o) or (240			<u> </u>					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
		s and ne Gros		paramete Oponin		Net Are	00	U-val		AXU		k-value		AXk
ELEN		area		Openin m	-	A ,n		W/m2		(W/		kJ/m²·l		kJ/K
Doo <mark>rs</mark>						1.98	×	1	=	1.98				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(1.4)+	0.04] =	5.74				(27)
Windo	ws Type	e 2				1.92	x1	/[1/(1.4)+	0.04] =	2.55				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(1.4)+	0.04] =	0.85				(27)
Floor T	Гуре 1					30	x	0.13	=	3.9				(28)
Floor T	Гуре 2					37.4	x	0.13	=	4.862			- -	(28)
Walls -	Type1	48.	6	4.48		44.12	x	0.18	=	7.94			- -	(29)
Walls -	Туре2	32.	8	17.3	2	15.48	x	0.18	=	2.79			ΞĒ	(29)
Walls -	ТуреЗ	8.6	3	0		8.6	x	0.18	=	1.55	T i		\exists \vdash	(29)
Walls -	Туре4	3.1	1	1.98		1.12	x	0.18	=	0.2	T i		Ξ Γ	(29)
Walls -	Туре5	13.	3	0		13.3	x	0.18	=	2.39	i F		Ξ Γ	(29)
Total a	area of e	elements	s, m²			173.8								(31)
* for win	dows and	l roof wind	lows, use e	effective wi	ndow U-va	alue calcula	ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	paragraph	n 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) =	54.52	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not known i	precisely the indicative values of TMP in Table 1f		-

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

can be ι	ised instea	ad of a dei	tailed calc	ulation.										
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						16.25	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			70.77	(37)
Ventila	tion hea	at loss ca	alculated	monthl	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.86	57.53	57.21	55.68	55.4	54.07	54.07	53.82	54.58	55.4	55.97	56.58		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	128.63	128.3	127.97	126.45	126.16	124.83	124.83	124.59	125.34	126.16	126.74	127.34		
										-	Sum(39)1	12 /12=	126.44	(39)
		· ·	HLP), W/							= (39)m ÷	· ·			
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					/	Average =	Sum(40)1	12 /12=	1.15	(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 \//2	ter heat	ting ener	rgy requi	romont.								kWh/ye	aar.	
4. VVC			igy iequi	irement.								K V V I // y C	-ai.	
		ipancy, I									2.	81		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0	0013 x (1	IFA -13.	9)			
			ater usad	ne in litre	s per da	v Vd.av	erage =	(25 x N)	+ 36		101	.02		(43)
								o achieve		se target o		1.02		(10)
not more	e that 125	litres per p	person pei	day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		
											m(44) ₁₁₂ =		1212.28	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600	kWh/mon	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
										Total = Su	m(45) ₁₁₂ =	=	1589.49	(45)
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)) to (61)				L	
(46)m=	24.72	21.62	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94		(46)
	storage		in also allo				- 4			1			1	
0		```		0			0	within sa	ime ves	sei		0		(47)
	•	-			-		litres in	. ,	ara) ante	or (0' in (47)			
	storage		not wate	: (uns n	iciuues i	iistailtai	ieous co	mbi boil	ers) erne		47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
			m Table				, , , ,					0		(49)
			storage		or			(48) x (49)	_					
			-			or is not		(40) × (49)	-			0		(50)
,						h/litre/da					(0		(51)
		-	ee secti								L			
		from Ta									(0		(52)
Tempe	erature fa	actor fro	m Table	2b							(0		(53)

		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
				for each	month			((56)m = (55) × (41)r	m	L			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contain	s dedicate	l d solar sto	i orage, (57)i	I m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
•	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)		1	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m			-	-		
(61)m=	50.96	46.03	50.96	48.82	48.39	44.84	46.33	48.39	48.82	50.96	49.32	50.96		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)n	n
(62)m=	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		(62)
Solar DI	HW input	calculated	using App	endix G or	r Appendix	d 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)				1	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		_
								Outp	out from wa	ater heate	r (annual)₁	12	2174.27	(64)
Heat g	lains fro	m water	heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m]	
(65)m=	67.53	59.43	62.19	55.32	53.47	46.91	44.66	50.06	50.62	57.51	61.2	65.81		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Ini	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts		i		i			1	i		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	<u> </u>	È	·	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	r	i	i		
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5			L	
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5				
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table !	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	vaporatio	n (nega	tive valu	es) (Tab	ole 5)	-	-			-	-		
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)											
(72)m=	90.77	88.44	83.59	76.83	71.86	65.15	60.03	67.28	70.3	77.29	84.99	88.45		(72)
Total i	internal	gains =				(66)	m + (67)m	n + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	454.62	452.37	436.39	410.25	382.86	356.68	340.26	347.43	361.58	387.95	418.08	441		(73)
6. So	lar gains	S:												

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

Orientation:	Access Factor Table 6d	r	Area m²	Flux Table 6a			g_ FF Table 6b Table 6c			Gains (W)		
South 0.9>	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9	0.77	x	1.92	×	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9>	0.77	x	1.92	×	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9>	0.77	x	1.92	×	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	×	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9>	0.77	x	1.92	×	110.55	x	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	×	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9	0.77	x	1.92	x	55.42	x	0.63	x	0.7	=	65.03	(78)
South 0.9	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9>	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9>	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Sout <mark>hwest_{0.9},</mark>	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Sout <mark>hwest</mark> 0.9>	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Sout <mark>hwest</mark> 0.9>	0.77	x	0.64	x	113.91	/	0.63	x	0.7	=	22.28	(79)
Sout <mark>hwest</mark> 0.9>	0.77	x	0.64	x	104. <mark>3</mark> 9		0.63	x	0.7	=	20.42	(79)
Sout <mark>hwest_{0.9},</mark>	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9>	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9>	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9>	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9>	0.77	x	4.33	×	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9>	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9>	0.77	x	4.33	×	92.28	x	0.63	x	0.7	=	488.46	(80)
West 0.9>	0.77	x	4.33	×	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9>	0.77	x	4.33	×	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9>	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9>	0.77	x	4.33	×	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9>	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9>	0.77	x	4.33	×	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9>	0.77	x	4.33	×	24.49	x	0.63	x	0.7	=	129.63	(80)
West 0.9>	0.77	x	4.33	×	16.15	x	0.63	x	0.7	=	85.49	(80)

Solar g	Solar gains in watts, calculated for each month $(83)m = Sum(74)m \dots (82)m$													
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)	
Total gains – internal and solar (84)m = (73)m + (83)m , watts													-	
(84)m=	620.64	757.86	902.54	1048.86	1139.57	1122.32	1072.71	992.08	888.84	739.73	621.36	580.06	(84)	

7. Me	an inter	nal temp	perature	(heating	season)								
	Temperature during heating periods in the living area from Table 9, Th1 (°C)												21	(85)
		-	• •	living are		-			()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.95	0.85	0.67	0.5	0.56	0.82	0.97	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)		-	-		
(87)m=	19.7	19.88	20.18	20.54	20.82	20.96	20.99	20.99	20.89	20.49	20.02	19.67		(87)
Temp	erature	during h	neating p	eriods in	n rest of	dwelling	from Ta	able 9, T	h2 (°C)		-	-		
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)			-			
(89)m=	1	0.99	0.98	0.93	0.79	0.58	0.39	0.44	0.75	0.96	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing T2 (f	ollow ste	eps 3 to	7 in Tab	le 9c)				
(90)m=	18.2	18.48	18.9	19.43	19.79	19.94	19.97	19.97	19.88	19.37	18.69	18.17		(90)
									1	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	n interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	18.84	19.07	19.44	19.9	20.23	20.37	20.4	20.4	20.3	1 <mark>9.85</mark>	19.26	18.8		(92)
Ap <mark>ply</mark>	/ adjustr	nent to t	he mear	n interna	Itemper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	18.84	19.07	19.44	19.9	20.23	20.37	20.4	20.4	20.3	19.85	19.26	18.8		(93)
8. Space heating requirement														
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>	ation fac	tor for g	ains, hr	1.										
(94)m=	1	0.99	0.98	0.93	0.81	0.62	0.44	0.49	0.77	0.96	0.99	1		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8	4)m									
(95)m=	618.88	752.08	881.92	972.31	922.14	691.56	470.32	490.61	688.46	710.49	617.43	578.87		(95)
Mont	hly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		r	r	· · ·	i	r	<u>, ,</u>	x [(93)m	r í í	ŕ – – –			l	(07)
(97)m=				1390.77			474.58	498.22	777.7	1166.73		1859.62		(97)
Space (98)m=	e heatin 930.75	g require 716.41	576.09	or each n 301.29	114.27	VVh/mon	th = 0.02	24 x [(97)m – (95 0)m] x (4 339.44	1)m 664.64	952.88	l	
(90)11=	930.75	710.41	570.09	301.29	114.27	0	0		l per year				4595.76	(98)
See	a haatin	a roquir	omont in	la M/b/ma	hoor			1012	i per year	(RWII/year) = 0um(0	0)15,912 -		
		• •		kWh/m²	•								41.86	(99)
			nts – Ind	ividual h	eating s	<u>yste</u> ms i	ncluding	g micro-C	CHP)					
-	e heatin ion of sp	-	at from s	econdar	y/supple	mentary	v system						0	(201)
Fract	ion of sp	bace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	n, %						0	(208)

	Jan boatin		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	11
Space heating requirement (calculated above)														
	930.75	716.41	576.09	301.29	114.27	0	0	0	0	339.44	664.64	952.88		
(211)m	n = {[(98)m x (20	4)]	00 ÷ (20	6)									(211)
	996.52	767.03	616.8	322.58	122.34	0	0	0	0	363.43	711.61	1020.21		-
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10} 12	-	4920.51	(211)
•				y), kWh/	month									
= {[(98 (215)m=		01)]}x1	00 ÷ (20 0	0	0	0	0	0	0	0	0	0		
(,					-	-			-	ar) =Sum(2			0	(215)
Water	heating	1].
	-	•	ter (calc	ulated al	oove)								L	
	215.76	190.16	199.69	178.49	172.81	152.2	145.82	162.56	164.35	185.6	196.28	210.56		7
		ater hea											80.3	(216)
(217)m=		88.08	87.56	86.36	84.04	80.3	80.3	80.3	80.3	86.55	87.88	88.39		(217)
		heating, m x 100												
. ,	244.32	215.9	228.05	206.68	205.64	189.54	181.6	202.44	204.67	214.43	223.35	238.22		
								Tota	I = Sum(2	19a) ₁₁₂ =			2554.84	(219)
	Annual totals kWh/year												kWh/year	7
Space heating fuel used, main system 1													4920.51	ļ
Water	heating	fuel use	d										2554.84	
Electric	city for p	oumps, fa	ans and	electric	keep-hot	t								
centra	al heatin	ig pump:										30		(230c)
boi <mark>ler</mark>	with a f	an-assis	ted flue									45		(230e)
Total e	lectricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electric	city for li	ghting											430.44	(232)
12a. (CO2 em	issions -	- Individ	ual heati	ng syste	ems inclu	uding mi	cro-CHP						-
						En	orav			Emico	ion fac	tor	Emissions	
							ergy /h/year			kg CO			kg CO2/yea	r
Space	heating	(main s	ystem 1)) x			0.2		=	1062.83	(261)
Space	heating	(second	lary)			(215	5) x			0.5	19	=	0	_ (263)
Water	heating					(219)) x			0.2		=	551.84	(264)
Space	and wa	ter heati	ng			(261) + (262) -	+ (263) + (264) =				1614.68	(265)
Electric	city for p	oumps, fa	ans and	electric	keep-hot	t (231) x			0.5	19	=	38.93	(267)
Electric	city for li	ghting				(232	2) x			0.5		=	223.4	(268)
Total C	CO2, kg/	'year							sum o	f (265)(2	271) =		1877	(272)
														-

TER =

17.09

(273)

User Details:												
Assessor Name: Software Name:	Stroma	FSAP 201			Strom Softwa	are Vei	rsion:		Versio	n: 1.0.5.7		
			P	roperty <i>i</i>	Address	: LG1 Gi	reen					
Address :	, Londor	ו										
1. Overall dwelling dim	ensions:											
_				Area	a(m²)	I	Av. Hei	ight(m)		Volume(m ³)	-	
Basement				6	67.4	(1a) x	2	2.8	(2a) =	188.72	(3a)	
Ground floor				2	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)	
Total floor area TFA = (*	la)+(1b)+(1	c)+(1d)+(1e)+(1n) 1	09.8	(4)						
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)	
2. Ventilation rate:											-	
	mair		econdar	у	other		total			m ³ per hour		
Number of chimneys	heati		eating 0] + [0] = [0	X 4	40 =	0	(6a)	
Number of open flues			0] + [⁻	0] = [0	x	20 =	0	(6b)	
Number of intermittent fa	ans	L_				- L	0	x ′	10 =	0	(7a)	
Number of passive vent	s					Г	0	x ′	10 =	0	(7b)	
Number of flueless gas	fires						0	x	40 =	0	(7c)	
									Air ch	ange <mark>s per</mark> hou	ır	
Infiltration due to chimne If a pressurisation test has							0		÷ (5) =	0	(8)	
Number of storeys in t			a, proceed	<i>n</i> (<i>17)</i> , c	Juliel Wise (Jonanue II	0111 (9) 10 (10)		0	(9)	
Additional infiltration	and an <mark>onnig</mark>	(110)						• [(9)·	-1]x0.1 =	0	(0)	
Structural infiltration: ().25 for stee	el or timber f	rame or	0.35 for	masoni	v constr	uction			0	(11)	
if both types of wall are p deducting areas of open	oresent, use th	e value corres				•], ,	
If suspended wooden			ed) or 0.	1 (seale	ed), else	enter 0				0	(12)	
lf no draught lobby, er	nter 0.05, el	se enter 0								0	(13)	
Percentage of window	s and door	s draught st	ripped						·	0	(14)	
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)	
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =	i	0	(16)	
Air permeability value	, q50, expre	essed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	15	(17)	
If based on air permeab	ility value, t	hen (18) = [(1	7) ÷ 20]+(8	3), otherwi	se (18) = ((16)				0.75	(18)	
Air permeability value appli	es if a pressur	isation test has	been don	e or a deg	gree air pe	rmeability	is being us	sed			_	
Number of sides shelter	ed									2	(19)	
Shelter factor					(20) = 1 -		9)] =			0.85	(20)	
Infiltration rate incorpora	-				(21) = (18) x (20) =				0.64	(21)	
Infiltration rate modified	for monthly	wind speed	 					i		1		
Jan Feb	Mar A	pr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind s	peed from 7	Table 7										
(22)m= 5.1 5	4.9 4.4	4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7			

Wind F	actor (22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infilt	ration ra	te (allow	ing for s	nelter ar	nd wind s	peed) =	: (21a) x	(22a)m					
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75		
		<i>èctive air</i> al ventila	-	rate for	the appl	icable ca	se		-		-		0.5	(220)
				endix N (2	23b) = (23	a) × Fmv (e	equation (N5)) othe	rwise (23h	(23a) = (23a)			0.5	(23a) (23b)
						for in-use fa) (200)			0.5	(230) (23c)
			-	-	-	at recove				2h)m + (23h) x [1 – (23c)	58.65 	(230)
(24a)m=			0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96	. 100]	(24a)
		 ed mech	anical ve	L entilatior	u without	t heat rec	overv (I	1 MV) (24t						
(24b)m=		0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole I	house ex	tract ver	ntilation	ı or positiv	ve input v	ventilatio	on from o	outside	1	<u> </u>	ļ		
í	if (22b)	m < 0.5 :	× (23b),	then (24	c) = (23l	b); otherv	vise (24	c) = (22	o) m + 0	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
						ve input v erwise (24				0.5]				
(24d)m=	· /	0	0	0	0	0	0		0	0	0	0		(24d)
	<u> </u>	r change	rate - e	nter (24a) or (24	b) or (240	c) or (24	d) in bo	(25)					
(25)m=	1.02	1	0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96		(25)
2 40	ot looo	es and h		noromot	or									
ELEN		Gro		Openir		Net Are	ea	U-val	ue	AXU		k-value	<u>.</u>	AXk
			(m²)		ι90 1 ²	A ,n		W/m2		(W/	K)	kJ/m²·ł		kJ/K
Doo <mark>rs</mark>						1.98	x	1.8	=	3.564				(26)
Windo	ws Typ	e 1				4.33	x1	/[1/(1.6)+	0.04] =	6.51				(27)
Windo	ws Typ	e 2				1.92	x1	/[1/(1.6)+	0.04] =	2.89				(27)
Windo	ws Typ	e 3				0.64	x1	/[1/(1.6)+	0.04] =	0.96				(27)
Floor 7	Гуре 1					30	x	0.1	=	3				(28)
Floor 7	Гуре 2					37.4	x	0.25	=	9.35	i F		7	(28)
Walls	Type1	48	.6	4.48	3	44.12	x	0.55	=	24.27	i F		7	(29)
Walls -	Type2	32	.8	17.3	2	15.48	x	0.15	=	2.32	i F		$\exists \square$	(29)
Walls	ТуреЗ	8.0	6	0		8.6	×	0.55		4.73	i F		- -	(29)
Walls	Type4	3.	1	1.98	3	1.12	×	0.55		0.62	i F		- -	(29)
Walls	Туре5	13	.3	0		13.3	×	0.15	=	2	i F		\exists	(29)
Total a	area of	elements	s, m²			173.8					L			(31)
		d roof wind eas on both				alue calcula		g formula 1	/[(1/U-val	ue)+0.04] a	as given in	paragraph	3.2	

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	82.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design association are not known	procisely the indicative values of TMP in Table 1f	-	-

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix l	K						26	(36)
			are not kn	own (36) =	= 0.05 x (3	1)			(2.2)				r	_
	abric he									(36) =			108.62	(37)
Ventila	tion hea	at loss ca	· · · · · ·	monthly			1		(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	100.59	99.01	97.44	89.58	88.01	80.15	80.15	78.57	83.29	88.01	91.15	94.3		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	209.21	207.64	206.07	198.21	196.63	188.77	188.77	187.2	191.92	196.63	199.78	202.92		
							-			Average =		12 /12=	197.81	(39)
	· · ·	imeter (H	HLP), W/			·			(40)m	= (39)m ÷	· (4)		1	
(40)m=	1.91	1.89	1.88	1.81	1.79	1.72	1.72	1.7	1.75	1.79	1.82	1.85		-
Numbe	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.8	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
1 \//	4. Water heating energy requirement: kWh/year:													
ч . vvc			igy iequ	nement.								K V V I // y C	-ai.	
		upancy,			((T						81		(42)
	A > 13. A £ 13.		+ 1.76 x	[1 - exp	(-0.0003	549 X (11	-A -13.9)2)] + 0.0	JU13 X (IFA -13.	.9)			
			ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10'	1.02	1	(43)
		-				-	7	to achieve	a water us	se target o	f			
not more	e that 125	litres per	oerson pel	r day (all w	ater use, I	not and co								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot Wate				ach month	va,m = ĭa									
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		_
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D)))))))))))))))))))		Total = Su oth (see Ta			1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6]	
		1	1				1			Total = Su	m(45) ₁₁₂ =	=	1589.49	(45)
lf instan	taneous v	/ater heati	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46,) to (61)					
(46)m=	24.72	21.62	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94]	(46)
	storage												1	
-		. ,		• •			-	within sa	ame ves	sel		110		(47)
	•	•		nk in dw	•			· · /		or (0) in (47)			
	storage		not wate	er (this in	iciudes i	nstantar	ieous co	ombi boil	ers) ente	er U in (47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0	1	(48)
		actor fro				(<i>"</i>				<u> </u>	0]	(49)
					oor			(48) x (49)	_]	
			-	e, kWh/ye cylinder l		or is not		(40) × (49)	. –		1	10]	(50)
,				om Tabl							0.	01]	(51)
	•	neating s		on 4.3										
		from Ta									1.	03		(52)
Temperature factor from Table 2b 0.54											J	(53)		

		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		76 76		(54) (55)
	. ,			for each	month			((56)m = (55) × (41)ı	m	0.	10		(00)
(56)m=	23.57	21.29	23.57	22.81	23.57	22.81	23.57	23.57	22.81	23.57	22.81	23.57		(56)
		-		-			H11)] ÷ (5						ix H	(00)
(57)m=	23.57	21.29	23.57	22.81	23.57	22.81	23.57	23.57	22.81	23.57	22.81	23.57		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	•							0		(58)
	•	•	,			59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)ı	n
(62)m=	211.63	186.43	195.56	174.99	171.25	152.68	146.32	160.99	160.85	181.47	192.29	206.43		(62)
Solar DI	HW 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=	211.63	186.43	195.56	174.99	171.25	152.68	146.32	160.99	160.85	181.47	192.29	206.43		_
								Outp	out from wa	ater heate	r (annual)₁	12	2140.87	(64)
Hea <mark>t g</mark>	l <mark>ain</mark> s fro	m water	heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59)m</mark>]	
(65)m=	9 <mark>2.26</mark>	81.76	<mark>86</mark> .92	79.37	78.83	71.95	70.54	75.42	74.67	82.23	85.12	90.53		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	<mark>or ho</mark> t w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	s (Table	e 5), Wat	ts				-				_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82	168.82		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	60.93	54.12	44.01	33.32	24.91	21.03	22.72	29.53	39.64	50.33	58.75	62.63		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	404.88	409.08	398.49	375.95	347.5	320.76	302.9	298.7	309.28	331.82	360.27	387.01		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	e Table	5	-	-		
(69)m=	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	vaporatic	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)	!	!									
(72)m=	124	121.67	, 116.82	110.24	105.96	99.94	94.82	101.38	103.71	110.52	118.22	121.68		(72)
Total i	internal	gains =	:	!	!	(66)	m + (67)m	- 1 + (68)m -	• ⊦ (69)m + ((70)m + (7	1)m + (72)	m	I	
(73)m=	703.78	698.84	673.3	633.48	592.33	555.69	534.4	543.57	566.6	606.65	651.21	685.29		(73)
	lar gains	S:	1	1	1	1	1				1	I	l.	

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)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9x	0.77	x	1.92	x	76.57	×	0.63	x	0.7	=	89.86	(78)
South 0.9x	0.77	x	1.92	×	97.53	×	0.63	x	0.7	=	114.46	(78)
South 0.9x	0.77	x	1.92	x	110.23	×	0.63	x	0.7	=	129.37	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9x	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9x	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9x	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9x	0.77	x	1.92	x	82.59	×	0.63	x	0.7	=	96.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9x	0.77	x	1.92	x	40.4	×	0.63	x	0.7	=	47.41	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9x	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.63	Х	0.7	=	20.78	(79)
Southwest0.9x	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest _{0.9x}	0.77	x	0.64	х	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9x	0.77	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9x	0.77	x	0.64	×	104.39		0.63	x	0.7	=	20.42	(79)
Southwest0.9x	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9x	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9x	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9x	0.77	x	4.33	x	63.27	×	0.63	x	0.7	=	334.92	(80)
West 0.9x	0.77	x	4.33	x	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9x	0.77	x	4.33	x	115.77	×	0.63	x	0.7	=	612.8	(80)
West 0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9x	0.77	x	4.33	x	45.59	×	0.63	x	0.7	=	241.31	(80)
West 0.9x	0.77	x	4.33	×	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9x	0.77	x	4.33	x	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m.	(82)m		_	_
(83)m= 166.02 305.48 466.15 638.61 756.71 765.64 732.45 644.66 527.25 351.78 203.28 139.06													(83)
Total g	Total gains – internal and solar (84)m = (73)m + (83)m , watts												1
(84)m=	869.8	1004.32	1139.45	1272.08	1349.04	1321.33	1266.85	1188.23	1093.85	958.43	854.49	824.35	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
							from Tal	ble 9, Th	1 (°C)				21	(85)
		0	ains for			0		,	()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.98	0.95	0.88	0.75	0.6	0.65	0.85	0.96	0.99	0.99		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.02	19.23	19.58	20.09	20.51	20.83	20.95	20.93	20.7	20.14	19.53	19.04		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.4	19.41	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.97	0.93	0.83	0.63	0.42	0.48	0.76	0.94	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	eps 3 to ⁻	7 in Tabl					
(90)m=	16.87	17.17	17.69	18.44	19.01	19.42	19.51	19.51	19.28	18.53	17.64	16.91		(90)
()											g area ÷ (4		0.42	(91)
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$														
(92)m=	17.78	18.04	18.49	19.14	19.65	20.02	20.12	20.11	19.88	1 <mark>9.21</mark>	18.44	17.81		(92)
Apply	adjustr	nent to t	he mear	interna	l temper	ature fro	m Table	e 4e, whe	ere appro	priate				
(93)m=	17.78	18.04	18.49	19.14	19.65	20.02	20.12	20.11	19.88	19.21	18.44	17.81		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	i to the i	mean i <mark>nt</mark>	ternal ter	nperatu	re obtair	ed at st	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm					,						
(94)m=	0.99	0.98	0.96	0.92	0.84	0.68	0.5	0.55	0.79	0.94	0.98	0.99		(94)
	-	i	, W = (94	· · · ·	-				i		1	· · · · ·	1	
(95)m=	859.1	983.87		1170.19		894.52	633.56	652.14	864.49	900.12	837.49	815.96		(95)
		<u> </u>	ernal tem	i	1	1					<u> </u>			(00)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	-	1	an intern 2471.67	· · ·	r	1		x [(93)m	<u> </u>	ī — — —	0005.00	0704 70		(97)
						1022.9	664.14	694.85		1693.83		2761.76		(37)
(98)m=		1172.9	1023.37	618.62	324.26		n = 0.02	24 x [(97)m – (95 0	590.52	1028.01	1447.68		
(30)11-	1433.10	1172.5	1023.37	010.02	524.20	0	0						7664 50	(98)
								1018	l per year	(KWN/year) = Sum(9	0) 15,912 =	7664.52	
Space	e heatin	g require	ement in	kWh/m ²	²/year								69.8	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	g micro-C	CHP)					
-	e heatii on of sr	-	at from s	econdar	v/supple	mentarv	, svstem						0	(201)
	-		at from m				-, -, -, -, -, -, -, -, -, -, -, -, -, -	(202) = 1	- (201) =				1	(202)
	-		ng from		. ,				(201) = 02) × [1 –	(203)] =			1	(202)
			ace heat	-									170	(206)
	-		ry/suppl	• •		n sveton	ח %						0	(208)
				cinontal	Jinoutin	9 0901011	., 70						0	(200)

			-									i	-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin 1459.16	ř	ement (0	alculate 618.62	d above) 324.26)	0	0	0	590.52	1028.01	1447.68	1	
(211)m				100 ÷ (20		0	0	0	0	000.02	1020.01	1447.00		(211)
(211)11	858.33	689.94	601.98	363.9	190.74	0	0	0	0	347.36	604.71	851.57	1	(211)
			I	I				Tota	l Il (kWh/yea	ar) =Sum(2	1 211) _{15,1012}		4508.54	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									_
			00 ÷ (20	1									1	
(215)m=	0	0	0	0	0	0	0	0 Tota	0 l (kWh/ve	0 ar) =Sum(2	0	0	0	(215)
Wator	heating	1						1010		ai) – C uiri(1	- • • • • • 15,1012	2	0	(213)
	-	-	ter (calc	ulated a	bove)		-					-	_	
	211.63	186.43	195.56	174.99	171.25	152.68	146.32	160.99	160.85	181.47	192.29	206.43		_
		ater hea	1				1		1	1	1		170	(216)
(217)m=		170	170	170	170	170	170	170	170	170	170	170	J	(217)
		-	, kWh/m 0 ÷ (217)				_			_		_	_	
(219)m=	124.49	109.66	115.04	102.93	100.73	89.81	86.07	94.7	94.62	106.74	113.11	121.43		_
								Tota	II = Sum(2				1259.33	(219)
	l totals		ed main	system	1					k	Wh/year	r	kWh/year 4508.54	
		fuel use		System									1259.33	
				alaatria	ke en he								1239.33	
				electric									,	(000-
				icea, ext	ract or p	ositive	nput fron	n outside	Э			360.17		(230a
		ig pump		,						(222.)		30		(230c)
	-		above,	kWh/yea	ır			sum	of (230a).	(230g) =			390.17	(231)
Electric	city for li	ighting											430.44	(232)
10a. F	⁻ uel cos	sts - indiv	vidual he	eating sy	stems:									
						Fu				Fuel P			Fuel Cost	
							/h/year			(Table			£/year	_
Space	heating	- main s	system ?	1		(21	1) x			13.	19	x 0.01 =	594.68	(240)
Space	heating	- main s	system 2	2		(21:	3) x			0		x 0.01 =	0	(241)
Space	heating	- secon	Idary			(21	5) x			13.	19	x 0.01 =	0	(242)
Water	heating	cost (ot	her fuel)			(21	9)			13.	19	x 0.01 =	166.11	(247)
Pumps	, fans a	nd elect	ric keep	-hot		(23	1)			13.	19	x 0.01 =	51.46	(249)
	eak tari for ligh		ach of (2	30a) to (230g) se	eparately		licable a	nd apply	/ fuel prid		rding to $\frac{1}{x 0.01} =$	Table 12a	(250)
	-	•	arges (T	able 12)						L ^{13.}	<u>. </u>		0	(251)
		-		,										
• •		ems: rep I y cost		s (253) a	. ,		ded 50)(254)	=					869.02	(255)

11a. SAP rating - individual heating systems				
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(255) x (256)	i)] ÷ [(4) + 45.0] =		2.36	(257)
SAP rating (Section 12)			67.11	(258)
12a. CO2 emissions – Individual heating systems	including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	r
Space heating (main system 1)	(211) x	0.519 =	2339.93	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.519 =	653.59	(264)
Space and water heating	(261) + (262) + (263) + (2	64) =	2993.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	202.5	(267)
Electricity for lighting	(232) x	0.519 =	223.4	(268)
Total CO2, kg/year		sum of (265)(271) =	3419.42	(272)
CO2 emissions per m ²		(272) ÷ (4) =	31.14	(273)
El rating (section 14)			70	(274)
13a. Primary Energy				-
Space heating (main system 1)	Energy kWh/year (211) x	Primary factor 3.07 =	P. Energy kWh/year 13841.22	(261)
Space heating (secondary)	(215) x	3.07 =	0	(263)
Energy for water heating	(219) x	3.07 =	3866.16	(264)
Space and water heating	(261) + (262) + (263) + (2	64) =	17707.37	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	1197.83	(267)
Electricity for lighting	(232) x	0 =	1321.44	(268)
'Total Primary Energy		sum of (265)(271) =	20226.64	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	184.21	(273)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	SAP 201			Strom Softwa Address	are Ver	sion:		Versio	n: 1.0.5.7	
Address :	, London		P	roperty <i>i</i>	Address	. LGT GI	een				
1. Overall dwelling dime	·										
				Area	a(m²)		Av. Hei	ight(m)		Volume(m ³)	
Basement					• •	(1a) x	-	2.8	(2a) =	188.72	(3a)
Ground floor				4	42.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e)+(1n	I) 1	09.8	(4)					-
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:											-
	main heating		econdar eating	у	other		total			m ³ per hour	
Number of chimneys		_ + ["	0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0	_ +	0	ī + Г	0	- 1 - [0	x 2	20 =	0	(6b)
Number of intermittent fa	ans						4	x ^	10 =	40	(7a)
Number of passive vents	3						0	x ^	10 =	0	(7b)
Number of flueless gas f	ires					Ē	0	x 4	40 =	0	(7c)
									Air ch	ange <mark>s per</mark> hou	ר זו
Infiltration due to chimne	7						40		÷ (5) =	0.13	(8)
If a pressurisation test has l Number of storeys in t			d, proceed	d to (17), c	otherwise o	continue fr	om (9) to ((16)	ſ		
Additional infiltration	ne dw <mark>ennig</mark> (n	5)						[(9)-	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0).25 for steel o	r timber f	rame or	0.35 foi	r masoni	v constr	uction	[(0)	110.1 -	0	(10)
if both types of wall are p	present, use the va	alue corres				•			I		J, ,
deducting areas of openi If suspended wooden	• ·		ed) or 0	1 (seale	ad) else	enter 0			1	0	(12)
If no draught lobby, er		•	00) 01 0.		, oloo	ontor o				0	(12)
Percentage of window			ripped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =	ĺ	0	(16)
Air permeability value,	•			•		•	etre of e	nvelope	area	5	(17)
If based on air permeabi										0.38	(18)
Air permeability value applie Number of sides sheltere		on test has	been don	e or a deg	gree air pe	rmeability	is being us	sed	1		(19)
Shelter factor	50				(20) = 1 -	[0.075 x (1	9)] =			2 0.85	(13)
Infiltration rate incorpora	ting shelter fac	ctor			(21) = (18) x (20) =				0.33	(21)
Infiltration rate modified	for monthly wi	nd speed	l						I		-
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Tab	le 7									
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	te (allow	ing for sl	nelter an	d wind s	peed) =	(21a) x	(22a)m			-		
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	quation (I	N5)) , othe	erwise (23b	o) = (23a)			0	
						or in-use fa				, , ,			0	
a) lf	balance	ed mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)		(===)
, (24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	d mech	anical ve	entilation	without	heat rec	overy (N	ч ИV) (24t)m = (2	1 2b)m + (23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilatio	on from o	outside				•	
i	if (22b)n	n < 0.5 >	× (23b), †	then (24	c) = (23b	o); otherv	vise (24	c) = (22	b) m + 0	.5 × (23k) 	i	1	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	J	(24c)
						ve input v erwise (24				0.5]				
(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(24d)
Effe	<mark>ctiv</mark> e air	change	rate - ei	nter (24a) or (24k	o) or (240	c) or (24	d) in bo	x (25)					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. He	at losse	s and he	eat loss	paramet	er: 🧹									
ELEN		Gro		Openin m	gs	Net Are A ,n		U-val W/m2		A X U (W/		k-value kJ/m²·I		A X k kJ/K
Doo <mark>rs</mark>						1.98	X	1	=	1.98				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(1.4)+	0.04] =	5.74				(27)
Windo	ws Type	92				1.92	x1	/[1/(1.4)+	- 0.04] =	2.55				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(1.4)+	- 0.04] =	0.85				(27)
Floor 7	Гуре 1					30	x	0.13	=	3.9				(28)
Floor 7	Гуре 2					37.4	x	0.13	=	4.862	i F		Ξ F	(28)
Walls -	Type1	48.	6	4.48	3	44.12	x	0.18	=	7.94	ו ר		ΞĒ	(29)
Walls	Type2	32.	8	17.3	2	15.48	x	0.18	=	2.79	- i		- -	(29)
Walls	ТуреЗ	8.6	6	0		8.6	x	0.18	=	1.55	T I		ΞĒ	(29)
Walls -	Type4	3.1	1	1.98	3	1.12	x	0.18	=	0.2	i F		- -	(29)
Walls ⁻	Туре5	13.	3	0		13.3	x	0.18	=	2.39	i F		ΞĒ	(29)
Total a	area of e	elements	s, m²			173.8		-			I			(31)
* for win	dows and	roof wind	lows, use e	effective wi	ndow U-va	alue calcula	ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	paragraph	ז 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) =	54.52	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not know	n precisely the indicative values of TMP in Table 1f	<u>-</u>	-

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

can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						16.25	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			70.77	(37)
Ventila	tion hea	at loss ca	alculated	monthl	ý				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.86	57.53	57.21	55.68	55.4	54.07	54.07	53.82	54.58	55.4	55.97	56.58		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	128.63	128.3	127.97	126.45	126.16	124.83	124.83	124.59	125.34	126.16	126.74	127.34		
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39)₁. · (4)	12 /12=	126.44	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16		
Numbe	er of day	/s in moi	nth (Tab	le 1a)		1				Average =	Sum(40)1.	12 /12=	1.15	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
4. Water heating energy requirement: kWh/year:														
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)													(42)	
	A > 13. A £ 13.		+ 1.70 X	li - exp	(-0.0003	949 X (11	-A - 13.9)2)] + 0.0	JU 13 X (IFA - 13.	9)			
Annua	l averag	je hot wa						(25 x N)				1.02		(43)
				usage by . r day (<mark>all</mark> w		-	7	to achieve	a water us	se target o	f			
normore												_	1	
Listwet	Jan	Feb	Mar	Apr ach month	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
				1						1				
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
lf instan	tanoous v	ator hooti	ng at pain	f uso (no	hot wator	r storago)	ontor 0 in	boxes (46,		Total = Su	m(45) ₁₁₂ =		1589.49	(45)
				· · ·									1	(10)
(46)m= Water	0 storage	0 loss:	0	0	0	0	0	0	0	0	0	0		(46)
	0		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150]	(47)
-		. ,		ink in dw			-						1	
		•			•			mbi boil	ers) ente	er '0' in (47)			
Water	storage	loss:											_	
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Tempe	erature f	actor fro	m Table	2b								0]	(49)
			-	, kWh/ye				(48) x (49)	=			0]	(50)
				cylinder l om Tabl								0	1	(51)
		leating s				n/nu 6/08	•y)					0]	(51)
	•	from Ta										0]	(52)
Tempe	erature f	actor fro	m Table	2b								0]	(53)

•••		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	. , .		for each	month			((56)m = (55) × (41)	m		-		
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contain	s dedicate	l d solar sto	nage, (57)	I m = (56)m	x [(50) – (H11)] ÷ (50	0), else (5	1 7)m = (56)	n where (H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
	•						(58) ÷ 36 ter heatir	• •		r thormo	etat)			
(110) (59)m=												0		(59)
			for oook	month	(61)m -	(60) + 20	SE v (41)							
(61)m=						$(60) \div 30$	65 × (41)	0	0	0	0	0		(61)
			_		_		-			-		-	(50) m + (61)	
(62)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	(02)III = 97.04	98.2	114.44	124.92	135.66	(59)m + (61) I	(62)
							ve quantity							(02)
							, see Ap			r contribut	ION IO WALE	er neating)		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	Į					1		1			
(64)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		
								Outp	out from wa	ater heate	r (annual)₁	12	1351.07	(64)
Heat g	jains fro	m water	heating	, kWh/m	onth 0.2	5 [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark>	+ (57)m	+ (59)m]	
(65)m=	<mark>3</mark> 5.02	30.63	<u>31</u> .61	27.55	26.44	22.81	21.14	24.26	24.55	28.61	31.23	33.91		(65)
in <mark>clu</mark>	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 8	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated in	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	, also se	ee Table	5				
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	s e.g. ev	vaporatic	on (nega	tive valu	es) (Tab	ole 5)							-	
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)											
(72)m=	47.07	45.58	42.48	38.27	35.54	31.69	28.42	32.61	34.1	38.45	43.38	45.58		(72)
Total i	internal	gains =				(66))m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	407.91	406.51	392.28	368.69	343.53	320.21	305.65	309.75	322.38	346.11	373.46	395.14		(73)
6. So	lar gains	S:												

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9	0.77	x	1.92	x	46.75	×	0.63	x	0.7	=	54.87	(78)
South 0.9	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9	0.77	x	1.92	x	97.53	×	0.63	x	0.7	=	114.46	(78)
South 0.9	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9	0.77	x	0.64	x	62.67]	0.63	x	0.7	=	12.26	(79)
Southwest0.9	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Southwest0.9	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest0.9	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9	(0.7 <mark>7</mark>	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9	0.77	x	0.64	x	104. <mark>3</mark> 9		0.63	x	0.7	=	20.42	(79)
Southwest0.9	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9	0.77	x	0.64	x	31.49]	0.63	x	0.7	=	6.16	(79)
West 0.9	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9	0.77	x	4.33	x	38.42	×	0.63	x	0.7	=	203.37	(80)
West 0.9	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9	0.77	x	4.33	x	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9	0.77	x	4.33	x	113.09	×	0.63	x	0.7	=	598.62	(80)
West 0.9	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9	0.77	x	4.33	×	94.68	×	0.63	x	0.7	=	501.14	(80)
West 0.9	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9	0.77	x	4.33	x	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9	0.77	x	4.33	×	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 166.02 305.48 466.15 638.61 756.71 765.64 732.45 644.66 527.25 351.78 203.28 139.06												
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	ains – ir	nternal a	and solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	573.94	712	858.43	1007.3	1100.24	1085.85	1038.1	954.41	849.63	697.89	576.74	534.2	(84)

7.1010	ean inter	nal temp	perature	(heating	season)								
Temp	perature	during h	neating p	periods in	n the livii	ng area	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=	1	1	0.99	0.95	0.86	0.69	0.52	0.58	0.84	0.98	1	1		(86)
Mean	n interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.66	19.84	20.14	20.51	20.81	20.95	20.99	20.98	20.87	20.46	19.99	19.63		(87)
Temp	berature	durina h	neating p	periods ir	n rest of	dwellina	from Ta	ble 9. Tl	h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Litilis	ation fac	tor for a	ains for	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	1	0.98	0.94	0.81	0.6	0.4	0.46	0.77	0.97	1	1		(89)
		l tompor	Iin	the reat	of dwalli	na T2 (f			Tin Tohl					
(90)m=	18.72	18.9	ature in	19.57	19.83	19.95	19.97	19.97	19.9	19.53	19.06	18.7		(90)
(00)=	10.12	10.0	10.2	10.01	10.00	10.00	10.01	10.01			g area ÷ (4		0.42	(91)
	• •							<i></i>			. .	, 	0.42	(
	r	· · · ·	ature (fo	1	1		1		, 	40.00	40.45	40.00		(92)
(92)m=	19.12	19.3	19.6	19.97	20.24	20.38	20.4	20.4	20.31	19.92	19.45	19.09		(92)
(93)m=	19.12	19.3	he mear	19.97	20.24	20.38	20.4	20.4	20.31	19.92	19.45	19.09		(93)
			uirement		20.24	20.30	20.4	20.4	20.31	19.92	19.45	19.09		(00)
					re obtain	ed at st	en 11 of	Table 9	o so tha	t Ti m=('	76)m an	d re-calc	ulate	
			or gains					Tuble of	5, 65 tha		- c) c		ulato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>is</mark> a	ation for	tor for a	ains, hm											
	ation fac	tor for g						-						
(94)m=		0.99	0.98	0.94	0.83	0.63	0.45	0.51	0.8	0.97	1	1		(94)
Usefu	1 ul gains,	0.99		0.94		0.63	0.45	0.51	0.8	0.97	1	1		(94)
Usefu (95)m=	1 JI gains, 572.88	0.99 hmGm 708.13	0.98 , W = (94 843.12	0.94 4)m x (8 944.49	4)m 908.25	687.9	0.45	0.51 489.25	0.8	0.97 676.43	1 574.29	1 533.51		(94) (95)
Usefu (95)m= Monti	1 ul gains, 572.88 hly avera	0.99 hmGm 708.13 age exte	0.98 , W = (94 843.12 ernal tem	0.94 4)m x (8- 944.49 perature	4)m 908.25 e from Ta	687.9 able 8	469.66	489.25	676.53	676.43	574.29	533.51		(95)
Usefu (95)m= Monti (96)m=	1 Jul gains, 572.88 hly avers 4.3	0.99 hmGm 708.13 age exte 4.9	0.98 , W = (94 843.12 ernal tem 6.5	0.94 4)m x (8- 944.49 perature 8.9	4)m 908.25 e from Ta 11.7	687.9 able 8 14.6	469.66 16.6	489.25 16.4	676.53 14.1	676.43 10.6	I		1	
Usefu (95)m= Month (96)m= Heat	1 J gains, 572.88 hly avera 4.3 loss rate	0.99 hmGm 708.13 age exte 4.9 e for mea	0.98 , W = (94 843.12 ernal tem 6.5 an intern	0.94 4)m x (8 944.49 perature 8.9 nal tempo	4)m 908.25 e from Ta 11.7 erature,	687.9 able 8 14.6 Lm , W =	469.66 16.6 =[(39)m 2	489.25 16.4 x [(93)m	676.53 14.1 - (96)m	676.43 10.6	574.29 7.1	533.51 4.2		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76	4)m 908.25 e from Ta 11.7 erature, 1077.99	687.9 able 8 14.6 Lm , W = 721.02	469.66 16.6 =[(39)m 474.56	489.25 16.4 x [(93)m 498.18	676.53 14.1 - (96)m 778.38	676.43 10.6] 1176.41	574.29 7.1 1565.14	533.51		(95)
Usefu (95)m= Montil (96)m= Heat (97)m= Spac	1 J gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97)	676.53 14.1 - (96)m 778.38)m - (95	676.43 10.6] 1176.41)m] x (4	574.29 7.1 1565.14 1)m	533.51 4.2 1896.21		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76	4)m 908.25 e from Ta 11.7 erature, 1077.99	687.9 able 8 14.6 Lm , W = 721.02	469.66 16.6 =[(39)m 474.56	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4030.61	(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4930.61	(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m=	1 Jal gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85	4930.61 44.91	(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1J gains,572.88hly avera4.3loss rate1905.69e heatin991.61e heatinpace co	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require oling req	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m 474.56 th = 0.02	489.25 16.4 x [(93)m 498.18 24 x [(97) 0	676.53 14.1 - (96)m 778.38)m - (95 0	676.43 10.6] 1176.41)m] x (4 371.99	574.29 7.1 1565.14 1)m 713.42	533.51 4.2 1896.21 1013.85		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1 JI gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61 e heatin ulated for	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require r June,	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in quiremer	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² nt August.	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 ² /year	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 $=[(39)m = 474.56$ $th = 0.02$ 0	489.25 16.4 x [(93)m 498.18 24 x [(97 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9	533.51 4.2 1896.21 1013.85 8) ₁₅₉₁₂ =		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac	1 JI gains, 572.88 hly avera 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require oling rec r June, C Feb	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² t August. Apr	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28 2/year <u>See Tal</u> May	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m 2 474.56 th = 0.02 0	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov	533.51 4.2 1896.21 1013.85 8)15.912 =		(95) (96) (97)
Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200 Calcu Heat	1 JI gains, 572.88 hly averation 4.3 Ioss rate 1905.69 e heatin 991.61 e heatin Jan Ioss rate Ioss rate	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar liculated	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m² ht August. Apr using 29	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 2/year See Tal May 5°C inter	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota Aug and exte	676.53 14.1 - (96)m 778.38)m - (95 0 I per year Sep ernal ten	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov e from T	533.51 4.2 1896.21 1013.85 8)15912 = Dec able 10)		(95) (96) (97) (98) (99)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200)m=	1 JI gains, 572.88 hly averation 4.3 loss rate 1905.69 e heatin 991.61 e heatin Jan loss rate 0	0.99 hmGm 708.13 age exte 4.9 e for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 0 ling rec r June, C Feb e Lm (ca 0	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar loculated 0	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m ² t August. Apr	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, kV 126.28 2/year <u>See Tal</u> May	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota	676.53 14.1 - (96)m 778.38)m - (95 0 I per year	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov	533.51 4.2 1896.21 1013.85 8)15.912 =		(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (200)m=	1 JI gains, 572.88 hly averation 4.3 loss rate 1905.69 e heatin 991.61 e heatin 1905.69 e heatin 991.61 loss rate Jan loss rate 0 ation fact	0.99 hmGm 708.13 age exte 4.9 for mea 1847.74 g require 765.82 g require 765.82 g require 765.82 g require 765.82	0.98 , W = (94 843.12 ernal tem 6.5 an intern 1676.25 ement fo 619.85 ement in guiremen July and Mar loculated 0	0.94 4)m x (8 944.49 perature 8.9 nal tempo 1399.76 or each n 327.8 kWh/m² ht August. Apr using 29	4)m 908.25 e from Ta 11.7 erature, 1077.99 nonth, k\ 126.28 2/year See Tal May 5°C inter	687.9 able 8 14.6 Lm , W = 721.02 Wh/mont 0 0	469.66 16.6 =[(39)m : 474.56 th = 0.02 0 Jul perature	489.25 16.4 x [(93)m 498.18 24 x [(97) 0 Tota Aug and exte	676.53 14.1 - (96)m 778.38)m - (95 0 I per year Sep ernal ten	676.43 10.6] 1176.41)m] x (4 371.99 (kWh/year (kWh/year	574.29 7.1 1565.14 1)m 713.42 r) = Sum(9 Nov e from T	533.51 4.2 1896.21 1013.85 8)15912 = Dec able 10)		(95) (96) (97) (98) (99)

Usefu	l loss, h	nmLm (W	Vatts) =	(100)m x	(101)m									
(102)m=	0	0	0	0	0	1050.05	872.68	873.47	0	0	0	0]	(102)
Gains	(solar	gains ca	lculated	for appli	cable w	eather re	egion, se	e Table	10)				_	
(103)m=	0	0	0	0	0	1379.35	1321.11	1225.3	0	0	0	0		(103)
		<i>g require</i> zero if (dwelling,	continue	ous (kW	(h) = 0.0	24 x [(10	03)m – (102)m]	x (41)m	
(104)m=	0	0	0	0	0	237.09	333.63	261.76	0	0	0	0]	
														(104)
Cooled fractionf C = cooled area \div (4) =1Intermittency factor (Table 10b)1														(105)
Intermi	ttency f	actor (Ta	able 10b)										
(106)m= 0 0 0 0 0 0.25 0.25 0.25 0 0 0 0														
									Total	l = Sum((104)	=	0	(106)
Space	cooling	requirer	ment for	month =	: (104)m	× (105)	× (106)r	n					-	
(107)m=	0	0	0	0	0	59.27	83.41	65.44	0	0	0	0		
									Total	= Sum(107)	=	208.12	(107)
Space	cooling	requirer	ment in k	kWh/m²/y	/ear				(107)) ÷ (4) =			1.9	(108)
8f. Fab	ric Ene	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, s	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) ·	+ (108) =	=		46.8	(109)
Targe	t Fabri	c Energ	y Efficie	ency (TF	EE)								53.82	(109)
			-											

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012			Softwa	a Num are Ver	sion:		Versio	n: 1.0.5.7	
	Landan		Pr	operty <i>i</i>	Address	: LG1 Gr	een				
Address : 1. Overall dwelling dimen	, London										
1. Overall dwelling differ	1510115.			Aroc	a (m²)		Av. Hei	ight(m)		Volume(m ³)	
Basement					a(m²) 67.4	(1a) x	-	2.8	(2a) =	188.72	(3a)
									1 I 7 7		1
Ground floor					12.4	(1b) x	2	2.6	(2b) =	110.24	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 1	09.8	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:									-		-
	main heating		ondary ting	y	other		total			m ³ per hour	
Number of chimneys			0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0	i + F	0] = [0	x 2	20 =	0	 _(6b)
Number of intermittent far	าร						4	x 1	0 =	40](7a)
Number of passive vents							0	x 1	0 =	0	(7b)
Number of flueless gas fir	-es						0	- x4	10 =	0	(7c)
						L	0			anges per hou]
Infiltration due to chimney							40		÷ (5) =	0.13	(8)
If a pressurisation test has be			proceed	l to (17), c	otherwise o	continue fr	om (9) to ((16)	ſ		
Number of storeys in th Additional infiltration	ie dw <mark>eiling</mark> (na	·)						[(9)-	1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or	timber fra	me or	0 35 for	masoni	v constr	uction	[(0)	1,0.1 -	0	(10) (11)
if both types of wall are pro-						•			l	0]()
deducting areas of openin				4 /					,		٦
If suspended wooden fl) or 0.	1 (seale	ed), else	enter U				0	(12)
If no draught lobby, ent Percentage of windows			nad							0	(13)
Window infiltration	and doors un	augint strip	peu		0.25 - [0.2	x (14) ÷ 1	001 =			0	(14) (15)
Infiltration rate						+ (11) + (1	-	⊦ (15) =		0	(15)
Air permeability value,	a50. expresse	d in cubic	metres						area	15	(17)
If based on air permeabili				•	•	•				0.88	(18)
Air permeability value applies	-						is being us	sed	l	0.00](=)
Number of sides sheltered	d									2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporati	ng shelter fac	tor			(21) = (18)) x (20) =				0.75	(21)
Infiltration rate modified for	or monthly win	d speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Tabl	e 7									
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24 c) If whole house extract ventilation or positive input ventilation from outside	Wind Fa	actor (2	2a)m =	(22)m ÷	4										
0.96 0.94 0.92 0.83 0.81 0.71 0.71 0.69 0.75 0.81 0.85 0.88 Calculate effective air change rate for the applicable caseIf mechanical ventilation:If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)00(23a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100](24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)(24c) If whole house extract ventilation or positive input ventilation from outside	(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Calculate effective air change rate for the applicable caseIf mechanical ventilation:0(23If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)000	Adjuste	d infiltr	ation rate	e (allowi	ing for sl	nelter an	nd wind s	peed) =	(21a) x	(22a)m	·				
If mechanical ventilation: 0 (23) If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23) a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m = 0 0 0 0 0 0 0 (24b)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24b)m = (24b)m = (22b)m + (23b) (24b)m = (2								-	0.69	0.75	0.81	0.85	0.88		
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23 If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23 a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m = 0 0 0 0 0 0 0 (24 (24b)m = (22b)m + (23b)				-	rate for t	he appli	cable ca	se	-	-	-				(22.5)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23 a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					endix N (2	(23a) = (23a	a) x Fmv (e	equation (I	N5)) othe	rwise (23	(23a)		l T		
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) \div 100]$ (24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0											0) = (200)] I		
(24a)m= 0 </td <td></td> <td></td> <td></td> <td>-</td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td>(2h)m + (</td> <td>(23h) 🗸 [[,]</td> <td> 1 – (23c)</td> <td>-</td> <td>(230)</td>				-	-	-					(2h)m + ((23h) 🗸 [[,]	 1 – (23c)	-	(230)
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24 c) If whole house extract ventilation or positive input ventilation from outside	́ г			r	î .	i	i i	<u> </u>	1 / 1	ŕ	1	<u>, , -</u>	r í í	÷ 100]	(24a)
(24b)m= 0 </td <td>· · ·</td> <td>palance</td> <td></td> <td></td> <td></td> <td>without</td> <td>heat rec</td> <td>overv (N</td> <td>I</td> <td>I</td> <td></td> <td>(23b)</td> <td></td> <td></td> <td>· · · ·</td>	· · ·	palance				without	heat rec	overv (N	I	I		(23b)			· · · ·
c) If whole house extract ventilation or positive input ventilation from outside	, L				1	1	1	· · ·	<u> </u>	ŕ	,	<u> </u>	0		(24b)
	c) If v	vhole h	ouse ex	ract ver	ntilation of	r positiv	/e input \	ventilatio	n from (utside			I		
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)						-	-).5 × (23	c)			
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (24	(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
 d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] 	,					•					0.51		<u> </u>		
		. ,		· · · ·	· ·		r Ì	· ·		<u>, </u>	-	0.86	0.89		(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	· · ·	tive air	change	rate - er			a) or (240	c) or (24	d) in bo	(25)			<u> </u>	_	
					· · ·	í t	r i	· · ·		1 /	0.83	0.86	0.89		(25)
											-			_	
3. Heat losses and heat loss parameter: ELEMENT Gross Openings Net Area U-value A X U k-value A X k							Not Ar						le velue		
ELEMENT Gross Openings Net Area U-value A X U k-value A X k area (m ²) m ² A ,m ² W/m2K (W/K) kJ/m ² ·K kJ/K	ELEM	ENI				-									
Doors 1.98 × 1.8 = 3.564 (26	Doo <mark>rs</mark>						1.98	×	1.8		3.564				(26)
Windows Type 1 $4.33 \times 1/[1/(1.6) + 0.04] = 6.51$ (27)	Window	vs Type	e 1				4.33	x1	/[1/(1.6)+	0.04] =	6.51				(27)
Windows Type 2 $1.92 \times 1/[1/(1.6) + 0.04] = 2.89$ (27)	Window	vs Type	2				1.92		/[1/(1.6)+	0.04] =	2.89				(27)
Windows Type 3 $0.64 \times 1/[1/(1.6) + 0.04] = 0.96$ (27)	Window	vs Type	93				0.64		/[1/(1.6)+	0.04] =	0.96				(27)
Floor Type 1 30 x 0.1 = 3 (28	Floor T	ype 1					30	×	0.1	=	3				(28)
Floor Type 2 37.4 × 0.25 = 9.35 (28	Floor T	ype 2					37.4	x	0.25		9.35	= i			(28)
	Walls T	ype1	48.6	6	4.48	3	44.12	<u>x</u>				= 1		\dashv	(29)
								_				= 1		\dashv	(29)
								_						4 1	(29)
								_				=		\exists	(29)
								_				╡╏		\exists	(29)
]		_	L		L	[(23)
* 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				,			175.0	·							(0.)

** include the areas on both sides of internal walls and partitions

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	82.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not know	n precisely the indicative values of TMP in Table 1f		-

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						26	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								_
Total fa	abric he	at loss							(33) +	(36) =			108.62	(37)
Ventila	tion hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	94.58	92.83	91.1	83.01	81.5	74.45	74.45	73.15	77.17	81.5	84.56	87.76		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	203.21	201.45	199.73	191.64	190.12	183.08	183.08	181.77	185.79	190.12	193.19	196.39		
		!							/	Average =	Sum(39)1.	12 /12=	191.63	(39)
Heat lo	oss para	ameter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	(4)		1	
(40)m=	1.85	1.83	1.82	1.75	1.73	1.67	1.67	1.66	1.69	1.73	1.76	1.79		
Numbe	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1	12 /12=	1.75	(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								I			1	
1 \//-	tor hoa	ting one	rav roqui	romont:								k\Mb/w	aar:	
4. Water heating energy requirement: kWh/year:														
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) (42)														(42)
	A > 13. A £ 13.		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0)013 x (IFA -13.	9)			
			ater usad	ae in litre	es per da	v Vd.av	erage =	(25 x N)	+ 36		101	1.02		(43)
Redu <mark>ce</mark>	the annua	al avera <mark>ge</mark>	hot water	usage by a	5% if the a	welling is	designed t	o achieve		se target o				()
not more	e that 125	litres per	person per	[•] day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		
_							_	- (m(44) ₁₁₂ =		1212.28	(44)
Energy (content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x L)Tm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1	
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		_
lf instan	tanaous v	vator hoati	na at noint	of use (no	hot water	r storage)	ontor 0 in	boxes (46)		Total = Su	m(45) ₁₁₂ =	-	1589.49	(45)
			· ·					. ,	. ,				1	(40)
(46)m= Water	0 storage	0	0	0	0	0	0	0	0	0	0	0		(46)
	-		includir	a anv so	olar or W	/WHRS	storage	within sa	me ves	sel		110		(47)
-				nk in dw			-						l	
	•	-			-			mbi boil	ers) ente	er '0' in (47)			
	storage			,					,	,	,			
a) If m	anufact	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				(0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=			0		(50)
b) If m	anufact	turer's de	eclared o	ylinder l	oss fact	or is not	known:							
		-		om Tabl	e 2 (kW	h/litre/da	ıy)				(0		(51)
	•	neating s		on 4.3									1	(m=)
		from Ta		2h								0		(52)
rempe	aiure I	actor fro	III Table	20								0	J	(53)

•		om water (54) in (5	-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	loss cal	,	for each	month			((56)m = (55) × (41)r	m		0	l	(00)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(56)
	-	-	-	-	-	-		-	7)m = (56)	-	-	-	l lix H	()
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	: loss (ar	nual) fro	om Table	9 3							0		(58)
	•	loss cal	,			59)m = ((58) ÷ 36	65 × (41)	m				1	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i 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)r	n
(62)m=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		(62)
Solar DI	HW 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 \	WWHRS	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=	140.08	122.51	126.42	110.22	105.76	91.26	84.57	97.04	98.2	114.44	124.92	135.66		
								Outp	out from wa	ater heate	r (annual)₁	12	1 <mark>3</mark> 51.07	(64)
Hea <mark>t g</mark>	j <mark>ain</mark> s fro	m water	heating.	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59)</mark> m]	
(65)m=	3 <mark>5.02</mark>	30.63	31.61	27.55	26.44	22.81	21.14	24.26	24.55	28.61	31.23	3 <mark>3.91</mark>		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	<mark>or ho</mark> t w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	<u>olic gair</u>	ns (Table	e 5), Wat	ts									_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ng gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5			-		
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5	-	-		
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)	, also se	e Table	5	-			
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table \$	5a)									_	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losse	s e.g. e\	vaporatic	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)										_	
(72)m=	47.07	45.58	42.48	38.27	35.54	31.69	28.42	32.61	34.1	38.45	43.38	45.58		(72)
Total i	internal	gains =				(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m	_	
(73)m=	407.91	406.51	392.28	368.69	343.53	320.21	305.65	309.75	322.38	346.11	373.46	395.14		(73)
6. So	lar gain:	S:												

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)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9x	0.77	x	1.92	x	76.57	×	0.63	x	0.7	=	89.86	(78)
South 0.9x	0.77	x	1.92	x	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9x	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9x	0.77	x	1.92	x	110.55	×	0.63	x	0.7	=	129.73	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9x	0.77	x	1.92	x	104.89	×	0.63	x	0.7	=	123.1	(78)
South 0.9x	0.77	x	1.92	x	101.89	×	0.63	x	0.7	=	119.57	(78)
South 0.9x	0.77	x	1.92	×	82.59	×	0.63	x	0.7	=	96.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	×	0.63	x	0.7	=	65.03	(78)
South 0.9x	0.77	x	1.92	×	40.4	×	0.63	x	0.7	=	47.41	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest _{0.9x}	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.63	x	0.7	=	20.78	(79)
Southwest _{0.9x}	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest0.9x	0.77	x	0.64	x	118.15		0.63	x	0.7	=	2 <mark>3.11</mark>	(79)
Southwest _{0.9x}	0.77	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	x	0.64	x	104.3 <mark>9</mark>		0.63	x	0.7	=	20.42	(79)
Southwest0.9x	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9x	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9x	0.77	x	4.33	x	19.64	×	0.63	x	0.7	=	103.96	(80)
West 0.9x	0.77	x	4.33	×	38.42	×	0.63	x	0.7	=	203.37	(80)
West 0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9x	0.77	x	4.33	x	92.28	×	0.63	x	0.7	=	488.46	(80)
West 0.9x	0.77	x	4.33	x	113.09	×	0.63	x	0.7	=	598.62	(80)
West 0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9x	0.77	x	4.33	×	110.22	×	0.63	x	0.7	=	583.41	(80)
West 0.9x	0.77	x	4.33	×	94.68	×	0.63	x	0.7	=	501.14	(80)
West 0.9x	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9x	0.77	x	4.33	x	45.59	×	0.63	x	0.7	=	241.31	(80)
West 0.9x	0.77	x	4.33	×	24.49	×	0.63	x	0.7	=	129.63	(80)
West 0.9x	0.77	x	4.33	×	16.15	×	0.63	x	0.7	=	85.49	(80)

Solar g	Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m = 166.02 305.48 466.15 638.61 756.71 765.64 732.45 644.66 527.25 351.78 203.28 139.06												
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	ains – ii	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	573.94	712	858.43	1007.3	1100.24	1085.85	1038.1	954.41	849.63	697.89	576.74	534.2	(84)

	ean inter	nal tem	perature	(heating	season)								
			neating p				from Tab	ole 9. Th	1 (°C)			1	21	(85)
•		•	ains for l			-		,	(-)					`
Canot	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.93	0.82	0.68	0.74	0.92	0.99	1	1		(86)
Mear	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ps 3 to 7	in Table	e 9c)				I	
(87)m=	18.86	19.07	19.44	19.97	20.42	20.78	20.92	20.9	20.61	20	19.38	18.88		(87)
Temr		durina h	neating p	eriods ir	n rest of	dwelling	from Ta	ble 9 Tl	n2 (°C)					
(88)m=	19.43	19.45	19.46	19.51	19.52	19.56	19.56	19.57	19.55	19.52	19.5	19.48		(88)
l Itilis:	ation fac	tor for a	ains for I	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.96	0.89	0.72	0.5	0.57	0.85	0.98	1	1		(89)
		l I tompor	ature in	the rest	of dwalli	na T2 (f		\sim	7 in Tabl					
(90)m=	17.54	17.76	18.13	18.69	19.12	19.46	19.55	19.54	19.32	18.73	18.1	17.59		(90)
(/									f		g area ÷ (4		0.42	(91)
N 4					- ···	() () () () () () () () () () () () () (. (4 6	A) T O					
		· · · ·	ature (fo	19.23			I	+ (1 – TL 20,12		10.07	18.64	10.14		(92)
(92)m=	18.1	18.31	18.68		19.67	20.02	20.13		19.87	19.27	18.64	18.14		(92)
			he mear						· · ·	· ·	19.64	10.14		(93)
(93)m=	18.1	18.31	18.68	19.23	19.67	20.02	20.13	20.12	19.87	19.27	18.64	18.14		(93)
		ting requ			un abtair			Table O		• T :	70)			
			ernal ter or gains			ied at ste	эрттог	Table 90	o, so tha	t 11,m=((6)m an	a re-calc	ulate	
	Jan	Feb	Mar	Apr	May	lup	Jul	Aug	Sen	Oct	Nov	Dec		
					IVIAV	Jun	Jul	I AUU I	Sep					
Utilis	ation fac				Iviay	Jun	Jui	Aug	Sep	Oci	NOV	000		
Utilis: (94)m=	ation fac		ains, hm		0.89	0.75	0.58	0.64	0.87	0.98	0.99	1		(94)
(94)m=	1	tor for g	ains, hm 0.98	0.96	0.89									(94)
(94)m=	1	tor for g	ains, hm	0.96	0.89									(94) (95)
(94)m= Usefu (95)m=	1 JI gains, 572.17	0.99 hmGm 707.21	ains, hm 0.98 , W = (94	1: 0.96 4)m x (84 963.44	0.89 4)m 980.48	0.75 818.29	0.58	0.64	0.87	0.98	0.99	1		
(94)m= Usefu (95)m=	1 JI gains, 572.17	0.99 hmGm 707.21	ains, hm 0.98 , W = (94 844.49	1: 0.96 4)m x (84 963.44	0.89 4)m 980.48	0.75 818.29	0.58	0.64	0.87	0.98	0.99	1		
(94)m= Usefu (95)m= Mont (96)m=	1 Jul gains, 572.17 hly avera 4.3	tor for g 0.99 hmGm 707.21 age exte 4.9	ains, hm 0.98 , W = (94 844.49 ernal tem	1: 0.96 4)m x (8- 963.44 perature 8.9	0.89 4)m 980.48 9 from Ta 11.7	0.75 818.29 able 8 14.6	0.58 600.69 16.6	0.64 609.86 16.4	0.87 738.7 14.1	0.98 680.47 10.6	0.99 573.58	1 532.97		(95)
(94)m= Usefu (95)m= Mont (96)m= Heat	1 Jul gains, 572.17 hly avera 4.3	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern	1: 0.96 4)m x (8- 963.44 perature 8.9	0.89 4)m 980.48 e from Ta 11.7	0.75 818.29 able 8 14.6	0.58 600.69 16.6	0.64 609.86 16.4	0.87 738.7 14.1 - (96)m	0.98 680.47 10.6	0.99 573.58 7.1	1 532.97		(95)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m=	1 ul gains, 572.17 hly avera 4.3 loss rate 2803.67	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26	0.89 4)m 980.48 9 from Ta 11.7 erature, 1515.7	0.75 818.29 able 8 14.6 Lm , W = 992.19	0.58 600.69 16.6 =[(39)m 2 646.1	0.64 609.86 16.4 x [(93)m 675.52	0.87 738.7 14.1 - (96)m 1071.36	0.98 680.47 10.6] 1648.66	0.99 573.58 7.1 2229.01	1 532.97 4.2		(95) (96)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m=	1 J gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26	0.89 4)m 980.48 9 from Ta 11.7 erature, 1515.7	0.75 818.29 able 8 14.6 Lm , W = 992.19	0.58 600.69 16.6 =[(39)m 2 646.1	0.64 609.86 16.4 x [(93)m 675.52	0.87 738.7 14.1 - (96)m 1071.36	0.98 680.47 10.6] 1648.66	0.99 573.58 7.1 2229.01	1 532.97 4.2		(95) (96)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m= Spac	1 J gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 r each n	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m	1 532.97 4.2 2736.72 1639.59	8864.57	(95) (96)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require 1340.63	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo	1: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 or each n 731.39	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59	8864.57 80.73	(95) (96) (97)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24 e heatin	tor for g 0.99 hmGm 707.21 age exter 4.9 e for mea 2702.2 g require 1340.63	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29	1: 0.96 4)m x (8- 963.44 perature 8.9 nal temper 1979.26 or each n 731.39 kWh/m ²	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59		(95) (96) (97)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1JI gains,572.17hly avera4.3loss rate2803.67e heatin1660.24e heatinpace co	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require 1340.63 g require oling req	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29	1: 0.96 4)m x (84 963.44 1963.44 1979.26 1979.26 1979.26 or each n 731.39 kWh/m ² nt	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\ 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59		(95) (96) (97)
(94)m= Usefu (95)m= Mont (96)m= Heat (97)m= Spac (98)m= Spac 8c. S	1JI gains,572.17hly avera4.3loss rate2803.67e heatin1660.24e heatinpace co	tor for g 0.99 hmGm 707.21 age exte 4.9 e for mea 2702.2 g require 1340.63 g require oling req	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29	1: 0.96 4)m x (84 963.44 1963.44 1979.26 1979.26 1979.26 or each n 731.39 kWh/m ² nt	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\ 398.2	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m = 646.1 th = 0.02	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0	0.98 680.47 10.6] 1648.66)m] x (4' 720.33	0.99 573.58 7.1 2229.01 1)m 1191.91	1 532.97 4.2 2736.72 1639.59		(95) (96) (97)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m=	1Jl gains,572.17hly avera4.3loss rate2803.67e heatin1660.24e heatinpace coJlated foJan	tor for g 0.99 hmGm 707.21 age exte 4.9 for mea 2702.2 g require 1340.63 g require oling rec r June, C	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29 ement in uiremer	i: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 r each n 731.39 kWh/m ² nt August. Apr	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2 ?/year <u>See Tal</u> May	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0	0.58 600.69 16.6 =[(39)m : 646.1 th = 0.02 0 Jul perature	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0 Tota Aug	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0 1 per year	0.98 680.47 10.6] 1648.66)m] x (4 720.33 (kWh/year	0.99 573.58 7.1 2229.01 1)m 1191.91) = Sum(9 Nov	1 532.97 4.2 2736.72 1639.59 8)15.912 = Dec		(95) (96) (97) (98) (99)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24 e heatin pace coo Jlated fo Jan loss rate	tor for g 0.99 hmGm 707.21 age exte 4.9 for mea 2702.2 g require 1340.63 g require oling rec r June, C	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29 ement in uiremen July and Mar	i: 0.96 4)m x (8- 963.44 perature 8.9 nal tempe 1979.26 r each n 731.39 kWh/m ² nt August. Apr	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, kV 398.2 ?/year <u>See Tal</u> May	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0 0	0.58 600.69 16.6 =[(39)m : 646.1 th = 0.02 0	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0 Tota Aug	0.87 738.7 14.1 – (96)m 1071.36 0m – (95 0 1 per year	0.98 680.47 10.6] 1648.66)m] x (4 720.33 (kWh/year	0.99 573.58 7.1 2229.01 1)m 1191.91) = Sum(9 Nov	1 532.97 4.2 2736.72 1639.59 8)15.912 = Dec		(95) (96) (97)
(94)m= Usefu (95)m= Monti (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (98)m= Land Calcu Heat (100)m=	1 JI gains, 572.17 hly avera 4.3 loss rate 2803.67 e heatin 1660.24 e heatin pace co Jlated fo Jan loss rate 0 ation fac	tor for g 0.99 hmGm 707.21 age exte 4.9 for mea 2702.2 g require 1340.63 g require oling rec r June, Feb e Lm (ca	ains, hm 0.98 , W = (94 844.49 ernal tem 6.5 an intern 2433.59 ement fo 1182.29 ement in uiremen July and Mar Iculated 0	1: 0.96 4)m x (8- 963.44 1963.44 1979.26 1979.26 1979.26 or each n 731.39 kWh/m ² t August. Apr using 25	0.89 4)m 980.48 e from Ta 11.7 erature, 1515.7 nonth, k\ 398.2 2/year 2/year See Tal May 5°C inter	0.75 818.29 able 8 14.6 Lm , W = 992.19 Wh/mont 0 0	0.58 600.69 16.6 =[(39)m : 646.1 th = 0.02 0 Jul perature	0.64 609.86 16.4 x [(93)m 675.52 24 x [(97) 0 Tota Aug and exte	0.87 738.7 14.1 - (96)m 1071.36 0m - (95 0 1 per year Sep ernal ten	0.98 680.47 10.6] 1648.66)m] x (4 720.33 (kWh/year (kWh/year	0.99 573.58 7.1 2229.01 1)m 1191.91) = Sum(9 Nov e from T	1 532.97 4.2 2736.72 1639.59 8) _{15,912} = Dec able 10)		(95) (96) (97) (98) (99)

Useful	l loss, h	mLm (W	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0		1057.52	1024.53	0	0	0	0	7	(102)
Gains	(solar o	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)				-	
(103)m=	0	0	0	0	0	1379.35	1321.11	1225.3	0	0	0	0	7	(103)
						lwelling,	continuo	ous (kW	(h) = 0.02	24 x [(10)3)m – (102)m]	l x (41)m	
<u>`</u> г	04)m to	Ì	104)m <	: 3 × (98)m								-	
(104)m=	0	0	0	0	0	131.01	196.11	149.37	0	0	0	0		_
										= Sum(,	=	476.5	(104)
Cooled fractionf C = cooled area \div (4) =1Intermittency factor (Table 10b)1														(105)
-		actor (Ta	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	= Sum(104)	=	0	(106)
Total = Sum(1.0.4) = 0 (106) Space cooling requirement for month = (104)m × (105) × (106)m														
(107)m=	0	0	0	0	0	32.75	49.03	37.34	0	0	0	0		
									Total	= Sum(107)	=	119.12	(107)
Space	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)	÷ (4) =			1.08	(108)
8f. Fabi	ric Enei	rgy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		81.82	(109)
													L	

User Details:	
Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.5.7	
Property Address: LG1 Green Address : , London	
1. Overall dwelling dimensions:	
Area(m ²) Av. Height(m) Volume(i	m³)
Basement 67.4 (1a) x 2.8 (2a) = 188.72	(3a)
Ground floor 42.4 (1b) x 2.6 (2b) = 110.24	(3b)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ (4)	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 298.96$	(5)
2. Ventilation rate:	
main secondary other total m ³ per he	our
Number of chimneysheating0+0+0=0× 40 =00	(6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$	(6b)
Number of intermittent fans $0 \times 10 = 0$	(7a)
Number of passive vents 0 x 10 = 0	(7b)
Number of flueless gas fires	(7c)
Air changes per	hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) = 0$ $\div (5) = 0$	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) 0	
Additional infiltration [(9)-1]x0.1 = 0	(9)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after	` ` `
deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0	(12)
If no draught lobby, enter 0.05, else enter 0	(12)
Percentage of windows and doors draught stripped	(14)
Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0	(15)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 15	(17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$ 0.75	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	
Number of sides sheltered2Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.85	(19)
	(20)
Infiltration rate incorporating shelter factor $(21) = (10) \times (20) = 0.64$ Infiltration rate modified for monthly wind speed	(21)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Monthly average wind speed from Table 7	
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	

Wind F	actor (22a)m =	(22)m ÷	- 4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjust	ed infilt	ration ra	te (allow	ing for s	helter ar	nd wind s	speed) =	: (21a) x	(22a)m	•	•	-	-	
	0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75]	
		<i>ective air</i> al ventila	-	rate for	the appl	icable ca	se		-	-			- 	(220)
				endix N (2	23h) - (23	a) × Fmv (e	equation (N5)) othe	rwise (23ł	n) – (23a)			0.5	(23a)
			• • • •		, ,	for in-use f				5) = (200)			0.5	(23b)
			-	-	-	at recove				2h)m ± ((23h) v [1 _ (23c)	58.65	(23c)
(24a)m=			0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96]	(24a)
						heat rec]	
(24b)m=									0		0	0	ו	(24b)
		L house ex	tract ve	I ntilation	I or positiv	ve input v	l ventilatio	I on from (L outside		1	I	1	
,					•	b); otherv				.5 × (23l	b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
						ve input v erwise (2				0.51	1		1	
(24d) <mark>m=</mark>	<u> </u>	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive ai	r change	e rate - e	nter (24a	a) or (24	b) or (24	c) or (24	ld) in bo	x (25)					
(25)m=	1.02	1	0.99	0.91	0.89	0.81	0.81	0.8	0.84	0.89	0.92	0.96		(25)
2 140	ot loop			noromot	0.51									
ELEN		es and h Gro		Openir		Net Ar	00	U-val		AXU		k-value	<u>_</u>	AXk
ELCN			a (m²)		193 1 ²	A,r		W/m2		(W/		kJ/m ² ·l		kJ/K
Doo <mark>rs</mark>						1.98	×	1.8	=	3.564				(26)
Windo	ws Typ	e 1				4.33		/[1/(1.6)+	- 0.04] =	6.51				(27)
Windo	ws Typ	e 2				1.92	x1	/[1/(1.6)+	- 0.04] =	2.89				(27)
Windo	ws Typ	e 3				0.64		/[1/(1.6)+	- 0.04] =	0.96				(27)
Floor 7	Гуре 1					30	x	0.1	=	3				(28)
Floor 7	Гуре 2					37.4	×	0.25	=	9.35	= i		\exists	(28)
Walls -	Type1	48	.6	4.48	3	44.12	2 ×	0.55		24.27			\dashv	(29)
Walls -	• •	32		17.3		15.48		0.15		2.32			\dashv	(29)
Walls	• •	8.0		0		8.6	×	0.55		4.73			\dashv	(29)
Walls	• •	3.		1.98		1.12		0.55		0.62			\dashv	(29)
Walls	• •													(29)
		elements		0		13.3		0.15	=	2	[
				offoctivo	indow I I v	173.8 alue calcul		a formula r	1/[/1/1/1	UD)+0 01	as aivon ir	naragraph	22	(31)
		as on both					นเฮน นงกไข	gionnuid	//(// U -val	u c/+ 0.04] (us yiven III	ραιαγιαρι	1 0.2	

Fabric heat loss, $W/K = S (A \times U)$	(26)(30) + (32) =	82.62	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design approximate where the details of the construction are not known r	provide the indirative values of TMD in Table 1f		-

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

can be ι	ised inste	ad of a dei	tailed calc	ulation.										
Thermal bridges : $S(L \times Y)$ calculated using Appendix K26if details of thermal bridging are not known (36) = $0.05 \times (31)$ 26												26	(36)	
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			108.62	(37)
Ventila	tion hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	100.59	99.01	97.44	89.58	88.01	80.15	80.15	78.57	83.29	88.01	91.15	94.3		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	209.21	207.64	206.07	198.21	196.63	188.77	188.77	187.2	191.92	196.63	199.78	202.92		
Heat lo	oss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) ₁ (4)	.12 /12=	197.81	(39)
(40)m=	1.91	1.89	1.88	1.81	1.79	1.72	1.72	1.7	1.75	1.79	1.82	1.85		
Numbe	er of day	/s in mor	nth (Tab	le 1a)					/	Average =	Sum(40)1	.12 /12=	1.8	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			<u> </u>											
1 \//-	tor hoa	ting ener	av roqui	romont.								kWh/ye	oor:	
4. 000	lier nea		igy iequ	i ement.								KVVII/yt	-ai.	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)														(42)
	A > 13. A £ 13.		+ 1.76 X	[1 - exp	(-0.0003	49 X (1F	·A -13.9))2)] + 0.0	0013 X (1	IFA -13.	9)			
			ater usag	ge in litre	s per da	y Vd,av	erage =	(25 x N)	+ 36		101	.02		(43)
						-	7	o achieve .	a water us	se target o	f <mark></mark>			
notmore			berson per	⁻ day (all w		ioi and col	(0)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot Wate	-		-	ach month	Va,m = 1a	ctor from I		- · ·						
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99	103.04	107.08	111.13		-
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x D	0Tm / 3600			m(44) ₁₁₂ = ables 1b, 10		1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
16 1				- (Total = Su	m(45) ₁₁₂ =	:	1589.49	(45)
						• •		boxes (46)	. ,				I	
(46)m= Water	24.72 storage	21.62 loss:	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94		(46)
	-		includir	ig any so	olar or W	WHRS	storage	within sa	me ves	sel	· ·	110		(47)
If com	munity h	eating a	ind no ta	nk in dw	elling, e	nter 110	litres in	(47)						
	•	-			-			mbi boile	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWh	n/day):				()		(48)
Tempe	erature f	actor fro	m Table	2b							()		(49)
			-	, kWh/ye				(48) x (49)	=		11	10		(50)
,				ylinder l om Tabl							0.0	01		(51)
		leating s			(.,	.,,				0.		l	
	•	from Ta									1.0	03		(52)
Tempe	erature f	actor fro	m Table	2b							0.	54		(53)

0.	Energy lost from water storage, kWh/year Enter (50) or (54) in (55)						(47) x (51) x (52) x (53) =					76 76		(54) (55)
	. ,	loss cal	,	for each	month			((56)m = (55) × (41)ı	m	0.	70		(00)
(56)m=	23.57	21.29	23.57	22.81	23.57	22.81	23.57	23.57	22.81	23.57	22.81	23.57		(56)
		-		-			H11)] ÷ (5						l lix H	(00)
(57)m=	23.57	21.29	23.57	22.81	23.57	22.81	23.57	23.57	22.81	23.57	22.81	23.57		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	• 3							0		(58)
	-					59)m = ((58) ÷ 36	5 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatir	ng and a	cylinde	r thermo	stat)	-		
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)	m
(62)m=	211.63	186.43	195.56	174.99	171.25	152.68	146.32	160.99	160.85	181.47	192.29	206.43		(62)
Solar DI	-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	from w	ater hea	ter											
(64)m=	211.63	186.43	195.56	174.99	171.25	152.68	146.32	160.99	160.85	181.47	192.29	206.43		
								Outp	out from wa	ater heate	r <mark>(annual)</mark> ₁	12	2140.87	(64)
Hea <mark>t g</mark>	ains fro	m water	heating.	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(<mark>46)m</mark> (+ (57)m	+ (<mark>59</mark>)m]	
(65)m=	92.26	81.76	86.92	79.37	78.83	71.95	70.54	75.42	74.67	82.23	85.12	90.53		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	<mark>or hot</mark> w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	<u>olic gair</u>	s (Table	<u>5), Wat</u>	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		-			
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	-	-		
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a)	, also se	e Table	5			_	
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table s	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (T	able 5)											
(72)m=	124	121.67	116.82	110.24	105.96	99.94	94.82	101.38	103.71	110.52	118.22	121.68		(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m	-	
(73)m=	487.85	485.6	469.62	443.66	416.95	391.46	375.05	381.52	394.99	421.18	451.31	474.23		(73)
6. So	lar gains	S:											-	

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9x	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9x	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9x	0.77	x	1.92	x	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9x	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9x	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9x	0.77	x	1.92	x	110.55	x	0.63	x	0.7	=	129.73	(78)
South 0.9x	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9x	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9x	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9x	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9x	0.77	x	1.92	x	55.42	x	0.63	x	0.7	=	65.03	(78)
South 0.9x	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9x	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9x	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9x	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9x	0.77	x	0.64	×	106.25		0.63	x	0.7	=	20.78	(79)
Southwest _{0.9x}	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Southwest _{0.9x}	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest _{0.9x}	0.77	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest _{0.9x}	0.77	x	0.64	x	104. <mark>3</mark> 9		0.63	x	0.7	=	20.42	(79)
Southwest0.9x	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9x	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9x	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9x	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9x	0.77	x	4.33	×	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9x	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9x	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	488.46	(80)
West 0.9x	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9x	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9x	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9x	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9x	0.77	x	4.33	×	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9x	0.77	x	4.33	×	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9x	0.77	x	4.33	×	24.49	x	0.63	x	0.7	=	129.63	(80)
West 0.9x	0.77	x	4.33	×	16.15	x	0.63	x	0.7	=	85.49	(80)

Solar gains in watts, calculated for each month $(83)m = Sum(74)m \dots (82)m$														
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)	
Total gains – internal and solar (84)m = (73)m + (83)m , watts														
(84)m=	653.87	791.09	935.77	1082.26	1173.66	1157.1	1107.5	1026.18	922.24	772.96	654.59	613.29	(84)	

7. Me	an inter	nal temp	perature	(heating	season)								
							from Tal	ble 9, Th	1 (°C)				21	(85)
		tor for g	• •			-		,	()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.97	0.92	0.8	0.66	0.71	0.9	0.98	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.86	19.07	19.44	19.97	20.42	20.78	20.92	20.9	20.62	20.01	19.38	18.88		(87)
Temp	erature	during h	neating p	periods in	n rest of	dwelling	from Ta	able 9, T	h2 (°C)			-		
(88)m=	19.4	19.41	19.42	19.47	19.48	19.53	19.53	19.54	19.51	19.48	19.46	19.44		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.87	0.69	0.48	0.54	0.83	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tab	le 9c)				
(90)m=	16.64	16.95	17.49	18.28	18.91	19.38	19.5	19.5	19.2	18.36	17.43	16.68		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA x T1	+ (1 – fL	.A) × T2					
(92)m=	17.58	17.85	18.32	18.99	19.55	19.98	20.1	20.09	19.8	19.06	18.25	17.61		(92)
Ap <mark>ply</mark>	adjustr	nent to t	he mear	n interna	Itemper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>				
(93)m=	17.58	17.85	18.32	18.99	19.55	19.98	20.1	20.09	19.8	19.06	18.25	17.61		(93)
		t <mark>ing re</mark> qւ												
		mean int factor fo				ied at st	ep 11 of	Table 9	b, so tha	it Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>	ation fac	tor for g	ains, hr	1:				. <u> </u>						
(94)m=	0.99	0.99	0.98	0.95	0.87	0.73	0.56	0.61	0.85	0.96	0.99	1		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8	4)m		-		-					
(95)m=	650.37	782.83	914.55	1023.06	1026.41	847.67	617.95	629.67	780.5	745.64	648.55	610.73		(95)
	<u> </u>	age exte	1	perature	i	1	i		i	i	i	i	l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		1	1	· · ·	r	1	<u>, , , , , , , , , , , , , , , , , , , </u>	x [(93)m	r Ó	ŕ – – –	0000.04	0704.0		(07)
(97)m=		2688.67				1014.9	661.57	691.18	1093.86		2228.21	2721.3		(97)
Space (98)m=		g require 1280.72		703.56	10nth, K 384.77	/vn/mon ⁻	th = 0.02	24 x [(97)m – (95 0	682.89	<u> </u>	1570.27		
(30)11-	1303.13	1200.72	1131.11	703.30	304.77	0	0		l per year				8473.8	(98)
Snoo	a haatin	a roquir		la M/b/ma	hoor			1010	i por your	(ittiniyoui) = Oum(0	0/15,912 -		
		g require			•								77.17	(99)
			nts – Ind	ividual h	eating s	ystems i	ncluding	y micro-C	CHP)					
	e heatiı ion of sp	n g: bace hea	at from s	econdar	y/supple	mentary	v system						0	(201)
Fract	ion of sp	ace 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	ing syste	em 1								170	(206)
Efficie	ency of a	seconda	ry/suppl	ementar	y heatin	g systen	า, %						0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heating	g require	ement (c	alculate	d above)				-				· ·	
	1583.13	1280.72	1131.11	703.56	384.77	0	0	0	0	682.89	1137.35	1570.27		
(211)m	= {[(98])m x (20	(4)] } x 1	00 ÷ (20)6)									(211)
	931.25	753.36	665.36	413.86	226.34	0	0	0	0	401.7	669.03	923.69		_
_								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	2	4984.59	(211)
•			econdar 00 ÷ (20	y), kWh/ wa	month									
- {[(90) (215)m=	0	0	00 ÷ (20	0	0	0	0	0	0	0	0	0		
I			1					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating													
Output				ulated a									I	
Efficier	211.63 ncy of wa	186.43	195.56	174.99	171.25	152.68	146.32	160.99	160.85	181.47	192.29	206.43	170	(216)
(217)m=	170 170	170	170	170	170	170	170	170	170	170	170	170	170	(217)
			kWh/m			170	110	170	170	110	170	170		()
(219)m	= (64)	<u>m x 100</u>) ÷ (217)	m									1	
(219)m=	124.49	109.66	115.04	102.93	100.73	89.81	86.07	94.7	94.62	106.74	113.11	121.43		٦
Annua	l totals							Tota	I = Sum(2		Mhhaon		1259.33	(219)
		fuel use	ed, main	system	1					K	Wh/year		kWh/year 4984.59	7
	heating												1259.33	
				electric	keen-ho	ł					_			
				iced, ext			oput from	n outcide				000.47		(230a)
						USILIVE II	iiput iion		-			360.17		
	al heatin				-			sum	of (230a)	(230g) =		30	000.47	(230c)
			above, i	kWh/yea	ſ			Sum	01 (230a).	(2309) =			390.17	(231)
	city for li												430.44	(232)
12a. (CO2 em	issions -	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHP)					
							ergy				ion fac	tor	Emissions	
						kW	/h/year			kg CO	2/kWh		kg CO2/yea	ar
Space	heating	(main s	ystem 1)		(21	1) x			0.5	19	=	2587	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.5	19	=	653.59	(264)
Space	and wat	er heati	ng			(26	1) + (262)	+ (263) + (264) =				3240.6	(265)
Electric	city for p	umps, fa	ans and	electric	keep-hot	t (23 ⁻	1) x			0.5	19	=	202.5	(267)
Electric	city for li	ghting				(232	2) x			0.5	19	=	223.4	(268)
Total C	:02, kg/	year							sum o	of (265)(2	271) =		3666.49	(272)
Dwelli	ng CO2	Emissi	on Rate	•					(272)	÷ (4) =				(273)
													33.39	(213)

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	AP 2012			Stroma Softwa	are Ver	sion:		Versio	n: 1.0.5.7	
			Pro	operty /	Address:	: LG1 Gr	een				
Address :	, London										
1. Overall dwelling dime	ensions:										
				Area	a(m²)		Av. Hei	ght(m)		Volume(m ³)	-
Basement				6	67.4	(1a) x	2	.8	(2a) =	188.72	(3a)
Ground floor				4	12.4	(1b) x	2	.6	(2b) =	110.24	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+	(1d)+(1e)+	(1n)	1	09.8	(4)			-		-
Dwelling volume						(3a)+(3b)	+(3c)+(3d))+(3e)+	.(3n) =	298.96	(5)
2. Ventilation rate:											
	main heating	seco heat		,	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 fa	ns					- F	4	x 1	0 =	40	(7a)
Number of passive vents							0	x 1	0 =	0	(7b)
Number of flueless gas fi	0	(7c)									
Infiltration due to chimner	ve flues and f	ans = (6a) + (6a)	Sb)+(7a)+(7b)+(7b)+(7b)+(7b)+(7b)+(7b)+(7b)+(7b	7c) =	Г	40			anges per hou	lr](8)
If a pressurisation test has b	7					continue fr	40 om (9) to (÷ (5) =	0.13	(0)
Number of storeys in th	ne dw <mark>elling</mark> (ne	5)							[0	(9)
Additional infiltration								[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or	r timber fram	ne or ().35 for	masonr	y constr	uction			0	(11)
if both types of wall are p deducting areas of openir			ling to t	the greate	er wall are	a (after					
If suspended wooden f			or 0.1	(seale	d), else	enter 0			[0	(12)
If no draught lobby, en	ter 0.05, else	enter 0		,	,.					0	(13)
Percentage of windows	s and doors dr	aught stripp	ed							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00		ĺ	0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =	İ	0	(16)
Air permeability value,	q50, expresse	ed in cubic m	netres	per ho	our per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabil	ity value, then	(18) = [(17) ÷	20]+(8)	, otherwi	se (18) = (16)				0.38	(18)
Air permeability value applie		on test has bee	en done	or a deg	gree air pei	rmeability	is being us	sed			-
Number of sides sheltere	ed				(20) 1	0 07E v (4	0)1			2	(19)
Shelter factor	la a al alta a ta	1			(20) = 1 -		9)] =			0.85	(20)
Infiltration rate incorporat	•				(21) = (18)) x (20) =				0.33	(21)
Infiltration rate modified f		· · ·		11	Δ	0		N1-			
Jan Feb	Mar Apr		lun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		· · · · · ·									
(22)m= 5.1 5	4.9 4.4	4.3 3	.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				-	
	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se	-	-		-		- 	(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	auation (N5)) . othe	rwise (23t	o) = (23a)			0	
						or in-use fa				, , ,			0	
a) If	balance	ed mech	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	-	(200)
(24a)m=		0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	overy (I	u MV) (24t)m = (2	- 2b)m + (23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from o	outside	-	-	-		
i	if (22b)r	n < 0.5 >	< (23b), 1	then (240	c) = (23k	o); otherv	vise (24	c) = (22	b) m + 0	.5 × (23b) 	,		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
						ve input v erwise (24				0.51				
(24d)m=	<u> </u>	0.58	0.58	0.56	0.56	0.55	0.55	0.5 + [(2	0.55	0.56	0.57	0.57		(24d)
ì í						o) or (240			<u> </u>					
(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
		s and ne Gros		paramete Oponin		Net Are	00	U-val		AXU		k-value		AXk
ELEN		area		Openin m	-	A ,n		W/m2		(W/		kJ/m²·l		kJ/K
Doo <mark>rs</mark>						1.98	×	1	=	1.98				(26)
Windo	ws Type	e 1				4.33	x1	/[1/(1.4)+	0.04] =	5.74				(27)
Windo	ws Type	e 2				1.92	x1	/[1/(1.4)+	0.04] =	2.55				(27)
Windo	ws Type	e 3				0.64	x1	/[1/(1.4)+	0.04] =	0.85				(27)
Floor T	Гуре 1					30	x	0.13	=	3.9				(28)
Floor T	Гуре 2					37.4	x	0.13	=	4.862			- -	(28)
Walls -	Type1	48.	6	4.48		44.12	x	0.18	=	7.94			- -	(29)
Walls -	Туре2	32.	8	17.3	2	15.48	x	0.18	=	2.79			ĪĒ	(29)
Walls -	ТуреЗ	8.6	3	0		8.6	x	0.18	=	1.55	T i		Ξ Γ	(29)
Walls -	Туре4	3.1	1	1.98		1.12	x	0.18	=	0.2	T i		Ξ Γ	(29)
Walls -	Туре5	13.	3	0		13.3	x	0.18	=	2.39	i F		Ξ Γ	(29)
Total a	area of e	elements	s, m²			173.8								(31)
* for win	dows and	l roof wind	lows, use e	effective wi	ndow U-va	alue calcula	ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	paragraph	n 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) =	54.52	(33)
Heat capacity $Cm = S(A \times k)$	((28)(30) + (32) + (32a)(32e) =	0	(34)
Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m ² K	Indicative Value: Medium	250	(35)
For design assessments where the details of the construction are not known i	precisely the indicative values of TMP in Table 1f		-

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Thermal bridges : $S(L \times Y)$ calculated using Appendix K16.25if details of thermal bridging are not known (36) = 0.05 x (31)(36)								(36)						
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			70.77	(37)
Ventila	tion hea	at loss ca	alculated	monthl	/				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.86	57.53	57.21	55.68	55.4	54.07	54.07	53.82	54.58	55.4	55.97	56.58		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	128.63	128.3	127.97	126.45	126.16	124.83	124.83	124.59	125.34	126.16	126.74	127.34		
Heat lo	oss para	meter (F	HLP), W	/m²K			•			Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	126.44	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.13	1.14	1.15	1.15	1.16]	
(10)											Sum(40)1.	-	1.15	(40)
Number of days in month (Table 1a)														
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			-				-							
4. Water heating energy requirement: kWh/year:														
	Assumed occupancy, N 2.81 (42) if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)													
	A £ 13.9		1.107		(0.0000		10.0	/2/] • 0.0	,010 x (,			
								(25 x N)				1.02		(43)
				usage by : ^r day (all w				to achieve	a water us	se target o	t			
										0.1		Du		
Hot wate	Jan er usage i	Feb	Mar day for e	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
	-			-			90.92	94.96	00	103.04	107.08	111.13		
(44)m=	111.13	107.08	103.04	99	94.96	90.92	90.92	94.96	99				1010.00	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1212.28	(44)
(45)m=	164.8	144.13	148.73	129.67	124.42	107.36	99.49	114.16	115.53	134.64	146.97	159.6		
										Fotal = Su	m(45) ₁₁₂ =		1589.49	(45)
lf instant	taneous w	ater heatii	ng at point	of use (no	hot water	· storage),	enter 0 in	boxes (46,) to (61)				1	
(46)m=	24.72 storage	21.62	22.31	19.45	18.66	16.1	14.92	17.12	17.33	20.2	22.05	23.94		(46)
	•		includir	ng any so	olar or W	/WHRS	storage	within sa	me ves	sel		150	1	(47)
0		,		0 1) litres in			001		150		(47)
	•	-			-			ombi boil	ers) ente	er '0' in (47)			
	storage			(,			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	17		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energy	/ lost fro	m water	· storage	, kWh/ye	ear			(48) x (49)	=		0.	63		(50)
				cylinder l									1	
				om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
	•	eating s from Ta	ee secti	on 4.3									1	
			m Table	2b								0 0		(52) (53)
.				-							'	~	1	(00)

	nergy lost from water storage, kWh/year inter (50) or (54) in (55)							(47) x (51)) x (52) x (53) =		0		(54) (55)
	. ,	. , .	,	for each	month			((56)m = ((55) × (41)ı	m				
(56)m=	19.51	17.62	19.51	18.88	19.51	18.88	19.51	19.51	18.88	19.51	18.88	19.51		(56)
If cylind	er contain	s dedicate	d solar sto	nage, (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=	19.51	17.62	19.51	18.88	19.51	18.88	19.51	19.51	18.88	19.51	18.88	19.51		(57)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3		-			-		0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatir	ng and a	a cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i 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=	207.56	182.76	191.5	171.06	167.19	148.75	142.26	156.93	156.92	177.41	188.36	202.36		(62)
Solar DI	HW input	calculated	using App	endix G o	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)
Outpu	t from w	ater hea	iter				-							
(64)m=	207.56	182.76	191.5	171.06	167.19	148.75	142.26	156.93	156.92	177.41	188.36	202.36		
								Outp	out from wa	ater heate	r (annual)₁	12	2093.05	(64)
Hea <mark>t g</mark>	j <mark>ain</mark> s fro	m water	heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(4 <mark>6)m</mark>	+ (57)m	+ (<mark>59)</mark> m]	
(65)m=	<mark>8</mark> 9.01	78.83	83.67	76.23	75.58	68.81	67.29	72.17	71.52	78.98	81.98	87.28		(65)
in <mark>clι</mark>	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ate <mark>r is f</mark> r	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table S	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	tts				-				_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68	140.68		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	24.37	21.65	17.61	13.33	9.96	8.41	9.09	11.81	15.86	20.13	23.5	25.05		(67)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	271.27	274.08	266.99	251.89	232.83	214.91	202.94	200.13	207.22	222.32	241.38	259.3		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5				
(69)m=	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07	37.07		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54	-112.54		(71)
Water	heating	gains (1	Table 5)											
(72)m=	119.64	117.3	112.46	105.87	101.59	95.57	90.45	97.01	99.34	106.16	113.86	117.31		(72)
Total i	internal	gains =		-		(66)	m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m=	483.48	481.24	465.26	439.29	412.58	387.09	370.68	377.15	390.62	416.82	446.94	469.87		(73)
6. So	lar gain	S:	-	-	-	-	-	-						

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South 0.9>	0.77	x	1.92	x	46.75	x	0.63	x	0.7	=	54.87	(78)
South 0.9>	0.77	x	1.92	x	76.57	x	0.63	x	0.7	=	89.86	(78)
South 0.9>	0.77	x	1.92	x	97.53	x	0.63	x	0.7	=	114.46	(78)
South 0.9>	0.77	x	1.92	x	110.23	x	0.63	x	0.7	=	129.37	(78)
South 0.9	0.77	x	1.92	x	114.87	x	0.63	x	0.7	=	134.81	(78)
South 0.9>	0.77	x	1.92	x	110.55	x	0.63	x	0.7	=	129.73	(78)
South 0.9	0.77	x	1.92	x	108.01	x	0.63	x	0.7	=	126.76	(78)
South 0.9	0.77	x	1.92	x	104.89	x	0.63	x	0.7	=	123.1	(78)
South 0.9	0.77	x	1.92	x	101.89	x	0.63	x	0.7	=	119.57	(78)
South 0.9>	0.77	x	1.92	x	82.59	x	0.63	x	0.7	=	96.92	(78)
South 0.9>	0.77	x	1.92	x	55.42	x	0.63	x	0.7	=	65.03	(78)
South 0.9>	0.77	x	1.92	x	40.4	x	0.63	x	0.7	=	47.41	(78)
Southwest0.9>	0.77	x	0.64	x	36.79		0.63	x	0.7	=	7.2	(79)
Southwest0.9>	0.77	x	0.64	x	62.67		0.63	x	0.7	=	12.26	(79)
Southwest0.9>	0.77	x	0.64	x	85.75		0.63	x	0.7	=	16.77	(79)
Southwest0.9	0.77	x	0.64	×	106.25		0.63	х	0.7	=	20.78	(79)
Southwest0.9	0.77	x	0.64	x	119.01		0.63	x	0.7	=	23.28	(79)
Sout <mark>hwest_{0.9},</mark>	0.77	x	0.64	x	118.15		0.63	x	0.7	=	23.11	(79)
Southwest0.9	(0.7 <mark>7</mark>	x	0.64	x	113.91		0.63	x	0.7	=	22.28	(79)
Southwest0.9	0.77	x	0.64	x	104.39		0.63	x	0.7	=	20.42	(79)
Sout <mark>hwest</mark> 0.9>	0.77	x	0.64	x	92.85		0.63	x	0.7	=	18.16	(79)
Southwest0.9	0.77	x	0.64	x	69.27		0.63	x	0.7	=	13.55	(79)
Southwest0.9	0.77	x	0.64	x	44.07		0.63	x	0.7	=	8.62	(79)
Southwest0.9>	0.77	x	0.64	x	31.49		0.63	x	0.7	=	6.16	(79)
West 0.9>	0.77	x	4.33	x	19.64	x	0.63	x	0.7	=	103.96	(80)
West 0.9>	0.77	x	4.33	x	38.42	x	0.63	x	0.7	=	203.37	(80)
West 0.9>	0.77	x	4.33	x	63.27	x	0.63	x	0.7	=	334.92	(80)
West 0.9>	0.77	x	4.33	x	92.28	x	0.63	x	0.7	=	488.46	(80)
West 0.9>	0.77	x	4.33	x	113.09	x	0.63	x	0.7	=	598.62	(80)
West 0.9>	0.77	x	4.33	x	115.77	x	0.63	x	0.7	=	612.8	(80)
West 0.9>	0.77	x	4.33	x	110.22	x	0.63	x	0.7	=	583.41	(80)
West 0.9>	0.77	x	4.33	x	94.68	x	0.63	x	0.7	=	501.14	(80)
West 0.9>	0.77	x	4.33	x	73.59	x	0.63	x	0.7	=	389.52	(80)
West 0.9	0.77	x	4.33	x	45.59	x	0.63	x	0.7	=	241.31	(80)
West 0.9>	0.77	x	4.33	×	24.49	x	0.63	x	0.7	=	129.63	(80)
West 0.9>	0.77	x	4.33	×	16.15	x	0.63	x	0.7	=	85.49	(80)

Solar gains in watts, calculated for each month(83)m = Sum(74)m(82)m													
(83)m=	166.02	305.48	466.15	638.61	756.71	765.64	732.45	644.66	527.25	351.78	203.28	139.06	(83)
Total g	ains – ii	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	649.5	786.72	931.41	1077.9	1169.29	1152.74	1103.13	1021.81	917.87	768.6	650.22	608.93	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
							from Tal	ble 9, Th	1 (°C)				21	(85)
		tor for g	• •			-			. ,					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.49	0.55	0.81	0.97	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.72	19.91	20.2	20.56	20.83	20.96	20.99	20.99	20.9	20.52	20.05	19.69		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.92	0.78	0.57	0.38	0.43	0.73	0.96	0.99	1		(89)
Mean	n interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to	7 in Tabl	le 9c)				
(90)m=	18.24	18.51	18.94	19.45	19.8	19.95	19.97	19.97	19.89	19.4	18.73	18.2		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	n interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA x T1	+ (1 – fL	_A) × T2					
(92)m=	18.87	19.1	19.47	19.92	20.24	20.38	20.4	_20.4	20.31	19.87	19.29	18.83		(92)
Ap <mark>ply</mark>	/ adjustr	nent to t	he mear	interna	l temper	ature fro	m Table	e 4e, whe	ere appro	opri <mark>ate</mark>	J			
(93)m=	18.87	19.1	19.47	19.92	20.24	20.38	20.4	20.4	20.31	19.87	19.29	18.83		(93)
8. Space heating requirement														
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Util <mark>isa</mark>		ctor for g			<u> </u>	- Curr		7.0.9			1101	200		
(94)m=	1	0.99	0.97	0.92	0.8	0.6	0.43	0.48	0.76	0.95	0.99	1		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8-	4)m									
(95)m=	647.27	779.75	907.54	992.44	933.26	694.67	470.87	491.61	697.22	733.98	645.26	607.38		(95)
Mont	hly aver	age exte	ernal terr	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	r	r	r	· · · ·	r	1	<u>, ,</u>	x [(93)m	r Ó	Ē	1	I	I	
(97)m=		1822.03					474.65	498.35	778.82	1170	1544.4	1863.56		(97)
•		ř			· · · ·	r	î .	24 x [(97	í Ó	<u>í - `</u>	r Ó	024.0	l	
(98)m=	912.57	700.42	559.72	288.81	107.08	0	0	0	0	324.4	647.38	934.6	4474.06	(98)
-					.,			TOTE	l per year	(kwn/yea	r) = Sum(9	8)15,912 =	4474.96	
Space	e heatin	g require	ement in	kWh/m ²	²/year								40.76	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)														
	e heatin ion of sp	ng: bace hea	at from s	econdar	y/supple	mentary	v system						0	(201)
	-	bace hea					•	(202) = 1	– (201) =				1	(202)
	-	tal heati		-				(204) = (2	02) × [1 –	(203)] =			1	(204)
		main spa	-	-									93.5	(206)
		' seconda		• •		g systen	า, %						0	(208)
								-						

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea)r
Space				alculated	,		001	Aug	Ocp	000		Dee	KWII/yee	u
	912.57	700.42	559.72	288.81	107.08	0	0	0	0	324.4	647.38	934.6		
(211)m	ı = {[(98)m x (20	4)]}x1	00 ÷ (20)6)						-			(211)
	976.01	749.11	598.63	308.89	114.52	0	0	0	0	346.95	692.38	999.57		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	4786.06	(211)
•				y), kWh/	month									
1			00 ÷ (20 0		0	0	0	0	0	0	0	0		
(215)m=	0	0	0	0	0	0	0	-	-	-	215) _{15,1012}	0	0	(215)
Wator	heating							, ota	. (- 10715,1012		0	
	-	•	ter (calc	ulated al	bove)									
	207.56	182.76	191.5	171.06	167.19	148.75	142.26	156.93	156.92	177.41	188.36	202.36		
Efficier	ncy of w	ater hea	iter										79.8	(216)
(217)m=	88.31	88.06	87.51	86.2	83.66	79.8	79.8	79.8	79.8	86.4	87.85	88.39		(217)
		•	kWh/m											
(219)m (219)m=		m x 100 207.55) <u>÷ (217)</u> 218.83	m 198.44	199.84	186.41	178.27	196.66	196.64	205.32	214.42	228.94		
(,									I = Sum(2				2466.36	(219)
Annua	I totals									k	Wh/year	•	kWh/year	
Spa <mark>ce</mark>	heating	fuel use	ed, main	system	1								4786.06	
Wat <mark>er</mark>	heating	fuel use	d										2466.36	Ī
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t					_			J
		ig pump										30		(230c)
		an-assis										45		(230e)
Total e	lectricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electric	city for li	ghting											430.44	(232)
12a. (CO2 em	issions -	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHF)					
						En	ergy			Emiss	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	r
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	1033.79	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0](263)
Water	heating		• •			(219	9) x			0.2		=	532.73	(264)
	-	ter heati	na			(26	1) + (262) ·	+ (263) + (264) =	0.2	10		1566.52	(265)
			•	electric	kaan ha		1) x	(/ (=		-
		•	ans anu	electric	кеер-по					0.5			38.93	(267)
	city for li					(232	2) x			0.5		=	223.4	(268)
Total C	:O2, kg/	year							sum o	f (265)(2	271) =		1828.84	(272)

TER =

24.5

(273)

APPENDIX B – SBEM RESULTS



551-557 Finchley Road

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

551-557 Finchley Road Baseline

As designed

Date: Tue Oct 06 14:05:50 2020

Administrative information

Building Details

Address: Address 1, Address 2, City, Postcode

Certification tool

Calculation engine: SBEM Calculation engine version: v5.6.a.2 Interface to calculation engine: Virtual Environment Interface to calculation engine version: v7.0.12 BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

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

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	31.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	31.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	40.7
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	Ua-Limit	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.55	0.55	SP00002_W1
Floor	0.25	0.73	0.73	SP00002_F
Roof	0.25	0.68	0.68	SP000003_C
Windows***, roof windows, and rooflights	2.2	5.6	5.6	SP000009_W4_O0
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _{a-Limit} = Limiting area-weighted average U-values [W	· /-			

Ua-Calc = Calculated area-weighted average U-values [W/(m²K)]

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

There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

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

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

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	15*
* Buildings with less than 500 m ² total useful 15 m ³ /(h.m ²) at 50 Pa.	floor area may avoid the need for a press	ure test provided that the air permeability is taken as Page 1 of 6

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Baseline System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency		
This system	0.81	-	-	-	-		
Standard value	0.91*	N/A	N/A	N/A	N/A		
Automatic moni	Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO						
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.							

1- SYST0000-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]				
This building	0.7	-				
Standard value 0.9* N/A						
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.						

Local mechanical ventilation, exhaust, and terminal units

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

Zone name		SFP [W/(I/s)]							UD officionov		
ID of system type	Α	В	С	D	E	F	G	Н	I	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
LG Plant	-	-	-	0.7	-	-	-	-	-	0.7	0.5
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5
GF COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5
CIRCULATION	-	-	-	0.7	-	-	-	-	-	0.7	0.5
GF COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5
GF COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
LG Plant	-	90	30	574

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
LG COM	-	90	30	706
LG COM	-	90	30	645
LG COM	-	90	30	942
LG COM	-	90	30	869
GF COM	-	90	30	758
CIRCULATION	-	90	-	185
GF COM	-	90	30	796
GF COM	-	90	30	661

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
LG Plant	N/A	N/A
LG COM	N/A	N/A
GF COM	YES (+169.9%)	NO
GF COM	YES (+168.2%)	NO
GF COM	YES (+154.3%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	374.1	374.1
External area [m ²]	418.6	418.6
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	15	3
Average conductance [W/K]	572.79	186.88
Average U-value [W/m ² K]	1.37	0.45
Alpha value* [%]	6.71	19.8

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

Building Use

% Area Building Type 100 A1/A2 Retail/Financia

A1/A2 Retail/Financial and Professional services
A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution
C1 Hotels
C2 Residential Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
C2 Residential Institutions: Universities and colleges
C2A Secure Residential Institutions
Residential spaces
D1 Non-residential Institutions: Community/Day Centre
D1 Non-residential Institutions: Libraries, Museums, and Galleries
D1 Non-residential Institutions: Education
D1 Non-residential Institutions: Primary Health Care Building
D1 Non-residential Institutions: Crown and County Courts
D2 General Assembly and Leisure, Night Clubs, and Theatres
Others: Passenger terminals
Others: Emergency services
Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs

Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	46.45	4.08
Cooling	0	0
Auxiliary	5.71	4.89
Lighting	53.99	55.09
Hot water	2.05	1.66
Equipment*	18.4	18.4
TOTAL**	108.2	65.72

* Energy used by equipment does not count towards the total for consumption or calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	314.18	232.14
Primary energy* [kWh/m ²]	237.86	186.53
Total emissions [kg/m ²]	40.7	31.6

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

ŀ	HVAC Systems Performance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2		Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	120.9	193.3	46.5	0	5.7	0.72	0	0.81	0
	Notional	12.1	220.1	4.1	0	4.9	0.82	0		

Key to terms

Lloot dom [M]/m2]	Lecting energy demond
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

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

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*				
Wall	0.23	0.55	SP000002_W1				
Floor	0.2	0.73	SP000002_F				
Roof 0.15		0.68	SP000003_C				
Windows, roof windows, and rooflights	1.5	5.6	SP000009_W4_O0				
Personnel doors 1.5		-	"No external personnel doors"				
Vehicle access & similar large doors 1.5		-	"No external vehicle access doors"				
High usage entrance doors 1.5		-	"No external high usage entrance doors"				
U _{i-Typ} = Typical individual element U-values [W/(m ² K))j		Ui-Min = Minimum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the minimum U-value occurs.							

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	15

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

551-557 Finchley Road Lean

Date: Tue Oct 06 08:22:57 2020

Administrative information

Building Details

Address: Address 1, Address 2, City, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2 Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details

Name: Name Telephone number: Phone Address: Street Address, City, Postcode

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	31.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	31.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	30.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element		Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.55	0.55	SP000002_W1
Floor	0.25	0.25	0.25	SP000002_F
Roof	0.25	0.18	0.18	SP000003_C
Windows***, roof windows, and rooflights	2.2	1.6	1.6	SP000009_W4_O0
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors		-	-	"No external high usage entrance doors"
Ua-Limit = Limiting area-weighted average U-values [W	. ,,			

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

Ui-Calc = Calculated maximum individual element U-values [W/(m²K)]

There might be more than one surface where the maximum U-value occurs.

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

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

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

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	15*
* Buildings with less than 500 m ² total useful 15 m ³ /(h.m ²) at 50 Pa.	floor area may avoid the need for a press	ure test provided that the air permeability is taken as Page 1 of 6

As designed

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Lean System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency			
This system	0.91	-	-	-	-			
Standard value	0.91*	N/A	N/A	N/A	N/A			
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES								
		ns <=2 MW output. For sing nulti-boiler system, limiting	le boiler systems >2 MW o efficiency is 0.82.	r multi-boiler system	ns, (overall) limiting			

1- SYST0001-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]						
This building	1	-						
Standard value	tandard value 0.9* N/A							
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.								

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(I/s)]											
ID of system type	Α	В	С	D	E	F	G	Н	I	HR efficiency		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
LG Plant	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
LG COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
GF COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
CIRCULATION	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
GF COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	
GF COM	-	-	-	0.7	-	-	-	-	-	0.7	0.5	

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
LG Plant	-	80	30	484

General lighting and display lighting	Luminous efficacy [Im/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
LG COM	-	80	30	596
LG COM	-	80	30	544
LG COM	-	80	30	795
LG COM	-	80	30	733
GF COM	-	80	30	639
CIRCULATION	-	80	-	156
GF COM	-	80	30	672
GF COM	-	80	30	557

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
LG Plant	N/A	N/A
LG COM	N/A	N/A
GF COM	YES (+31%)	NO
GF COM	YES (+30.2%)	NO
GF COM	YES (+23.4%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Actual 374.1	Notional
374.1	0 - 4 4
	374.1
418.6	418.6
LON	LON
15	3
220.1	186.88
0.53	0.45
17 45	19.8
	220.1

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

Building Use

% Area Building Type 100 A1/A2 Retail/Financia

A1/A2 Retail/Financial and Professional services
A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution
C1 Hotels
C2 Residential Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
C2 Residential Institutions: Universities and colleges
C2A Secure Residential Institutions
Residential spaces
D1 Non-residential Institutions: Community/Day Centre
D1 Non-residential Institutions: Libraries, Museums, and Galleries
D1 Non-residential Institutions: Education
D1 Non-residential Institutions: Primary Health Care Building
D1 Non-residential Institutions: Crown and County Courts
D2 General Assembly and Leisure, Night Clubs, and Theatres
Others: Passenger terminals
Others: Emergency services
Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs

Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional		
Heating	13.05	4.08		
Cooling	0	0		
Auxiliary	5.59	4.89		
Lighting	47.75	55.09		
Hot water	1.44	1.66		
Equipment*	18.4	18.4		
TOTAL**	67.82	65.72		

* Energy used by equipment does not count towards the total for consumption or calculating emissions. ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	201.99	232.14
Primary energy* [kWh/m ²]	177.32	186.53
Total emissions [kg/m ²]	30.1	31.6

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

ŀ	HVAC Systems Performance									
Sys	System Type Heat dem MJ/m2 Cool dem MJ/m2 Heat con kWh/m2 Cool con kWh/m2 Aux con kWh/m2 Heat SSEEF Cool SSEER Heat gen SEFF Cool gen SEFF						Cool gen SEER			
[ST	[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	40.2	161.8	13	0	5.6	0.86	0	0.91	0
	Notional	12.1	220.1	4.1	0	4.9	0.82	0		

Key to terms

= Heating energy demand
= Cooling energy demand
= Heating energy consumption
= Cooling energy consumption
= Auxiliary energy consumption
= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
= Cooling system seasonal energy efficiency ratio
= Heating generator seasonal efficiency
= Cooling generator seasonal energy efficiency ratio
= System type
= Heat source
= Heating fuel type
= Cooling fuel type

Key Features

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

Building fabric

Element	U і-Тур	Ui-Min	Surface where the minimum value occurs*
Wall	0.23	0.55	SP000002_W1
Floor	0.2	0.25	SP000002_F
Roof	0.15	0.18	SP000003_C
Windows, roof windows, and rooflights	1.5	1.6	SP000009_W4_O0
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors 1.5		-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m ² K)]			U _{i-Min} = Minimum individual element U-values [W/(m ² K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	15

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