

# 25 Old Gloucester Street, London WC1N 3AF

**Energy Strategy** 

June 2017

**CUTTING THE COST OF CARBON** 

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# 1 Issue Register

Revision	Reason for Issue	Date of Issue	Issued By
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### 3 Executive Summary

This document responds to planning policy in respect of energy consumption and carbon dioxide emissions. The methodology used herein is consistent with the latest Greater London Authority (GLA) guidance and Part L of the Building Regulations.

There are no installed or proposed district heating schemes in the immediate vicinity of the site, and therefore it is not considered feasible to connect the Proposed Development to a district heating scheme. The Proposed Development is considered to be too small to incorporate a community heating system, with only 6 dwellings and a small commercial kitchen load within the scheme. Combined heat and power (CHP) has been assessed in terms of feasibility. There is no economic or sustainable justification for over-sizing the CHP plant, and therefore the CHP unit size needs to be carefully matched to the demands of the development. The smallest commercially available CHP unit is too large for the scheme due to the limited number of residential dwellings, and therefore CHP is not considered to be viable for the Proposed Development.

The new build elements of the Proposed Development features significantly improved insulation and air tightness standards, when compared against the compliance requirements of Part L 2013 of the Building Regulations. In addition, energy efficient lighting is to be provided throughout the dwellings in excess of the Part L1 2013 requirements. There are limited improvements possible for the existing building due to the listed status of the building, but high efficiency heating and lighting systems are proposed throughout. The proposed energy efficiency measures would reduce the annual carbon dioxide emissions of the site by 5,740 kgCO<sub>2</sub>, which equates to a reduction of 17.4% against the baseline TER 2013.

A feasibility study of the currently available low and zero carbon technologies has been undertaken, with photovoltaic panels proposed for the development at roof level to generate electricity for the site. It has been estimated that the proposed photovoltaic systems would reduce the annual carbon dioxide emissions of the site by 4,063 kgCO2, which equates to a reduction of 12.3% against the TER 2013.

The incorporation of the energy efficiency measures, and photovoltaic panels equates to a reduction of 29.8% against the TER 2013 for the schemes. This is considered to be the maximum improvement feasible for the scheme due to the limited opportunities in improving the energy efficiency of the existing building.

A summary of the reduction in emissions is shown in Tables 1 and 2 below, and graphically in Figure 1 below.

Stage	Regulated carbon dioxide emissions (heating, cooling, hot water, lighting, fans & pumps) (kgCO <sub>2</sub> /yr)	Unregulated carbon dioxide emissions (cooking, appliances, communal lighting & power) (kgCO <sub>2</sub> /yr)
Building Regulations Compliance (TER 2013)	32,938	15,150
Energy Efficiency Measures ('Be Lean')	27,198	15,150
Proposed Development with PVs ('Be Green')	23,135	15,150

Table 1 – Carbon dioxide emissions after each stage of the Energy Hierarchy for SAP 2012

Stage	Regulated carbon dioxide savings						
	(kgCO2 per annum)	(%)					
Savings from energy demand reduction	5,740	17.4					
Savings from PVs	4,063	12.3					
Total Cumulative Savings	9,803	29.8					

Table 2 – Regulated carbon dioxide savings from each stage of the Energy Hierarchy for SAP 2012

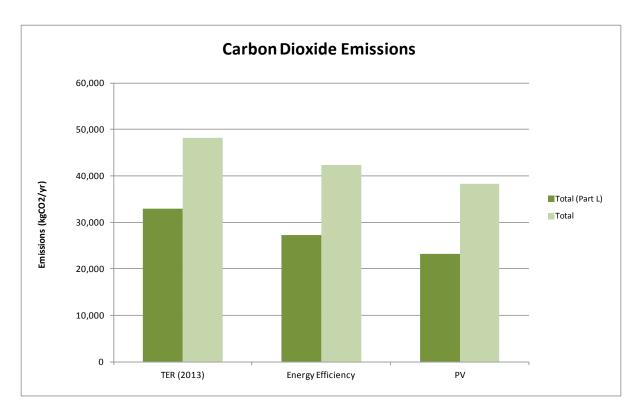


Figure 1 – Summary of carbon dioxide emissions

### 4 Introduction

#### 4.1 Proposed Development

The Proposed Development comprises the refurbishment and extension of the existing commercial space at basement ground and first floor, with the conversion and extension of the existing building at first, second and third floors to create 3 new residential apartments, and the construction of 3 new build apartments at first, second and third floor.

#### 4.2 Planning Policy Context

#### 4.2.1 National

The following description is taken from the London Renewables Toolkit (LRT):

"Increased development of renewable energy resources is vital to facilitating the delivery of the Government's commitments on both climate change and renewable energy. The Government's Energy Policy, including its policy on renewable energy, is set out in the Energy White Paper. This aims to put the UK on a path to cut its carbon dioxide emissions by some 60% by 2050, with real progress by 2020, and to maintain reliable and competitive energy supplies. As part of the strategy for achieving these reductions the White Paper sets out:

- The Government's target to generate 10% of UK electricity from renewable energy sources by 2010
- The Government's aspiration to double that figure to 20% by 2020 and suggests that still
  more renewable energy will be needed beyond that date.

"The Energy White Paper indicated that the Government would be looking to work with regional and local bodies to deliver its objectives, including establishing regional targets for renewable energy generation. Regional Planning Guidance should include the target for renewable energy generation for its respective region, derived from assessments of the region's renewable energy resource potential."

The National Planning Policy Framework sets out the Government's national policy for renewable energy. It states that "to help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources."

#### 4.2.2 Regional

The London Plan is the overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. It forms part of the development plan for Greater London. The London Plan 2011 was published on 22 July 2011.

Policy 5.2 (Minimising Carbon Dioxide Emissions) states that:

"Development proposals should make the fullest contribution to minimizing carbon dioxide emissions in accordance with the following energy hierarchy:

1 – Be lean: use less energy

2 – Be clean: supply energy efficiently3 – Be green: use renewable energy

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

Year	Improvement on 2010 Building Regulations					
	Residential buildings	Non-domestic buildings				
2010 – 2013	25 per cent	25 per cent				
2013 – 2016	40 per cent	40 per cent				
2016 – 2019	Zero carbon	As per building regulations requirements				
2019 – 2031		Zero carbon				

Table 3 – Proposed carbon dioxide reduction targets under the 2011 London Plan

Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

As a minimum, energy assessments should include the following:

- a) Calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations at each stage of the energy hierarchy
- b) Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services
- Proposals to further reduce carbon dioxide emissions through the use of decentralized energy where feasible, such as district heating and cooling and combined heat and power (CHP)
- d) Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies."

#### Policy 5.7 (Renewable Energy) states that:

"The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

Within the framework of the energy hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible."

Following the update to Part L of the Building Regulations in April 2014, the carbon dioxide reduction targets have been revised to reflect the changes in software and Building Regulations compliance targets. The GLA have confirmed in their policy update that the current requirement is for a 35% reduction in carbon dioxide emissions against the Part L 2013 TER requirements.

#### 4.2.3 Local

The Core Strategy sets out the key elements of the vision for the Borough of Camden, and is a central part of the Local Development Framework (LDF). Core Policy CS13 on 'tackling climate change through promoting higher environmental standards' states that:

#### '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:

- a) 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, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralized energy networks;
  - 3. generating renewable energy on-site; and
- d) 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

#### Local energy generation

The Council will promote local energy generation and networks by:

- e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:
  - housing estates with community heating or the potential for community heating and other uses with large heating loads;
  - the growth areas of King's Cross; Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;
  - schools to be redeveloped as part of Building Schools for the Future programme;
  - existing or approved combined heat and power/local energy networks (see Map 4); and other locations where land ownership would facilitate their implementation.
- f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

#### Water and surface water flooding

We will make Camden a water efficient borough and minimise the potential for surface water flooding by:

g) protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;

- h) making sure development incorporates efficient water and foul water infrastructure;
- i) requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and downstream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross (see Map 5).

#### Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

- j) taking measures to reduce its own carbon emissions;
- k) trialling new energy efficient technologies, where feasible; and
- I) raising awareness on mitigation and adaptation measures.'

Policy DP22 on 'promoting sustainable design and construction' states that:

"The Council will require development to incorporate sustainable design and construction measures. Schemes must:

- a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
- b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

- c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.;
- d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;
- e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

- f) summer shading and planting;
- g) limiting run-off;
- h) reducing water consumption;
- i) reducing air pollution; and
- j) not locating vulnerable uses in basements in flood-prone areas.'

Following the Government's Ministerial Statement released on 25 March 2015 in response to the Housing Standards Review Consultation, a number of changes have been introduced to technical housing standards in England, including the withdrawal of the Code for Sustainable Homes as a national standard.

### 5 Methodology

This report draws on the information and approach set out in the GLA's latest Energy Planning guidance. The currency used for emissions is carbon dioxide, rather than the carbon equivalent, for consistency with Part L of the Building Regulations.

A Part L analysis is conducted to calculate carbon dioxide emissions for the following end uses: heating; hot water; cooling; fans, pumps and controls; and lighting. Various energy-saving measures are considered in terms of technical and economic feasibility and their effect on carbon dioxide emissions. A package of energy-saving measures is proposed that meets the Part L standard, without reliance on the contribution of CHP or renewables. Unregulated energy end uses, such as appliances, are added using the SBEM or SAP software.

CHP is then considered in terms of technical and economic feasibility and its effect on carbon dioxide emissions. The strategic issues relating to each technology are also considered in the context of the Proposed Development, and two or three preferred options are short-listed. These are then considered in more detail in terms of technical and economic feasibility and its effect on carbon dioxide emissions.

Calculations are presented in summary form in subsequent sections, with detailed calculations in Appendix A.

Figure 2 below provides a summary of the methodology in the form of a flow diagram.

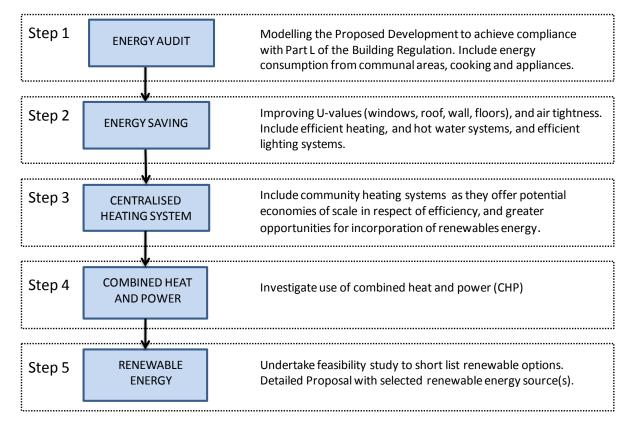


Figure 2 – Flow diagram of methodology

### 6 Energy Demand

The Development would feature energy saving measures such that compliance with Part L of the Building Regulations (2013) would be achieved without reliance on the contribution of renewable technologies.

#### 6.1 Residential Element

#### 6.1.1 New build apartments

As required under Part L, the new build residential units have been assessed under Part L1A, with calculations undertaken using the Stroma FSAP Assessor software to establish the energy consumption of the scheme.

The minimum requirements for compliance with Part L1A were established using a gas baseline, and feasible improvements were included to further reduce the carbon dioxide emissions. The measures outlined below have been used in the Part L1A calculations, and exceed the requirements of Part L1A. The proposed fabric performance is compared against the Part L1A 2013 requirements in Table 4 below:

Element	Proposed Development	Part L1A 2013 Requirements
External wall U-value	0.18 W/m².K	0.30 W/m <sup>2</sup> .K
Exposed roof U-value	0.15 W/m².K	0.20 W/m <sup>2</sup> .K
Exposed floor U-value	0.15 W/m².K	0.25 W/m <sup>2</sup> .K
Window U-value	1.40 W/m².K	2.00 W/m <sup>2</sup> .K
Door U-value	1.40 W/m².K	2.00 W/m <sup>2</sup> .K
Party wall U-value	0.00 W/m².K (fully filled party wall)	0.20 W/m <sup>2</sup> .K
Air permeability	4 m <sup>3</sup> /hr/m <sup>2</sup> @ 50 Pa (with tests undertaken in each dwelling)	10 m <sup>3</sup> /hr/m <sup>2</sup> @ 50 Pa
Thermal bridging	Celotex Enhanced Construction Details to be used, with target y-value for lintels to be 0.05 W/m.K	0.15
Low energy lighting	100%	75%

Table 4 - Comparison of proposed residential performance for new build dwellings

High efficiency gas-fired condensing combination boilers have been used. Enhanced heating controls are proposed for the development, with temperature and time zone control, and weather compensators.

#### 6.1.2 Apartments created by material change of use

As required under Part L, the new residential units created by a material change of use have been assessed under Part L1B, with calculations undertaken using the Stroma FSAP Assessor software to establish the energy consumption of the scheme. As these are not assessed as new build units, the TER worksheets have been calculated for each unit using the minimum efficiency standards required under Part L1B.

The minimum requirements for compliance with Part L1B were established using a gas baseline, and feasible improvements were included to further reduce the carbon dioxide emissions. The measures outlined below have been used in the Part L1B calculations, and exceed the requirements of Part L1B. The proposed fabric performance is compared against the Part L1B 2013 requirements in Table 5 below:

Element	Proposed Development	Part L1B 2013 Requirements
Existing external wall U-value	0.28 W/m <sup>2</sup> .K	0.30 W/m <sup>2</sup> .K
New external wall U-value	0.18 W/m <sup>2</sup> .K	0.30 W/m <sup>2</sup> .K
Existing roof U-value	0.13 W/m².K	0.16 W/m <sup>2</sup> .K
New flat roof U-value	0.15 W/m².K	0.18 W/m <sup>2</sup> .K
Window U-value	1.40 W/m².K	1.60 W/m².K
Door U-value	1.40 W/m².K	1.80 W/m <sup>2</sup> .K
Party wall U-value	0.00 W/m².K (fully filled party wall)	0.20 W/m².K
Air permeability	5 m³/hr/m² @ 50 Pa (with tests undertaken in each dwelling)	15 m <sup>3</sup> /hr/m <sup>2</sup> @ 50 Pa
Thermal bridging	0.15 (cannot be assessed due to retention of existing external fabric)	0.15
Low energy lighting	100%	75%

Table 5 – Comparison of proposed residential performance for new build dwellings

High efficiency gas-fired condensing combination boilers have been used. Enhanced heating controls are proposed for the development, with temperature and time zone control, and weather compensators.

#### 6.2 Commercial Element

#### 6.2.1 Existing main hall and dining hall

As required under Part L, the existing building has been assessed under Part L2B, with calculations undertaken using the accredited DesignBuilder software to establish the energy consumption of the scheme.

Due to the listed status of the building, it is not proposed to install insulation on the internal or external faces of the existing external walls. While floor and ceiling finishes are to be replaced, it is not considered feasible to excavate the basement floor or install new insulation over the floor. The existing windows and doors are to be retained, and therefore opportunities for improving the fabric efficiency of the existing building are limited.

New heating, hot water, ventilation and lighting services are proposed throughout the existing building, and the following assumptions have been made for the energy model:

- Gas fired heating system, with seasonal efficiency of 96%.
- Local mechanical extract systems for the toilet cores.
- LED lighting throughout, with 100 lamp lumens per circuit-Watt.
- Occupancy sensors for lighting within circulation areas and toilet cores.
- Daylight sensors for lighting within the main hall and office areas.

#### 6.2.2 New build rear extension

As required under Part L, the new build rear extension has been assessed under Part L2A, with calculations undertaken using the accredited DesignBuilder software to establish the energy consumption of the scheme.

The minimum requirements for compliance with Part L2A were established, and feasible improvements were included to further reduce the carbon dioxide emissions. The measures outlined below have been used in the Part L2A calculations, and exceed the requirements of Part L2A. The proposed fabric performance is compared against the Part L2A 2013 requirements in Table 6 below:

Element	Proposed Development	Part L2A 2013 Requirements				
External wall U-value	0.18 W/m².K	0.35 W/m <sup>2</sup> .K				
Exposed roof U-value	0.15 W/m².K	0.25 W/m <sup>2</sup> .K				
Exposed floor U-value	0.15 W/m².K	0.25 W/m².K				
Window and roof Glazing U-value	1.00 W/m².K	2.20 W/m <sup>2</sup> .K				
External Door	1.40 W/m².K	2.20 W/m <sup>2</sup> .K				
Air permeability	5 m³/hr/m² @ 50 Pa	10 m³/hr/m² @ 50 Pa				
Lighting	luminaire lumens per circuit- Watt	Office and storage areas - 60 luminaire lumens per circuit-Watt  All other areas - 60 lamp				

#### Daylight sensors

Table 6 – Comparison of proposed commercial performance

New heating, hot water, ventilation and lighting services are proposed throughout the extended building, and the following assumptions have been made for the energy model:

- Gas fired heating system, with seasonal efficiency of 96%.
- Local mechanical extract systems for the toilet cores and kitchen.
- LED lighting throughout, with 100 lamp lumens per circuit-Watt.
- Occupancy sensors for lighting within circulation areas and toilet cores.
- Daylight sensors for lighting within the office areas.

### 7 Passive Design & Preventing Overheating

#### 7.1 Passive Design

The apartments have been designed such that there are no dwellings with only North facing windows – the dwellings will all therefore receive beneficial solar gains and natural daylight at some point during the day.

Apartments 1.01, 1.02, 2.01 and 3.01 have north facing external balconies, which are considered to be beneficial during the summer months, as they provide external shaded areas for occupants, and also enable the opening of larger access doors to provide cooler air for ventilation.

#### 7.2 Avoiding Overheating

In compliance with London Plan policy 5.9, the scheme has been designed to avoid overheating and to minimise cooling demand.

There is solar shading afforded by the 4 storey buildings on the opposite side of Old Gloucester Street, as well as by the 5 storey buildings to the south-east on Southampton Row.

SAP 2012 contains a procedure to check whether solar gains for residential properties are excessive. Detailed SAP calculations have been undertaken for each of the dwellings within the scheme, and these have indicated that the dwellings will have a slight or insignificant risk of high internal temperatures. Energy efficient design and 100% low energy lighting are proposed for the residential properties, and full details of this are provided in this Energy Strategy report. The Overheating Calculations are provided in Appendix E of this report.

SBEM also contains a procedure for checking whether solar gains for non domestic spaces are excessive. This is not appropriate for the existing part of the building as there are no changes proposed to the existing fabric for these areas. The overheating assessment has been undertaken for the new build extension, and the BRUKL report for this space is provided in Appendix D of this reports as confirmation – the roof glazing for the mezzanine admin office has been designed with a g-value of 0.45 to reduce solar overheating in this space, with high efficiency LED lighting proposed throughout.

A green roof is also proposed above the commercial side rear extension to significantly reduce heat build-up at roof level, and also to improve the efficiency and life expectancy of the proposed PV systems.

### 8 Community Heating & CHP

The Mayor's Energy Strategy favours community heating systems because they offer:

- Potential economies of scale in respect of efficiency and therefore reduced carbon emissions; and
- Greater potential for future replacement with Low or Zero Carbon (LZC) technologies.

There are no existing or proposed district heating systems in the immediate vicinity of the site, and therefore not considered to be feasible to connect to a district heating system. This is confirmed by the London Heat Map for the area around the site, included in Figure 3 below.



Figure 3 – London Heat Map for the site

The Proposed Development is considered to be too small to successfully incorporate a community heating system, with typically 60 dwellings being the minimum to provide an economically feasible centralized system which also provides a reduction in carbon dioxide emissions. It is also considered that the small increase in heating plant efficiency due to the incorporation of a system of the limited size that this particular scheme would require would be cancelled out by the increase in energy consumption required to pump the heating water circuit. As the Proposed Development comprises 9 apartments and a small commercial unit, there is a low density heat demand, which lowers the feasibility for connection to a district heating system.

Initial studies using the SAP software showed that the provision of a community heating scheme for the 6 dwellings would result in an increased carbon footprint of 17%, with associated increased energy costs, administrative charges and fees. This is due to increased circulation losses and lower summer DHW efficiencies than using high efficiency individual combination boilers. As there are no current plans to install a district heating system in the area, it is not considered to be feasible to provide a communal heating system for the development.

Combined heat and power (CHP) has also been assessed in terms of feasibility. There is no economic or sustainable justification for over-sizing the CHP plant, and therefore the CHP unit size needs to be

carefully matched to the demands of the development. The Proposed Development is not large enough to contain a district wide CHP system to serve surrounding buildings and future schemes, and the smallest commercially available CHP unit is too large for the scheme due to the limited number of residential dwellings. CHP systems are usually specified for large schemes with more than 100-150 dwellings due to the need to have a large enough heat demand to supply from the CHP system — the smallest commercially available CHP unit (the Baxi DACHS micro-CHP unit) would supply 60 dwellings, and therefore would not be economically or technically feasible for this scheme. Therefore CHP is not considered to be viable for the Proposed Development.

### 9 Renewables – Feasibility Study

The LRT provides benchmark sizing and cost data for "renewable energy technologies suitable for London". It therefore provides information to assess the various technologies at an early design stage, with initial measurements of the impact of using each technology on the building's carbon dioxide emissions. Table 7 (below) outlines these technologies and the variations proposed in the LRT used in this assessment.

Technology	End Use Demand Met
Wind	Electricity
PV Cells - rooftop	Electricity
PV Cells - cladding	Electricity
Solar Water Heating	Annual DHW (50 %)
Biomass heating (a)	Annual Space Heating +Domestic Hot Water (33%)
Biomass heating (b)	Annual Space Heating +Domestic Hot Water (50%)
Biomass heating (c)	Annual Space Heating +Domestic Hot Water (100%)
Biomass CHP (a)	Annual Space Heating +Domestic Hot Water (33%)
Biomass CHP (b)	Annual Space Heating +Domestic Hot Water (50%)
Ground sourced heat pumps (a)	Annual Space Heating +Domestic Hot Water (50%)
Ground sourced heat pumps (b)	Annual Space Heating +Domestic Hot Water (100%)
Ground sourced heat pumps (c)	Peak Space Heating (50 %) Annual Space Heating + Domestic Hot Water (85 %)
Ground cooling (a)	Annual Cooling (50%)
Ground cooling (b)	Annual Cooling (100%)

Table 7 – Renewable energy technologies suitable for London

The following other "acceptable renewable energy technologies" are considered to be not typically appropriate in London:

- Fuel cells using hydrogen from renewable sources;
- Gas from anaerobic digestion;
- Geothermal:
- · Ground cooling air systems;
- Micro hydro; and
- Solar air collectors.

On the basis of this preliminary analysis, and a review of the general advantages and disadvantages of the different technologies relative to the Proposed Development, the following technologies were not considered to be appropriate to the Proposed Development:

- Wind turbines: on the basis of visual appearance, noise issues and concerns over outputs in urban areas. Wind turbines are not considered appropriate for the urban context. There are still concerns over noise with the horizontal axis turbines, and therefore they are not considered appropriate for the development. The average wind speed for the Proposed Development is noted on the Encraft website as 4.7m/s at 10m this is significantly below the required average wind speed to make wind turbines a practical solution, particularly when the power output of the turbines is reduced by 7/8ths when the wind speed is halved;
- **Biomass:** on the basis of concerns over air quality issues from flue discharge; concerns over transport issues relating to regular deliveries of biomass; security and cost of fuel supply; concerns over disposal of ash; and relatively high maintenance. Biomass is not considered to be a suitable fuel for use within an urban development, and therefore this technology is not considered appropriate for the development. Deliveries of biomass pellets is undertaken by large vehicles the equivalent size of domestic oil delivery tankers and it is not considered appropriate to have vehicles of this size navigating the local streets and making regular deliveries to the site;
- **Biomass CHP:** on the basis of embodied impacts; high maintenance; concerns over air quality issues from flue discharge; concerns over transport issues relating to regular deliveries of biomass; lack of micro-scale units on the market to suit this scale of development; and it being an immature technology. Biomass is not considered to be a suitable fuel for use within an urban development, therefore this technology is not considered appropriate for the development. A large biomass fuelled CHP with heat output of 200 kW is available, but this is approximately 40 times larger than required for this scheme, particularly as the current biomass fuelled CHP units need to operate 24/7 biomass CHP is therefore not considered to be feasible for this scheme;
- Solar thermal: due to the higher carbon dioxide reductions from the photovoltaic systems, it
  is not proposed to include solar thermal within the scheme. This may be reviewed at
  detailed design stage, to identify any new technologies and panel types that would make
  solar thermal more appropriate;
- **Ground source:** due to the limited site area at ground level, there is insufficient area available for horizontal loops. The use of open loop boreholes has been discounted as there is a risk of drilling and not finding a suitable aquifer. The use of closed loop boreholes has been discounted because there is insufficient site area to contain the required number.

### 10 Renewables - Detailed Proposal

On the basis of this preliminary analysis, and a review of the general advantages and disadvantages of the different technologies relative to the Proposed Development, the following technologies were considered to be appropriate to the Proposed Development:

Photovoltaic panels.

#### 10.1 Photovoltaic Panels

Photovoltaic panels extract the energy of the sun to generate electricity. It is proposed that photovoltaic panels be installed on the roofs, to generate electricity for the development. These electrical generation systems would be connected to the National Grid so that any surplus electricity can be exported to the Grid, and would be eligible for the feed-in tariffs.

A photovoltaic system of 9.92 kWp is proposed for the development at roof level, with 4.48 kWp facing due south-west on the new rear pitched roof, 3.20 kWp facing due south-west on the front pitched roof, and 2.24 kWp facing due south-west on the new flat roof. All panels would be installed at the same angle as the pitched roofs, and at 15° for the flat roof system, and are currently assumed to be 320 Wp panels with dimensions of 1680mm by 1000mm. This system would provide an annual output of 7,681 kWh for the site.

The rear photovoltaic system of 4.48 kWp would be connected directly to the new build extension at basement/ground floor in order to meet the BREEAM requirements for the unit. The remaining photovoltaic systems would be connected to the Landlord system for the residential units.

The incorporation of the photovoltaic systems within the scheme would reduce the annual carbon dioxide emissions of the Proposed Development by 4,063 kgCO<sub>2</sub>, which equates to a reduction of 12.3% against the regulated emissions (2013). A proposed layout is attached in Appendix A, which would be reviewed during the detailed design stage to reflect changes in available products and prices.





Figure 4 - Typical photovoltaic panel installations

### 11 Conclusion

This document has responded to planning policy in respect of energy consumption and carbon dioxide emissions. The methodology used herein is consistent with the latest GLA guidance and Part L of the Building Regulations.

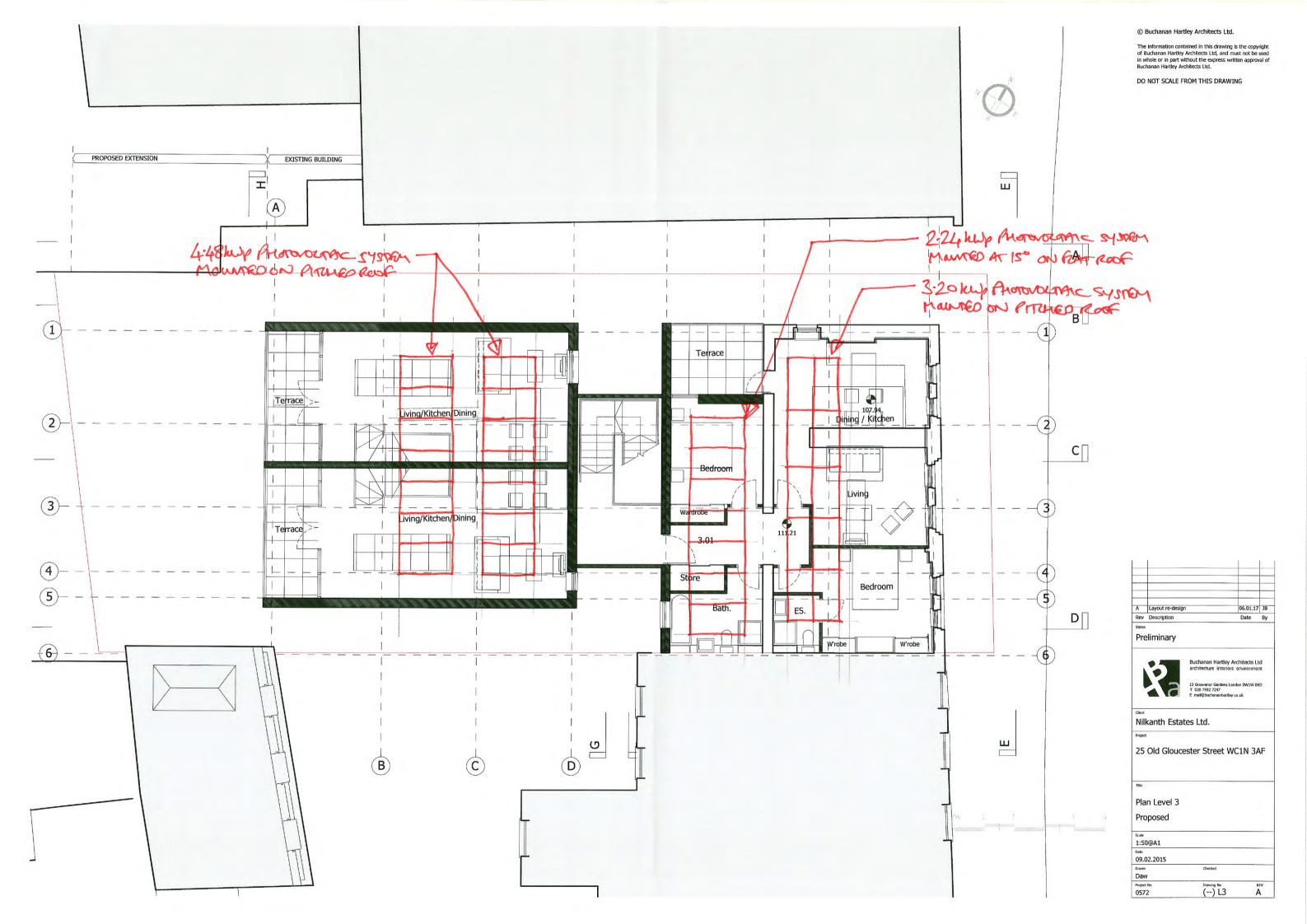
There are no installed or proposed district heating schemes in the immediate vicinity of the site, and therefore it is not considered feasible to connect the Proposed Development to a district heating scheme. The Proposed Development is considered to be too small to incorporate a community heating system, with only 6 dwellings and a small commercial kitchen load within the scheme. CHP has been assessed in terms of feasibility. There is no economic or sustainable justification for oversizing the CHP plant, and therefore the CHP unit size needs to be carefully matched to the demands of the development. The smallest commercially available CHP unit is too large for the scheme due to the limited number of residential dwellings, and therefore CHP is not considered to be viable for the Proposed Development.

The new build elements of the Proposed Development features significantly improved insulation and air tightness standards, when compared against the compliance requirements of Part L 2013 of the Building Regulations. In addition, energy efficient lighting is to be provided throughout the dwellings in excess of the Part L1 2013 requirements. There are limited improvements possible for the existing building due to the listed status of the building, but high efficiency heating and lighting systems are proposed throughout. The proposed energy efficiency measures would reduce the annual carbon dioxide emissions of the site by 5,740 kgCO<sub>2</sub>, which equates to a reduction of 17.4% against the baseline TER 2013.

A feasibility study of the currently available low and zero carbon technologies has been undertaken, with photovoltaic panels proposed for the development at roof level to generate electricity for the site. It has been estimated that the proposed photovoltaic systems would reduce the annual carbon dioxide emissions of the site by 4,063 kgCO2, which equates to a reduction of 12.3% against the TER 2013.

The incorporation of the energy efficiency measures, and photovoltaic panels equates to a reduction of 29.8% against the TER 2013 for the schemes. This is considered to be the maximum improvement feasible for the scheme due to the limited opportunities in improving the energy efficiency of the existing building.

# 12 Appendix A – Proposed PV Layout



# 13 Appendix B – Baseline TER Worksheets

The following SAP TER worksheets are taken from the SAP 2012 software for the modelled dwellings in accordance with current London Plan policy. The TER worksheets have been created for the 3 dwellings created by a material change of use in accordance with the compliance requirements of Part L1B.

			User D	etails:						
Assessor Name: Software Name:	John Simpson Stroma FSAP 2	012		Strom Softwa					006273 on: 1.0.4.7	
				Address						
Address :	1.02, 25 Old Glou	cester St,	LONDO	N, WC1I	N 3AF					
1. Overall dwelling dime	ensions:									
			Area	a(m²)		Av. He	ight(m)	,	Volume(m	<u> </u>
Ground floor				88.5	(1a) x		2.5	(2a) =	221.25	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(	1e)+(1r	n) [	88.5	(4)					
Dwelling volume					(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	221.25	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	ır
Number of chimneys	0 +	0	<b>+</b> [	0	] = [	0	X	40 =	0	(6a)
Number of open flues	0 +	0	╡╻┝	0	, 	0	x	20 =	0	(6b)
Number of intermittent fa					J			10 =		=
					Ļ	3			30	(7a)
Number of passive vents	5				L	0	X	10 =	0	(7b)
Number of flueless gas f	ires					0	X	40 =	0	(7c)
								Air ch	anges per h	our
Indituation due to alimone	us flues and fans	(6a) (6b) (7	70) ı ( <b>7</b> b) ı (	<b>7</b> 0) –	г			i		
Infiltration due to chimne If a pressurisation test has a	•				ontinuo fr	30		÷ (5) =	0.14	(8)
Number of storeys in t		idea, procee	u 10 (17), (	ourier wise (	onunue n	om ( <del>9)</del> to	(10)		0	(9)
Additional infiltration	are aweiling (115)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: (	0.25 for steel or timbe	er frame or	0.35 for	r masoni	v constr	uction	1(-)		0	(11)
	present, use the value con				•				<u> </u>	<b>`</b> ′
deducting areas of open.								,		_
If suspended wooden	•	,	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er									0	(13)
Percentage of window	s and doors draught	stripped							0	(14)
Window infiltration				0.25 - [0.2			(4.5)		0	(15)
Infiltration rate				(8) + (10)		, , ,	, ,		0	(16)
Air permeability value	•		•	•		etre of e	envelope	area	5	(17)
If based on air permeabi	-					. , .			0.39	(18)
Air permeability value application. Number of sides sheltered	·	nas been dor	ne or a deg	gree air pe	meability	is being u	sea			(40)
Shelter factor	au			(20) = 1 -	0.0 <b>75</b> x (1	9)] <b>=</b>			2 0.85	(19)
Infiltration rate incorpora	ting shelter factor			(21) = (18		/ <del>-</del>			0.33	(21)
Infiltration rate modified	-	ed			, ,			ļ	0.55	()
Jan Feb	Mar Apr Ma	1	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		, 1 50	I	1		1	1		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		
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	, , , , , , , , , , , , , , , , , , ,	1 5.5	I	I	•	l	1			
Wind Factor (22a)m = (2	22)m ÷ 4									
(000) 4.07 4.05	1 2	0.05	0.05	0.00	4	4.00	4.40	4.40		

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

Adjusted infiltr	ation rate (all	owing for s	helter ar	nd wind s	speed) =	(21a) x	(22a)m					
0.42 Calculate effec	0.41 0.4		0.35 the appli	0.31	0.31	0.3	0.33	0.35	0.37	0.39		
	al ventilation:										0	(23a
If exhaust air h	eat pump using	Appendix N, (2	23b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(23k
If balanced with	heat recovery:	efficiency in %	allowing	for in-use f	actor (fron	n Table 4h	) =				0	(230
a) If balance	d mechanica	l ventilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
(24a)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24a
b) If balance	d mechanica	l ventilation	without	heat red	covery (I	MV) (24b	m = (22)	2b)m + (2	23b)	ī	1	
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24k
,	ouse extract n < 0.5 × (23		•	•				.5 × (23b	)		_	
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0		(240
,	ventilation or n = 1, then (2							0.5]			_	
(24d)m= 0.59	0.58 0.5	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(240
Effective air	change rate	- enter (24a	a) or (24l	b) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.59	0.58 0.5	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(25)
3. Heat losse	s and heat lo	ss paramet	er:									
ELEMENT	Gross area (m²)	Openir n	ngs n²	Net Ar A ,r		U-val W/m2		A X U (W/I	<b>〈</b> )	k-value kJ/m²-		A X k kJ/K
Doors				2.1	х	1	=	2.1				(26)
Windows Type	: 1			3.15	x1	/[1/( 1.4 )+	0.04] =	4.18				(27)
Windows Type	2			0.78	<sub>x</sub> 1	/[1/( 1.4 )+	0.04] =	1.03				(27)
Windows Type	3			1.6	<sub>x</sub> 1	/[1/( 1.4 )+	0.04] =	2.12				(27)
Windows Type	4			1.6	x1	/[1/( 1.4 )+	0.04] =	2.12				(27)
Windows Type	5			2.25	x1	/[1/( 1.4 )+	0.04] =	2.98				(27)
Floor Type 1				85.4	x	0.13	=	11.102	<u> </u>		$\neg \vdash$	(28)
Floor Type 2				3.1	х	0.13	=	0.403				(28)
Walls Type1	85.1	13.8	8	71.22	2 X	0.18	=	12.82				(29)
Walls Type2	13.7	2.1		11.6	X	0.18	=	2.09			<b>=</b> =	(29)
Roof	5	0		5	x	0.13	<u> </u>	0.65	= i		7 F	(30)
Total area of e	lements, m <sup>2</sup>	· · ·		192.3	3							(31)
Party wall				16.3	x	0		0				(32)
* for windows and ** include the area					lated using	formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragrapl	1 3.2	
Fabric heat los	s, $W/K = S$ (	A x U)				(26)(30	) + (32) =				47.56	(33)
Heat capacity	Cm = S(A x P)	()					((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass	parameter (	TMP = Cm	÷ TFA) iı	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
For design assess			e construct	tion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		<u></u>
Thermal bridge			using Ap	pendix l	K						14.98	(36)

if details	s of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)						_		
	abric hea								(33) +	(36) =		Ĺ	62.55	(37)
Ventila	ation hea	it loss ca	alculated	monthl	У	ı		ı	` ′	= 0.33 × (	25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	42.88	42.63	42.39	41.25	41.04	40.05	40.05	39.86	40.43	41.04	41.47	41.92		(38)
Heat to	ransfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	105.43	105.18	104.94	103.8	103.59	102.59	102.59	102.41	102.97	103.59	104.02	104.47		
Heat lo	oss para	meter (H	HLP), W/	m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> .	12 /12=	103.8	(39)
(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.16	1.16	1.17	1.18	1.18		
										Average =	Sum(40) <sub>1</sub> .	12 /12=	1.17	(40)
Numb	er of day	s in mor	nth (Tabl	le 1a)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ener	gy requi	rement:								kWh/ye	ar:	
_	_	_												
	ned occu A > 13.9			[1 ovn	( 0 0003	240 v (TE	-A 12 O	\2\1 + O (	1012 v (	TEA 12		.6		(42)
	A > 13.8 A £ 13.9		+ 1.76 X	[ı - exp	(-0.0003	949 X (11	-A -13.9	)2)] + 0.0	) X C I U	IFA -13.	9)			
	l averag	•	ater usac	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		96	.06		(43)
Reduce	the annua	l average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.00		( - /
not mor	e that 125	litres per p	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 wat	er usage ir	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	105.67	101.82	97.98	94.14	90.3	86.45	86.45	90.3	94.14	97.98	101.82	105.67		
Energy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	1152.72	(44)
(45)m=	156.7	137.05	141.42	123.3	118.31	102.09	94.6	108.56	109.85	128.02	139.75	151.76		
									-	Total = Su	m(45) <sub>112</sub> =	=	1511.4	(45)
If instan	taneous w	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)			_		
(46)m=	23.5	20.56	21.21	18.49	17.75	15.31	14.19	16.28	16.48	19.2	20.96	22.76		(46)
	storage													
Storag	je volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	nd no ta	nk in dw	velling, e	nter 110	litres in	(47)						
	vise if no		hot wate	er (this in	icludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (	47)			
	storage					4.544								
•	nanufact				or is kno	wn (kvvr	n/day):					0		(48)
Tempe	erature fa	actor fro	m Table	2b								0		(49)
Energy	y lost fro		•	-				(48) x (49)	) =			0		(50)
	nanufact			-										<b>(= 1)</b>
•		195 IUSS	iacior if	טווו ומט	e∠(KVV	ii/iitie/da	ıy <i>)</i>					0		(51)
Hot wa		_		nn / 2										
Hot wa	munity h	eating s	ee sectio	on 4.3										(52)
Hot wa If com Volum	munity h	eating s from Tal	ee section ble 2a									0		(52) (53)
Hot wa If com Volum Tempe	munity he factor erature fa	eating s from Tal actor fro	ee section ble 2a m Table	2b	a a r			(A7) v (54)	v (52) v (	53) –		0		(53)
Hot was If common Volum Temper Energy	munity h	eating s from Tal actor from m water	ee section ble 2a m Table storage	2b	ear			(47) x (51)	) x (52) x (	53) =				

Water storage loss	calculated	for each	month			((56)m = (	55) × (41)ı	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains dec	cated solar sto	orage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ı lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit loss	(annual) fr	om Table	e 3							0		(58)
Primary circuit loss	calculated	for each	month (	59)m = (	(58) ÷ 36	55 × (41)	m					
(modified by fac	or from Tab	ole H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)		•	
(59)m = 0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calcula	ed for each	n month	(61)m =	(60) ÷ 36	65 × (41)	)m					_	
(61)m= 50.96 46	03 49.93	46.42	46.01	42.63	44.06	46.01	46.42	49.93	49.32	50.96		(61)
Total heat required	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= 207.66 183	.08 191.35	169.72	164.32	144.72	138.66	154.57	156.28	177.95	189.06	202.71		(62)
Solar DHW input calcu	ated using App	oendix G o	r Appendix	H (negati	ve quantity	v) (enter '0	if no sola	r contribut	ion to wate	er heating)	•	
(add additional line	s if FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water	neater	_										
(64)m= 207.66 183	.08 191.35	169.72	164.32	144.72	138.66	154.57	156.28	177.95	189.06	202.71		-
						Outp	out from wa	ater heate	r (annual)₁	12	2080.08	(64)
Heat gains from w	ter heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m	1	
(65)m= 64.84 57	08 59.51	52.6	50.84	44.6	42.47	47.6	48.13	55.05	58.79	63.2		(65)
include (57)m in	calculation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gains	see Table	5 and 5a	):									
Metabolic gains (T	able 5), Wa	tts										
Jan F	eb Mar											
(66)m= 130.23 130		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
` '	.23 130.23		May 130.23	Jun 130.23	Jul 130.23	Aug 130.23	Sep 130.23	Oct 130.23	Nov 130.23	Dec 130.23		(66)
Lighting gains (cal		Apr 130.23	130.23	130.23	130.23	130.23	130.23					(66)
Lighting gains (cal (67)m= 22.11 19	ulated in A	Apr 130.23	130.23	130.23	130.23	130.23	130.23					(66) (67)
	culated in A	Apr 130.23 ppendix 12.09	130.23 L, equat	130.23 ion L9 o	130.23 r L9a), a 8.25	130.23 Iso see	130.23 Table 5 14.39	130.23	130.23	130.23		` ,
(67)m= 22.11 19	culated in A	Apr 130.23 ppendix 12.09	130.23 L, equat	130.23 ion L9 o	130.23 r L9a), a 8.25	130.23 Iso see	130.23 Table 5 14.39	130.23	130.23	130.23		` ,
(67)m= 22.11 19 Appliances gains (	culated in A 15.97 calculated in 74 232.56	Apr 130.23 ppendix 12.09 Append 219.41	130.23 L, equat 9.04 dix L, eq 202.81	130.23 ion L9 of 7.63 uation L	130.23 r L9a), a 8.25 13 or L1	130.23 Iso see 10.72 3a), also	130.23 Table 5 14.39 see Tal 180.5	130.23 18.27 ole 5 193.65	130.23 21.32	130.23		(67)
(67)m= 22.11 19 Appliances gains ( (68)m= 236.29 238	culated in A 15.97 calculated in 74 232.56 culated in A	Apr 130.23 ppendix 12.09 Append 219.41	130.23 L, equat 9.04 dix L, eq 202.81	130.23 ion L9 of 7.63 uation L	130.23 r L9a), a 8.25 13 or L1	130.23 Iso see 10.72 3a), also	130.23 Table 5 14.39 see Tal 180.5	130.23 18.27 ole 5 193.65	130.23 21.32	130.23		(67)
(67)m= 22.11 19 Appliances gains (68)m= 236.29 236 Cooking gains (ca	culated in A 15.97 calculated in 74 232.56 culated in A 02 36.02	Apr 130.23 ppendix 12.09 n Append 219.41 appendix 36.02	130.23 L, equat 9.04 dix L, eq 202.81 L, equat	130.23 ion L9 of 7.63 uation L 187.2	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a)	130.23 Iso see 10.72 3a), also 174.32	130.23  Table 5  14.39  see Tal  180.5  ee Table	130.23 18.27 ble 5 193.65 5	130.23 21.32 210.26	130.23 22.73 225.87		(67) (68)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 238  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g	culated in A 15.97 calculated in 74 232.56 culated in A 02 36.02	Apr 130.23 ppendix 12.09 n Append 219.41 appendix 36.02	130.23 L, equat 9.04 dix L, eq 202.81 L, equat	130.23 ion L9 of 7.63 uation L 187.2	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a)	130.23 Iso see 10.72 3a), also 174.32	130.23  Table 5  14.39  see Tal  180.5  ee Table	130.23 18.27 ble 5 193.65 5	130.23 21.32 210.26	130.23 22.73 225.87		(67) (68)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 238  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g	culated in A 15.97 calculated in 74 232.56 culated in A 02 36.02 ains (Table	Apr 130.23 ppendix 12.09 n Append 219.41 appendix 36.02 5a) 3	130.23 L, equat 9.04 dix L, eq 202.81 L, equat 36.02	130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	130.23 Iso see 10.72 3a), also 174.32 1, also se 36.02	130.23 Table 5 14.39 see Tal 180.5 ee Table 36.02	130.23 18.27 ble 5 193.65 5 36.02	21.32 210.26 36.02	22.73 225.87 36.02		(67) (68) (69)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 238  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g (70)m= 3	culated in A 15.97 calculated in 74 232.56 culated in A 02 36.02 ains (Table 3 ation (nega	Apr 130.23 ppendix 12.09 n Appendix 219.41 appendix 36.02 5a) 3 attive value	130.23 L, equat 9.04 dix L, eq 202.81 L, equat 36.02	130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	130.23 Iso see 10.72 3a), also 174.32 1, also se 36.02	130.23  Table 5  14.39  see Tal  180.5  ee Table  36.02	130.23 18.27 ble 5 193.65 5 36.02	21.32 210.26 36.02	22.73 225.87 36.02		(67) (68) (69)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 238  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g (70)m= 3  Losses e.g. evapo	culated in A 15.97 calculated in 74 232.56 culated in A 02 36.02 ains (Table 3 ation (nega	Apr 130.23 ppendix 12.09 n Appendix 219.41 appendix 36.02 5a) 3 attive value	130.23 L, equat 9.04 dix L, eq 202.81 L, equat 36.02	130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	130.23 Iso see 10.72 3a), also 174.32 , also se 36.02	130.23  Table 5  14.39  see Tal  180.5  ee Table  36.02	130.23  18.27  ble 5  193.65  5  36.02	21.32 210.26 36.02	22.73 225.87 36.02		(67) (68) (69) (70)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 238  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g (70)m= 3  Losses e.g. evapo (71)m= -104.19 -106	culated in A 15.97 calculated in A 232.56 culated in A 02 36.02 atins (Table 3 ation (nega 19 -104.19 s (Table 5)	Apr 130.23 ppendix 12.09 n Appendix 219.41 appendix 36.02 5a) 3 attive value	130.23 L, equat 9.04 dix L, eq 202.81 L, equat 36.02	130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	130.23 Iso see 10.72 3a), also 174.32 , also se 36.02	130.23  Table 5  14.39  see Tal  180.5  ee Table  36.02	130.23  18.27  ble 5  193.65  5  36.02	21.32 210.26 36.02	22.73 225.87 36.02		(67) (68) (69) (70)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 236  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g (70)m= 3  Losses e.g. evapo (71)m= -104.19 -106  Water heating gain	culated in A 54 15.97 calculated in A 52 36.02 ation (nega 19 -104.19 s (Table 5) 93 79.98	Apr 130.23 ppendix 12.09 n Append 219.41 appendix 36.02 5a) 3 attive valu -104.19	130.23 L, equat 9.04 dix L, eq 202.81 L, equat 36.02 3 es) (Tab	130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02  3 ole 5) -104.19	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	130.23 Iso see 10.72 3a), also 174.32 1, also se 36.02 3	130.23  Table 5 14.39 see Tal 180.5 ee Table 36.02  3 -104.19	130.23  18.27 ble 5  193.65  5  36.02  3  -104.19	130.23 21.32 210.26 36.02 3 -104.19	130.23 22.73 225.87 36.02 3 -104.19		(67) (68) (69) (70) (71)
(67)m= 22.11 19  Appliances gains ( (68)m= 236.29 236  Cooking gains (ca (69)m= 36.02 36  Pumps and fans g (70)m= 3  Losses e.g. evapo (71)m= -104.19 -104  Water heating gair (72)m= 87.15 84	culated in A 54 15.97 calculated in A 54 232.56 culated in A 52 36.02 nins (Table 3 ation (nega 19 -104.19 s (Table 5) 93 79.98	Apr 130.23 ppendix 12.09 n Append 219.41 appendix 36.02 5a) 3 attive valu -104.19	130.23 L, equat 9.04 dix L, eq 202.81 L, equat 36.02 3 es) (Tab	130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02  3 ole 5) -104.19	130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02 3	130.23 Iso see 10.72 3a), also 174.32 1, also se 36.02 3	130.23  Table 5 14.39 see Tal 180.5 ee Table 36.02  3 -104.19	130.23  18.27 ble 5  193.65  5  36.02  3  -104.19	130.23 21.32 210.26 36.02 3 -104.19	130.23 22.73 225.87 36.02 3 -104.19		(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: A	access Factor able 6d	•	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	11.28	x	0.63	x	0.7	=	23.28	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	22.97	x	0.63	x	0.7	<b>=</b>	47.38	(75)
Northeast 0.9x	0.77	X	2.25	x	41.38	x	0.63	x	0.7	<u> </u>	85.36	(75)
Northeast <sub>0.9x</sub>	0.77	x	2.25	x	67.96	х	0.63	x	0.7	] =	140.19	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	91.35	x	0.63	x	0.7	<b>=</b>	188.44	(75)
Northeast 0.9x	0.77	X	2.25	x	97.38	X	0.63	x	0.7	=	200.89	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	91.1	x	0.63	x	0.7	=	187.93	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	72.63	x	0.63	x	0.7	=	149.82	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	50.42	x	0.63	x	0.7	=	104.01	(75)
Northeast <sub>0.9x</sub>	0.77	x	2.25	x	28.07	x	0.63	x	0.7	=	57.9	(75)
Northeast <sub>0.9x</sub>	0.77	x	2.25	x	14.2	x	0.63	x	0.7	=	29.29	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	9.21	x	0.63	x	0.7	=	19.01	(75)
East 0.9x	1	X	3.15	x	19.64	x	0.63	x	0.7	=	18.91	(76)
East 0.9x	1	x	0.78	x	19.64	x	0.63	x	0.7	=	3.28	(76)
East 0.9x	1	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(76)
East 0.9x	1	X	0.78	x	38.42	x	0.63	x	0.7	=	6.42	(76)
East 0.9x	1	X	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(76)
East 0.9x	1	X	0.78	x	63.27	x	0.63	x	0.7	=	10.58	(76)
East 0.9x	1	X	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(76)
East 0.9x	1	X	0.78	x	92.28	x	0.63	x	0.7	=	15.43	(76)
East 0.9x	1	X	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(76)
East 0.9x	1	X	0.78	x	113.09	x	0.63	x	0.7	=	18.91	(76)
East 0.9x	1	X	3.15	X	115.77	x	0.63	x	0.7	=	111.45	(76)
East 0.9x	1	X	0.78	X	115.77	x	0.63	x	0.7	=	19.35	(76)
East 0.9x	1	X	3.15	X	110.22	X	0.63	X	0.7	=	106.11	(76)
East 0.9x	1	X	0.78	x	110.22	X	0.63	x	0.7	=	18.43	(76)
East 0.9x	1	X	3.15	x	94.68	X	0.63	X	0.7	=	91.14	(76)
East 0.9x	1	X	0.78	X	94.68	X	0.63	X	0.7	=	15.83	(76)
East 0.9x	1	X	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(76)
East 0.9x	1	X	0.78	X	73.59	X	0.63	X	0.7	=	12.3	(76)
East 0.9x	1	X	3.15	X	45.59	X	0.63	X	0.7	=	43.89	(76)
East 0.9x	1	X	0.78	x	45.59	X	0.63	X	0.7	=	7.62	(76)
East 0.9x	1	X	3.15	X	24.49	X	0.63	X	0.7	=	23.58	(76)
East 0.9x	1	X	0.78	X	24.49	X	0.63	X	0.7	=	4.09	(76)
East 0.9x	1	X	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(76)
East 0.9x	1	x	0.78	x	16.15	x	0.63	x	0.7	=	2.7	(76)
West 0.9x	0.77	X	1.6	x	19.64	x	0.63	x	0.7	=	9.6	(80)
West 0.9x	0.77	X	1.6	x	19.64	x	0.63	x	0.7	=	9.6	(80)
West 0.9x	0.77	X	1.6	X	38.42	x	0.63	X	0.7	=	18.79	(80)

	_														
West	0.9x	0.77	X	1.6	6	X	38.4	12	X	0.63	X	0.7	=	18.79	(80)
West	0.9x	0.77	X	1.6	6	X	63.2	27	X	0.63	X	0.7	=	30.94	(80)
West	0.9x	0.77	X	1.6	6	X	63.2	27	x	0.63	X	0.7	=	30.94	(80)
West	0.9x	0.77	X	1.6	6	X	92.2	28	x	0.63	X	0.7	=	45.12	(80)
West	0.9x	0.77	X	1.6	6	X	92.2	28	x	0.63	X	0.7	=	45.12	(80)
West	0.9x	0.77	X	1.6	6	X	113.	09	x	0.63	X	0.7	=	55.3	(80)
West	0.9x	0.77	X	1.6	6	X	113.	09	x	0.63	X	0.7	=	55.3	(80)
West	0.9x	0.77	X	1.6	6	X	115.	77	x	0.63	X	0.7	=	56.61	(80)
West	0.9x	0.77	X	1.6	6	X	115.	77	x	0.63	X	0.7	=	56.61	(80)
West	0.9x	0.77	X	1.6	6	X	110.	22	x	0.63	X	0.7	=	53.89	(80)
West	0.9x	0.77	X	1.6	6	X	110.	22	x	0.63	X	0.7	=	53.89	(80)
West	0.9x	0.77	X	1.6	6	X	94.6	68	x	0.63	X	0.7	=	46.29	(80)
West	0.9x	0.77	x	1.6	3	X	94.6	68	x	0.63	x	0.7	=	46.29	(80)
West	0.9x	0.77	X	1.6	3	X	73.5	59	x	0.63	x	0.7	=	35.98	(80)
West	0.9x	0.77	x	1.6	6	X	73.5	59	x	0.63	X	0.7	=	35.98	(80)
West	0.9x	0.77	x	1.6	6	X	45.5	59	x	0.63	x	0.7	=	22.29	(80)
West	0.9x	0.77	x	1.6	6	X	45.5	59	x	0.63	X	0.7	=	22.29	(80)
West	0.9x	0.77	X	1.6	6	X	24.4	19	x	0.63	x	0.7	=	11.97	(80)
West	0.9x	0.77	x	1.6	3	X	24.4	19	x	0.63	x	0.7	=	11.97	(80)
West	0.9x	0.77	x	1.6	6	X	16.1	15	x	0.63	X	0.7	=	7.9	(80)
West	0.9x	0.77	x	1.6	6	X	16.1	15	x	0.63	X	0.7	=	7.9	(80)
	_														
Solar	ains in	watts, calc	ulated	for each	n mont	h			(83)m	= Sum(74)m	(82)m				
(83)m=	64.67	128.36 2	218.73	334.69	426.82	4	44.92 4	20.25	349	.38 259.12	153.9	9 80.91	53.05		(83)
Total g	ains – i	nternal and	d solar	(84)m =	: (73)m	+ (	83)m , w	vatts		•	•	•	•	•	
(84)m=	475.3	536.75	612.32	704.33	772.06	7	66.77 7	27.42	663	.47 585.93	504.9	8 459.21	451.66		(84)
7. Me	an inter	nal tempe	rature (	(heating	seaso	n)									
Temp	erature	during hea	ating pe	eriods ir	the liv	ing	area fro	m Tab	ole 9,	Th1 (°C)				21	(85)
Utilisa	ation fac	tor for gain	ns for li	ving are	a, h1,r	n (s	ee Table	e 9a)							
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.91		0.76	0.6	0.6	7 0.9	0.99	1	1		(86)
Mean	interna	l temperat	ure in I	iving are	ea T1 (	follo	w steps	3 to 7	in T	able 9c)				•	
(87)m=	19.65		20.04	20.4	20.72	$\overline{}$		20.98	20.9	<del></del>	20.39	19.96	19.62		(87)
Temn	erature	during he	ating n	erinds in	rest o	f dw	Ælling fr	om Ta	hla C	 ), Th2 (°C)				ı	
(88)m=	19.93		19.93	19.94	19.94	_		19.95	19.9	<del> </del>	19.94	19.94	19.94	]	(88)
					به مالاه به	<u> </u>			0-2	<b>!</b>				J	
(89)m=	1	tor for gair	0.99	0.96	0.87	$\overline{}$	<del>`</del>	0.47	9a) 0.5	4 0.84	0.98	1	1	1	(89)
		ļ												J	(55)
			r			Ť	<u>`</u>		_	to 7 in Tab	<del></del>	1		1	(00)
(90)m=	18.12	18.32	18.69	19.22	19.66		19.9	19.95	19.9		19.21		18.09	_	(90)
											ILA = Ll	ving area ÷ (	4) =	0.4	(91)
							٠	<b>T</b> 4		(I A) To					

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

(92)m= 18.73 18.9												
	19.23	19.69	20.09	20.31	20.36	20.36	20.19	19.68	19.13	18.71		(92)
Apply adjustment to t	he mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m= 18.73 18.9	19.23	19.69	20.09	20.31	20.36	20.36	20.19	19.68	19.13	18.71		(93)
8. Space heating req	uirement											
Set Ti to the mean in the utilisation factor for				ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for g	ains, hm	1:										
(94)m= 1 1	0.99	0.96	0.88	0.71	0.52	0.59	0.86	0.98	1	1		(94)
Useful gains, hmGm	, W = (94	4)m x (84	4)m									
(95)m= 474.19 534.31	605.02	676.22	677.28	540.92	378.21	390.94	503.89	494	457.15	450.84		(95)
Monthly average exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for me	_				<del>-``</del>	- ,						
(97)m= 1521.56 1472.97			869.04	585.99	386.04	405.05	627.58	941.07	1251.81	1515.64		(97)
Space heating requir							<u> </u>	<del>- `</del>	r e			
(98)m= 779.24 630.78	543.95	319.7	142.67	0	0	0	0	332.62	572.15	792.22		_
						Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	4113.33	(98)
Space heating requir	ement in	kWh/m²	/year								46.48	(99)
9a. Energy requireme	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating:							·					
Fraction of space hea	at from se	econdar	y/supple	mentary	system						0	(201)
Fraction of space hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main spa	ace heati	ing syste	em 1							İ	93.4	= ()
Efficiency of seconda		ementar	y heating	n system	- 0/							(206)
Jan Feb	Mar			g dydion	1, %						0	(206)
	Iviai	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(208)
Space heating requir				Jun		Aug	Sep	Oct	Nov	Dec	0	(208)
Space heating requir 779.24 630.78				Jun		Aug 0	Sep 0	Oct 332.62	Nov 572.15	Dec 792.22	0	(208)
· <del></del>	ement (c 543.95	alculated	d above)	Jun	Jul						0	(208)
779.24 630.78	ement (c 543.95	alculated	d above)	Jun	Jul						0	(208) ar
$ \begin{array}{c c} 779.24 & 630.78 \\ (211)m = \{[(98)m \times (200)] \\ \end{array} $	ement (c 543.95 04)] } x 1	319.7 00 ÷ (20	d above) 142.67 06)	Jun ) 0	Jul 0	0	0	332.62 356.12	572.15 612.58	792.22 848.2	0	(208) ar
779.24	ement (c 543.95 (24)] } x 1 582.39	319.7 00 ÷ (20 342.29	d above) 142.67 96) 152.75	Jun ) 0	Jul 0	0	0	332.62 356.12	572.15 612.58	792.22 848.2	0 kWh/ye	(208) ar
779.24	ement (c 543.95 04)] } x 1 582.39	319.7 00 ÷ (20 342.29 y), kWh/	d above) 142.67 96) 152.75	Jun ) 0	Jul 0	0	0	332.62 356.12	572.15 612.58	792.22 848.2	0 kWh/ye	(208) ar
$779.24$ $630.78$ $(211)$ m = {[(98)m x (2083) 675.36]}  Space heating fuel (space for the state of the state	ement (c 543.95 04)] } x 1 582.39	319.7 00 ÷ (20 342.29 y), kWh/	d above) 142.67 96) 152.75	Jun ) 0	Jul 0	0 Tota	0 0 I (kWh/yea	332.62 356.12 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub>	792.22 848.2 =	0 kWh/ye	(208) ar
779.24 630.78 (211)m = {[(98)m x (20) 834.3 675.36]} Space heating fuel (s = {[(98)m x (201)]} x 1	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20	319.7 00 ÷ (20 342.29 y), kWh/	d above) 142.67 16) 152.75 month	Jun ) 0	Jul 0	0 Tota	0 0 I (kWh/yea	332.62 356.12 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub>	792.22 848.2 =	0 kWh/ye	(208) ar
779.24 630.78 (211)m = {[(98)m x (20) 834.3 675.36]} Space heating fuel (s = {[(98)m x (201)]} x 1	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20	319.7 00 ÷ (20 342.29 y), kWh/	d above) 142.67 16) 152.75 month	Jun ) 0	Jul 0	0 Tota	0 0 I (kWh/yea	332.62 356.12 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub>	792.22 848.2 =	0 kWh/ye	(208) ar (211)
779.24 630.78  (211)m = {[(98)m x (20) 834.3 675.36]}  Space heating fuel (s = {[(98)m x (201)] } x 1 (215)m = 0 0  Water heating  Output from water hea	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20	319.7 00 ÷ (20 342.29 y), kWh/ 8) 0	d above) 142.67 16) 152.75 month	Jun 0 0	0 0 0	0 Tota	0 0 I (kWh/yea	332.62 356.12 ar) =Sum(2 0 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub> 0	792.22 848.2 = 0	0 kWh/ye	(208) ar (211)
779.24 630.78 (211)m = {[(98)m x (20) 834.3 675.36]  Space heating fuel (s = {[(98)m x (201)] } x 1 (215)m = 0 0  Water heating  Output from water heat 207.66 183.08	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20 0	319.7 00 ÷ (20 342.29 y), kWh/ 8)	d above) 142.67 16) 152.75 month	Jun ) 0	Jul 0	0 Tota	0 0 I (kWh/yea	332.62 356.12 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub>	792.22 848.2 =	0 kWh/ye	(208) ar (211) (211)
779.24 630.78  (211)m = {[(98)m x (20) 834.3 675.36]}  Space heating fuel (s = {[(98)m x (201)]} x 1 (215)m = 0 0  Water heating  Output from water hea	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20 0	319.7 00 ÷ (20 342.29 y), kWh/ 8) 0	d above) 142.67 16) 152.75 month 0	Jun 0 0	0 0 0	0 Tota	0 I (kWh/yea	332.62 356.12 ar) =Sum(2 0 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub> 0	792.22 848.2 = 0	0 kWh/ye	(208) ar (211)
779.24 630.78 (211)m = {[(98)m x (20) 834.3 675.36}  Space heating fuel (s = {[(98)m x (201)] } x 1 (215)m = 0 0  Water heating Output from water heat 207.66 183.08	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20 0	319.7 00 ÷ (20 342.29 y), kWh/ 8) 0	d above) 142.67 16) 152.75 month 0	Jun 0 0	0 0 0	0 Tota	0 I (kWh/yea	332.62 356.12 ar) =Sum(2 0 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub> 0	792.22 848.2 = 0	0 kWh/ye 4404	(208) ar (211) (211)
779.24 630.78  (211)m = {[(98)m x (20) 834.3 675.36]}  Space heating fuel (s = {[(98)m x (201)] } x 1 (215)m = 0 0  Water heating  Output from water heat 207.66 183.08  Efficiency of water heat (217)m = 88.07 87.91  Fuel for water heating	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20 0 0 atter (calcider) 191.35 atter 87.53 , kWh/mc	319.7 00 ÷ (20 342.29 y), kWh/ 8) 0 ulated at 169.72 86.62	d above) 142.67 166) 152.75  month 0  0 0000000000000000000000000000000	Jun 0 0 0 144.72	0 0 0	0 Tota  0 Tota	0  I (kWh/yea  0  I (kWh/yea	332.62 356.12 ar) =Sum(2 0 ar) =Sum(2	572.15 612.58 211) <sub>15,1012</sub> 0 215) <sub>15,1012</sub>	792.22 848.2 = 0 =	0 kWh/ye 4404	(208) ar (211) (215)
779.24 630.78  (211)m = {[(98)m x (20) 834.3 675.36}  Space heating fuel (s = {[(98)m x (201)] } x 1 (215)m = 0 0  Water heating  Output from water heat 207.66 183.08  Efficiency of water heat (217)m = 88.07 87.91  Fuel for water heating (219)m = (64)m x 100	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20 0 ater (calcider) 191.35 ater 87.53 , kWh/mc 0 ÷ (217)	319.7 00 ÷ (20 342.29 y), kWh/ 8) 0 ulated al 169.72 86.62 onth	d above) 142.67 166) 152.75  month 0 0 00ve) 164.32	Jun 0 0 0 144.72 80.3	Jul 0 0 0 138.66 80.3	0 Tota  0 Tota  154.57	0 0 I (kWh/yea 156.28 80.3	332.62 356.12 ar) =Sum(2 0 ar) =Sum(2 177.95 86.6	572.15 612.58 211) <sub>15,1012</sub> 0 215) <sub>15,1012</sub> 189.06	792.22 848.2 = 0 = 202.71 88.14	0 kWh/ye 4404	(208) ar (211) (215)
779.24 630.78  (211)m = {[(98)m x (20) 834.3 675.36]}  Space heating fuel (s = {[(98)m x (201)] } x 1 (215)m = 0 0  Water heating  Output from water heating  Efficiency of water heating  (217)m = 88.07 87.91  Fuel for water heating	ement (c 543.95 04)] } x 1 582.39 secondary 00 ÷ (20 0 0 atter (calcidate) 191.35 atter 87.53 , kWh/mc	319.7 00 ÷ (20 342.29 y), kWh/ 8) 0 ulated at 169.72 86.62	d above) 142.67 166) 152.75  month 0  0 0000000000000000000000000000000	Jun 0 0 0 144.72	0 0 0	0 Tota  154.57  80.3	0  I (kWh/yea  0  I (kWh/yea	332.62 356.12 ar) =Sum(2 0 177.95 86.6	572.15 612.58 211) <sub>15,1012</sub> 0 215) <sub>15,1012</sub>	792.22 848.2 = 0 =	0 kWh/ye 4404	(208) ar (211) (215)

Annual totals		kWh/yea	r	kWh/yea	r
Space heating fuel used, main system 1		_		4404	
Water heating fuel used				2443.73	
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45	]	(230e)
Total electricity for the above, kWh/year	sum of (230a)	)(230g) =		75	(231)
Electricity for lighting				390.54	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	<b>Energy</b> kWh/year	Emission factors kg CO2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)			etor =		
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh		kg CO2/ye	ar
	kWh/year	kg CO2/kWh	=	kg CO2/ye	ar (261)
Space heating (secondary)	kWh/year (211) x (215) x	0.216 0.519	=	kg CO2/ye 951.26	ar (261) (263)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	0.216 0.519	=	kg CO2/ye  951.26  0  527.85	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	0.216 0.519 0.216	= =	kg CO2/ye  951.26  0  527.85  1479.11	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	0.216 0.519 0.216	= = =	kg CO2/ye  951.26  0  527.85  1479.11  38.93	(261) (263) (264) (265) (267)
Space heating (secondary)  Water heating  Space and water heating  Electricity for pumps, fans and electric keep-hot  Electricity for lighting	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	0.216 0.519 0.519 0.519 0.519	= = =	kg CO2/ye  951.26  0  527.85  1479.11  38.93  202.69	(261) (263) (264) (265) (267) (268)

TER =

(273)

19.44

		User Details:				
Assessor Name:	John Simpson	Stroma Nui	mber:	STRO	006273	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.4.7	
		Property Address: 202				
Address :	2.02, 25 Old Gloucester St,	LONDON, WC1N 3AF				
1. Overall dwelling dime	ensions:					
Ground floor		Area(m²)	Av. Height(m	<u> </u>	Volume(m³)	_
		42.29 (1a) x	2.4	(2a) =	101.5	(3a)
First floor		34.9 (1b) x	2.86	(2b) =	99.81	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) 77.19 (4)				
Dwelling volume		(3a)+(3	3b)+(3c)+(3d)+(3e)+	(3n) =	201.31	(5)
2. Ventilation rate:			1-1-1		2	
	main seconda heating heating	ry other	total	_	m³ per hou	r 
Number of chimneys	0 + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fa	ns		3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
					_	_
				Air ch	anges per ho	ur —
•	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)$		30	÷ (5) =	0.15	(8)
Number of storeys in the	een carried out or is intended, proced ne dwelling (ns)	ea to (17), otherwise continue	: Irom (9) to (16)	Г	0	(9)
Additional infiltration	io arrowing (rio)		[(	[9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 for masonry cons		`	0	(11)
	resent, use the value corresponding t	•		L		<b>_</b> '` '
	loor, enter 0.2 (unsealed) or 0	0.1 (sealed), else enter	0	Γ	0	(12)
If no draught lobby, en	ter 0.05, else enter 0			Ī	0	(13)
Percentage of windows	s and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14) -	÷ 100] =	Ī	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	Ī	0	(16)
Air permeability value,	q50, expressed in cubic metro	es per hour per square	metre of envelor	oe area	5	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] +$	(8), otherwise $(18) = (16)$		Ī	0.4	(18)
Air permeability value applie	s if a pressurisation test has been do	ne or a degree air permeabili	ty is being used	_		
Number of sides sheltere	ed	(00) 4 50 075	(40)]		2	(19)
Shelter factor		(20) = 1 - [0.075 x]		Ī	0.85	(20)
Infiltration rate incorporat		$(21) = (18) \times (20)$	=	L	0.34	(21)
Infiltration rate modified f	or monthly wind speed	<del>, , , , , , , , , , , , , , , , , , , </del>				
Jan Feb	Mar Apr May Jun	Jul Aug Ser	Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				-	
0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4		
Calculate effe		•	rate for t	he appli	cable ca	se	•				•		(23a)
If exhaust air h			endix N. (2	3b) = (23a	ı) × Fmv (e	eguation (N	N5)) . othe	rwise (23b	o) = (23a)			0	(23a)
If balanced with		0		, ,	, ,	. `	,, .	,	, (,			0	(23c)
a) If balance		-	-	_					2b)m + (	23b) <b>x</b> ['	1 – (23c)		(200)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If balance	ed mecha	anical ve	ntilation	without	heat red	covery (N	л ЛV) (24b	m = (22)	2b)m + (	23b)	ı	ı	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h	ouse ex	tract ven	tilation o	or positiv	e input	ventilatio	n from o	outside	•	•	•	•	
if (22b)r	n < 0.5 ×	(23b), t	hen (24d	c) = (23b)	); other	wise (24	c) = (22l	o) m + 0.	.5 × (23b	)	1	1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	ventilation $1$ , the				•				0.51				
(24d)m = 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.5 + [(2	0.56	0.57	0.57	0.58	1	(24d)
Effective air								ļ	0.01	0.0.	0.00	l	,
(25)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	]	(25)
3. Heat losse	s and ne	eat loss p	paramete	er:									
	Groo		Oponin	ac	Not Ar	.00	Haval		A V I I		k voluc		ΛΥΙ
ELEMENT	Gros area	_	Openin m	_	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-l		A X k kJ/K
<b>ELEMENT</b> Doors		_	•	_									
_	area	_	•	_	A ,r	m² x	W/m2	2K = [	(W/				kJ/K
Doors	area	_	•	_	A ,r	m² x x10	W/m2	2K = [ 0.04] = [	(W/ 2.1				kJ/K (26)
Doors Windows Type	area e 1 e 2	_	•	_	A ,r	m <sup>2</sup> x x10 x10	W/m2 1 /[1/( 1.4 )+		2.1 2.02				kJ/K (26) (27)
Doors Windows Type Windows Type	area	_	•	_	A ,r 2.1 1.52 2.56	x1. x1. x1.	W/m2 1 /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{ccc} 2K & & & \\ & & 0.04 & & \\ \hline 0.04 & & & \\ 0.04 & & & \\ 0.04 & & & \\ \end{array} $	(W/ 2.1 2.02 3.39				kJ/K (26) (27) (27)
Doors Windows Type Windows Type Windows Type	area = 1 = 2 = 3 = 4	_	•	_	A ,r 2.1 1.52 2.56 1.68	x1. x1. x1. x1.	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{array}{c} 2K \\ \hline \\ 0.04] = \begin{bmatrix} \\ 0.04] = \\ \\ 0.04] = \begin{bmatrix} \\ 0.04] = \\ \end{bmatrix}$	(W/ 2.1 2.02 3.39 2.23				kJ/K (26) (27) (27) (27)
Doors Windows Type Windows Type Windows Type Windows Type	area = 1 = 2 = 3 = 4	_	•	_	A ,r 2.1 1.52 2.56 1.68	x1. x1. x1. x1.	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{array}{c} 2K \\ \hline \\ 0.04] = \begin{bmatrix} \\ 0.04] = \\ \\ 0.04] = \begin{bmatrix} \\ 0.04] = \\ \end{bmatrix}$	(W/ 2.1 2.02 3.39 2.23 1.47				kJ/K (26) (27) (27) (27) (27)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type	area = 1 = 2 = 3 = 4	(m²)	•		A ,r 2.1 1.52 2.56 1.68 1.11 6.96	x1.	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$ \begin{array}{ccc}  & & & & \\  & & & & \\  & & & & \\  & & & &$	(W/ 2.1 2.02 3.39 2.23 1.47 9.23				kJ/K (26) (27) (27) (27) (27) (27)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor	area	(m²)	· m		A ,r 2.1 1.52 2.56 1.68 1.11 6.96 2.4	x1.	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13	EK = [ 0.04] = [ 0.04] = [ 0.04] = [ 0.04] = [ 0.04] = [ 0.04] = [ 0.04] = [	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312				(26) (27) (27) (27) (27) (27) (28)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1	area  1 2 3 4 4 5 5	(m²)	17.19		A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41	x1.	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18	EK = [ 0.04] = [	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312				kJ/K (26) (27) (27) (27) (27) (27) (28)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2	area  e 1  e 2  e 3  e 4  e 5  87.6	(m²)	17.11 2.1		A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41	x1.	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18	EK = [ 0.04] = [	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65				kJ/K (26) (27) (27) (27) (27) (27) (28) (29)
Doors Windows Type Walls Type1 Walls Type2 Roof Type1	area   6 3 3	17.19 2.1		A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41  14.7  9.9	m <sup>2</sup>	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18	EK = [ 0.04] = [	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65 1.29				kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29)	
Doors Windows Type Walls Type1 Walls Type2 Roof Type1 Roof Type2	area   6 3 3	17.19 2.1		A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41  14.7  9.9  35.3	m <sup>2</sup>	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18	EK = [ 0.04] = [	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65 1.29				(26) (27) (27) (27) (27) (27) (28) (29) (30) (30)	
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall * for windows and	area   (m²) 3 3 , m²	17.11 2.1 0 0	andow U-va	A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41  14.7  9.9  35.3  152  42.9  alue calcul	m <sup>2</sup>	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18  0.13	EK	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65 1.29 4.59	k)	kJ/m²-l		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30) (31)	
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e	area   (m²)  3  3  , m²  ows, use e sides of in	17.19 2.1 0 0 ffective witernal wall	andow U-va	A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41  14.7  9.9  35.3  152  42.9  alue calcul	X   X   X   X   X   X   X   X   X   X	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18  0.13	EK  = [ 0.04] =	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65 1.29 4.59	k)	kJ/m²-l		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30) (31)	
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall * for windows and ** include the area	area area area area area area area area	(m²)  3  3  , m²  ows, use e sides of interest of the sides of the sid	17.19 2.1 0 0 ffective witernal wall	andow U-va	A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41  14.7  9.9  35.3  152  42.9  alue calcul	X   X   X   X   X   X   X   X   X   X	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+  0.13  0.18  0.13  0.13	$\begin{array}{cccc} 2K & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & &$	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65 1.29 4.59	k)	kJ/m²-l	K	kJ/K (26) (27) (27) (27) (27) (28) (29) (30) (30) (31) (32)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall * for windows and ** include the area Fabric heat los	area   (m²)  3  3  , m²  sides of in  = S (A x A x k)	17.19 2.1 0 0 ffective witernal walk	e ndow U-va	A ,r  2.1  1.52  2.56  1.68  1.11  6.96  2.4  70.41  14.7  9.9  35.3  152  42.9  alue calculatitions	x1. x1. x1. x1. x1. x x x x x x x x x x	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+  0.13  0.18  0.13  0.13	$ \begin{array}{cccc} 2K & & & & & & \\  & & & & & & \\  & & & & &$	(W/ 2.1 2.02 3.39 2.23 1.47 9.23 0.312 12.67 2.65 1.29 4.59	K)	kJ/m²-l	13.2	kJ/K (26) (27) (27) (27) (27) (28) (29) (30) (30) (31) (32)	

an be used ii						/							(00)
	ridges : S (L				-	^						13.72	(36)
	ermal bridging c heat loss	are not kn	own (36) =	= 0.15 x (3	1)			(22)	(36) =				
		alaulataa	المدمدال						, ,	25\m v (5)		60.12	(37
	heat loss o	1	<del></del>		1	1	Λ		= 0.33 × (			]	
Ja	_	Mar	Apr	May	Jun	Jul 36.66	Aug	Sep	Oct	Nov	Dec		(38
39.4		38.95	37.84	37.63	36.66	30.00	36.49	37.04	37.63	38.05	38.49		(50
	fer coefficie	·			T	1			= (37) + (3			1	
89)m= 99.8	54 99.3	99.07	97.96	97.75	96.78	96.78	96.6	97.15	97.75	98.17	98.61	27.00	
leat loss p	parameter (	HLP), W	/m²K						Average = = (39)m ÷		12 /12=	97.96	(39
l0)m= 1.2	29 1.29	1.28	1.27	1.27	1.25	1.25	1.25	1.26	1.27	1.27	1.28		
lumber of	days in mo	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.27	(40
Ja	<del>- i</del>	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
11)m= 3°	1 28	31	30	31	30	31	31	30	31	30	31		(41
	-	-	-	-	-	-	-		-	-	-		
4. Water h	neating ene	rgy requi	irement:								kWh/ye	ear:	
	occupancy,						)	/-	10		41		(4:
if TFA > if TFA £ if TFA £ innual ave	13.9, N = 1 13.9, N = 1 erage hot w	+ 1.76 x ater usaç	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		9)	.38	]	•
if TFA > if TFA £ annual ave deduce the ar	13.9, N = 1 13.9, N = 1	+ 1.76 x ater usag hot water	ge in litre usage by	es per da 5% if the a	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		9)			•
if TFA > if TFA £ : Innual ave deduce the are of more that	13.9, N = 1 13.9, N = 1 erage hot w nnual average 125 litres per	+ 1.76 x ater usag hot water person per	ge in litre usage by day (all w Apr	es per da 5% if the d vater use, I	ay Vd,av Iwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36		9)		]   	·
if TFA > if TFA £ : Innual ave deduce the are of more that	13.9, N = 1 13.9, N = 1 erage hot w nnual average 125 litres per	+ 1.76 x ater usag hot water person per	ge in litre usage by day (all w Apr	es per da 5% if the d vater use, I	ay Vd,av Iwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 91	.38		·
if TFA > if TFA £ annual ave deduce the ar ot more that  Ja dot water usa	13.9, N = 1 13.9, N = 1 erage hot w innual average 125 litres per an Feb	+ 1.76 x ater usag hot water person per	ge in litre usage by day (all w Apr	es per da 5% if the d vater use, I	ay Vd,av Iwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 91	.38		(43
if TFA > if TFA £ Innual average the area of more that  Jacob water usa  14)m= 100.	13.9, N = 1 13.9, N = 1 erage hot w innual average 125 litres per an Feb	+ 1.76 x ater usage hot water person per Mar r day for ea	ge in litre usage by r day (all w Apr ach month	es per da 5% if the d vater use, I May Vd,m = fa 85.89	ay Vd,av Iwelling is not and co Jun ctor from 1	erage = designed and designed a	(25 x N) to achieve Aug (43) 85.89	+ 36 a water us Sep	Oct  93.2  Total = Su	9) 91 Nov 96.86 m(44) <sub>112</sub> =	.38  Dec  100.51	1096.5	(43
if TFA > if TFA £ Innual average the area of more that  Jacob water usa  14)m= 100.	13.9, N = 1 13.9, N = 1 13.9, N = 1 erage hot w nnual average 125 litres per an Feb age in litres per 1.51 96.86	+ 1.76 x ater usage hot water person per Mar r day for ea	ge in litre usage by r day (all w Apr ach month	es per da 5% if the d vater use, I May Vd,m = fa 85.89	ay Vd,av Iwelling is not and co Jun ctor from 1	erage = designed (d)  Jul Table 1c x  82.24	(25 x N) to achieve Aug (43) 85.89	+ 36 a water us Sep	Oct  93.2  Total = Su	9) 91 Nov 96.86 m(44) <sub>112</sub> =	.38  Dec  100.51	1096.5	(43
if TFA > if TFA £ innual average and in the second in the	13.9, N = 1 13.9, N = 1 13.9, N = 1 erage hot w nnual average 125 litres per en Feb age in litres per 1.51 96.86 nt of hot water 1.06 130.37	+ 1.76 x ater usage hot water person per Mar r day for ear 93.2 r used - cal	ge in litre usage by day (all w Apr ach month 89.55  culated me	es per da $5\%$ if the orater use, I  May $Vd,m = fa$ $85.89$ $onthly = 4$ .	ay Vd,av lwelling is not and co Jun ctor from 7 82.24 190 x Vd,r	erage = designed and designed a	(25 x N) to achieve Aug (43) 85.89 07m / 3600 103.26	+ 36 a water us  Sep  89.55  0 kWh/more 104.49	Oct  93.2  Total = Su  th (see Ta	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93	.38  Dec  100.51  c, 1d)  144.35	1096.5	(43
if TFA > if TFA £ innual average and in the second in the	13.9, N = 1 13.9, N = 1 13.9, N = 1 erage hot w nnual average 125 litres per an Feb age in litres per 1.51 96.86	+ 1.76 x ater usage hot water person per Mar r day for ear 93.2 r used - cal	ge in litre usage by day (all w Apr ach month 89.55  culated me	es per da $5\%$ if the orater use, I  May $Vd,m = fa$ $85.89$ $onthly = 4$ .	ay Vd,av lwelling is not and co Jun ctor from 7 82.24 190 x Vd,r	erage = designed and designed a	(25 x N) to achieve Aug (43) 85.89 07m / 3600 103.26	+ 36 a water us  Sep  89.55  0 kWh/more 104.49	Oct  93.2  Total = Su  121.78	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93	.38  Dec  100.51  c, 1d)  144.35		(43
if TFA > if TFA £ innual average and in the second in the	13.9, N = 1 13.9,	+ 1.76 x ater usage hot water person per Mar r day for ear 93.2 r used - cal	ge in litre usage by day (all w Apr ach month 89.55  culated me	es per da $5\%$ if the orater use, I  May $Vd,m = fa$ $85.89$ $onthly = 4$ .	ay Vd,av lwelling is not and co Jun ctor from 7 82.24 190 x Vd,r	erage = designed and designed a	(25 x N) to achieve Aug (43) 85.89 07m / 3600 103.26	+ 36 a water us  Sep  89.55  0 kWh/more 104.49	Oct  93.2  Total = Su  121.78	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93	.38  Dec  100.51  c, 1d)  144.35		(43
if TFA > if TFA £ innual average avera	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ea 93.2	ge in litre usage by r day (all w  Apr ach month  89.55  culated mo  117.28  f of use (no	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 1 82.24 190 x Vd,r 97.11 r storage),	erage = designed (d)  Jul Table 1c x  82.24  m x nm x E  89.99  enter 0 in  13.5	(25 x N) to achieve  Aug (43)  85.89  07m / 3600  103.26  boxes (46)  15.49	+ 36 a water us  Sep  89.55  0 kWh/more  104.49  1 to (61)  15.67	Oct  93.2  Total = Su  121.78  Total = Su  18.27	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93 m(45) <sub>112</sub> =	.38  Dec  100.51		(45)
if TFA > if TFA £ innual average and in the autor of more that the autor water usa the autor water storage volume in the autor water wat	13.9, N = 1 13.9,	+ 1.76 x ater usage hot water person per Mar r day for ear 93.2  134.53  ing at point 20.18	ge in litre usage by day (all w Apr ach month 89.55  culated me 117.28  for use (no	es per da 5% if the of rater use, I  May  Vd,m = fact  85.89  onthly = 4.  112.54  o hot water  16.88  olar or W	ay Vd,av welling is not and co Jun ctor from 7 82.24 190 x Vd,r 97.11 storage),	erage = designed and designed a	(25 x N) to achieve  Aug (43)  85.89  07m / 3600  103.26  boxes (46)  15.49  within sa	+ 36 a water us  Sep  89.55  0 kWh/more  104.49  1 to (61)  15.67	Oct  93.2  Total = Su  121.78  Total = Su  18.27	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93 m(45) <sub>112</sub> =	.38  Dec  100.51  c, 1d)  144.35		(45)
if TFA > if TFA £ innual average the area of more that area of the	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ea 93.2	ge in litre usage by r day (all w  Apr ach month  89.55  culated mo 117.28  r of use (no 17.59  and any so ank in dw	es per da 5% if the of rater use, I  May  Vd,m = fat  85.89  onthly = 4.  112.54  o hot water  16.88  olar or W  velling, e	ay Vd,av Iwelling is not and co Jun ctor from 1 82.24 190 x Vd,r 97.11 r storage), 14.57 IWHRS	erage = designed (d)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage ) litres in	(25 x N) to achieve  Aug (43) 85.89  07m / 3600 103.26  boxes (46) 15.49  within sa (47)	+ 36 a water us  Sep  89.55 b kWh/mor  104.49 c) to (61) 15.67 ame vess	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9)  Nov  96.86  m(44)112 = ables 1b, 1  132.93  m(45)112 =	.38  Dec  100.51		(44)
if TFA > if TFA £ innual average the area of more that area of the	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ea 93.2	ge in litre usage by r day (all w  Apr ach month  89.55  culated mo 117.28  r of use (no 17.59  and any so ank in dw	es per da 5% if the of rater use, I  May  Vd,m = fat  85.89  onthly = 4.  112.54  o hot water  16.88  olar or W  velling, e	ay Vd,av Iwelling is not and co Jun ctor from 1 82.24 190 x Vd,r 97.11 r storage), 14.57 IWHRS	erage = designed (d)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage ) litres in	(25 x N) to achieve  Aug (43) 85.89  07m / 3600 103.26  boxes (46) 15.49  within sa (47)	+ 36 a water us  Sep  89.55 b kWh/mor  104.49 c) to (61) 15.67 ame vess	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9)  Nov  96.86  m(44)112 = ables 1b, 1  132.93  m(45)112 =	.38  Dec  100.51		(43
if TFA > if TFA £ innual average and in the area of more that and the area of the ar	13.9, N = 1 13.9,	+ 1.76 x ater usage hot water person per Mar r day for ear 93.2  134.53  134.53  ing at point 20.18  ) includinand no tall hot water water series and no tall hot	ge in litre usage by day (all w Apr ach month 89.55  culated me 117.28  for use (no 17.59  and any so ank in dw er (this in	es per da 5% if the of water use, I  May Vd,m = fact 85.89  onthly = 4.  112.54  o hot water 16.88  olar or W welling, e	ay Vd,av welling is not and co  Jun ctor from 82.24  190 x Vd,r 97.11  storage), 14.57  /WHRS nter 110 nstantar	erage = designed (d)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage 0 litres in neous co	(25 x N) to achieve  Aug (43) 85.89  07m / 3600 103.26  boxes (46) 15.49  within sa (47)	+ 36 a water us  Sep  89.55 b kWh/mor  104.49 c) to (61) 15.67 ame vess	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9)  Nov  96.86  m(44) <sub>112</sub> = ables 1b, 1  132.93  m(45) <sub>112</sub> = 19.94	.38  Dec  100.51		(43)
if TFA > if TFA £ innual average the area of more that area of more that area of water usa and the area of the are	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ear 93.2 134.53 ing at point 20.18 including and no talk hot water eclared I	ge in litre usage by day (all w Apr ach month 89.55  culated mo 117.28  for use (no 17.59  and in dw er (this in	es per da 5% if the of water use, I  May Vd,m = fact 85.89  onthly = 4.  112.54  o hot water 16.88  olar or W welling, e	ay Vd,av welling is not and co  Jun ctor from 82.24  190 x Vd,r 97.11  storage), 14.57  /WHRS nter 110 nstantar	erage = designed (d)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage 0 litres in neous co	(25 x N) to achieve  Aug (43) 85.89  07m / 3600 103.26  boxes (46) 15.49  within sa (47)	+ 36 a water us  Sep  89.55 b kWh/mor  104.49 c) to (61) 15.67 ame vess	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93 m(45) <sub>112</sub> = 19.94	.38  Dec  100.51  c, 1d)  144.35  21.65		(45) (46) (46) (47)
if TFA > if TFA £ innual average the area of more that of more that area of the area of th	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ear 93.2 134.53 134.53 ing at point 20.18 ) includir and no tale hot water eclared I om Table r storage	ge in litre usage by day (all w Apr ach month 89.55  culated mo 117.28  for use (no 17.59  and in dw er (this in oss facto 2b e, kWh/ye	es per da 5% if the of water use, I  May Vd,m = far  85.89  onthly = 4.  112.54  o hot water  16.88  olar or W welling, e ocludes i  or is knowear	ay Vd,av fwelling is foot and co Jun ctor from 1 82.24 190 x Vd,r 97.11 r storage), 14.57 /WHRS nter 110 nstantar	erage = designed (d)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage 0 litres in neous con/day):	(25 x N) to achieve  Aug (43) 85.89  07m / 3600 103.26  boxes (46) 15.49  within sa (47)	+ 36 a water us  Sep  89.55 b kWh/more 104.49 c) to (61) 15.67 ame vess ers) ente	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93 m(45) <sub>112</sub> = 19.94	.38  Dec  100.51  c, 1d)  144.35  21.65		(45) (45) (46) (47) (48) (49)
if TFA > if TFA £ innual average the area of more that of more that area of more that area of more that area of more that area of the area	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ear 134.53  ing at point 20.18  ) includir and no tall hot water eclared I om Table or storage eclared of a factor fr	ge in litre usage by day (all w Apr ach month 89.55  culated mo 117.28  for use (no 17.59  and in dw er (this in oss facto 2b cylinder l com Table	es per da 5% if the of water use, I  May Vd,m = far 85.89  onthly = 4.  112.54  o hot water 16.88  olar or W welling, e ncludes i  or is kno	ay Vd,av welling is not and co  Jun ctor from 82.24  190 x Vd,r 97.11  storage), 14.57  /WHRS nter 110 nstantar wn (kWh	erage = designed id)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage 0 litres in neous con/day):  known:	(25 x N) to achieve  Aug (43)  85.89  7m / 3600  103.26  boxes (46)  15.49  within sa (47) pmbi boil	+ 36 a water us  Sep  89.55 b kWh/more 104.49 c) to (61) 15.67 ame vess ers) ente	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9)  Nov  96.86  m(44) <sub>112</sub> = ables 1b, 1  132.93  m(45) <sub>112</sub> = 19.94	.38  Dec  100.51  c, 1d)  144.35  21.65  0		(45) (44) (46) (47) (48) (49) (50)
if TFA > if TFA £ innual average the allot water usate the allot water usate the allot water usate the allot water usate the allot water storage voluments allot water storage voluments allot water storage in allot water storage the allot water storage to be allot water storage voluments allot water storag	13.9, N = 1 13.9,	ater usage hot water person per Mar r day for ear 93.2  134.53  134.53  134.53  ing at point 20.18  ) includir and no tale hot water eclared I om Table r storage eclared of a factor free ecections.	ge in litre usage by day (all w Apr ach month 89.55  culated mo 117.28  for use (no 17.59  and in dw er (this in oss facto 2b cylinder l com Table	es per da 5% if the of water use, I  May Vd,m = far 85.89  onthly = 4.  112.54  o hot water 16.88  olar or W welling, e ncludes i  or is kno	ay Vd,av welling is not and co  Jun ctor from 82.24  190 x Vd,r 97.11  storage), 14.57  /WHRS nter 110 nstantar wn (kWh	erage = designed id)  Jul Table 1c x  82.24  89.99  enter 0 in  13.5  storage 0 litres in neous con/day):  known:	(25 x N) to achieve  Aug (43)  85.89  7m / 3600  103.26  boxes (46)  15.49  within sa (47) pmbi boil	+ 36 a water us  Sep  89.55 b kWh/more 104.49 c) to (61) 15.67 ame vess ers) ente	Oct  93.2  Total = Su  121.78  Total = Su  18.27  sel	9) 91 Nov 96.86 m(44) <sub>112</sub> = ables 1b, 1 132.93 m(45) <sub>112</sub> =	.38  Dec  100.51  c, 1d)  144.35  21.65  0		(42 (43 (44 (46 (47 (48 (49 (50 (51

Energy lost fro		•	, kWh/ye	ear			(47) x (51)	) x (52) x (5	53) =		0		(54)
Enter (50) or	` , `	•					((50) (	(44)			0		(55)
Water storage		culated f		month		i	((56)m = (	55) × (41)r	n -	i	ı	I	
(56)m= 0	0 dadisata	0	0	0 (56)m	0	0	0	7\m (56)	0	0	0	:	(56)
If cylinder contains		1					1	1				IX IT	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	•	,									0		(58)
Primary circuit				•	•	` '	, ,						
(modified by	i						<del></del>	<del></del>		<del></del>		1	(50)
(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	44.58	47.5	44.16	43.77	40.56	41.91	43.77	44.16	47.5	47.77	50.96		(61)
Total heat requ	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × (	45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 200.02	174.95	182.02	161.44	156.31	137.67	131.89	147.03	148.66	169.27	180.7	195.31		(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add additiona	I lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter									_		
(64)m= 200.02	174.95	182.02	161.44	156.31	137.67	131.89	147.03	148.66	169.27	180.7	195.31		_
							Outp	out from wa	ater heate	r (annual) <sub>1</sub>	12	1985.27	(64)
Heat gains fro	m water	heating.	k\/\/h/m/	onth 0.24	5 ′ [0 85	~ (45)m	. (61)m	1100	(//E)m	. (57)m	. (EO)m	1	
			12 4 4 1 1/11 11	511ti1 0.2t	5 [0.00	^ ( <del>+</del> 3)iii	+ (01)11	ıj + 0.6 x	(46)111	+ (57)111	+ (59)11	1	
(65)m= 62.3	54.49	56.6	50.04	48.36	42.43	40.4	45.28	45.78	52.37	+ (57)111 56.14	60.74	]	(65)
	54.49	56.6	50.04	48.36	42.43	40.4	45.28	45.78	52.37	56.14	60.74		(65)
(65)m= 62.3	54.49 m in cald	56.6 culation o	50.04 of (65)m	48.36 only if c	42.43	40.4	45.28	45.78	52.37	56.14	60.74		(65)
(65)m= 62.3 include (57)	54.49 m in calc ains (see	56.6 culation of Table 5	50.04 of (65)m and 5a	48.36 only if c	42.43	40.4	45.28	45.78	52.37	56.14	60.74		(65)
(65)m= 62.3 include (57) 5. Internal ga	54.49 m in calc ains (see	56.6 culation of Table 5	50.04 of (65)m and 5a	48.36 only if c	42.43	40.4	45.28	45.78	52.37	56.14	60.74		(65)
include (57)  5. Internal game	54.49 m in calc ains (see as (Table	56.6 culation of Table 5 (5), Wat	50.04 of (65)m and 5a	48.36 only if c	42.43 ylinder i	40.4	45.28 dwelling	45.78 or hot w	52.37 ater is fr	56.14 om com	60.74 munity h		(65)
include (57)  5. Internal games  Metabolic gain  Jan	54.49 m in calc ains (see as (Table Feb 120.37	56.6  Culation (control of the state of the	50.04 of (65)m of and 5a ts Apr 120.37	48.36 only if c : : : : : : : : : : : : : : : : : : :	42.43 ylinder is Jun 120.37	40.4 s in the c	45.28 dwelling Aug 120.37	45.78 or hot w Sep 120.37	52.37 ater is fr	56.14 om com	60.74 munity h		
include (57) 5. Internal ga  Metabolic gain  Jan  (66)m= 120.37	54.49 m in calc ains (see as (Table Feb 120.37	56.6  Culation (control of the state of the	50.04 of (65)m of and 5a ts Apr 120.37	48.36 only if c : : : : : : : : : : : : : : : : : : :	42.43 ylinder is Jun 120.37	40.4 s in the c	45.28 dwelling Aug 120.37	45.78 or hot w Sep 120.37	52.37 ater is fr	56.14 om com	60.74 munity h		
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains	54.49 m in calc ains (see as (Table Feb 120.37 (calcular 16.9	56.6 culation of the Table 5 c	50.04 of (65)m of and 5a ts Apr 120.37 oppendix 10.41	48.36 only if c : May 120.37 L, equati 7.78	42.43 ylinder is  Jun 120.37 ion L9 of	40.4 s in the c  Jul 120.37 r L9a), a 7.1	45.28 dwelling Aug 120.37 lso see 9.22	45.78 or hot w Sep 120.37 Table 5	52.37 ater is fr Oct 120.37	56.14 om com Nov 120.37	60.74 munity h		(66)
include (57) 5. Internal games Metabolic gain Jan (66)m= 120.37 Lighting gains (67)m= 19.03	m in calcains (see Feb 120.37 (calcula 16.9 ins (calcula	56.6 culation of the Table 5 c	50.04 of (65)m of and 5a ts Apr 120.37 oppendix 10.41	48.36 only if c : May 120.37 L, equati 7.78	42.43 ylinder is  Jun 120.37 ion L9 of	40.4 s in the c  Jul 120.37 r L9a), a 7.1	45.28 dwelling Aug 120.37 lso see 9.22	45.78 or hot w Sep 120.37 Table 5	52.37 ater is fr Oct 120.37	56.14 om com Nov 120.37	60.74 munity h		(66)
include (57) 5. Internal games Metabolic gain Jan (66)m= 120.37 Lighting gains (67)m= 19.03 Appliances games (68)m= 213.47	m in calcons (See 15.68)  Table Feb 120.37 (calculation 16.9 calcons 215.68	56.6 culation of Table 5 (a) Wat Mar 120.37 ted in Ap 13.75 ulated in 210.1	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 Appendix 198.22	48.36 only if c :  May 120.37 L, equati 7.78 dix L, eq 183.22	Jun 120.37 ion L9 of 6.57 uation L	40.4 s in the c  Jul 120.37 r L9a), a 7.1 13 or L1: 159.7	45.28 dwelling Aug 120.37 lso see 9.22 3a), also 157.48	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07	52.37  ater is fr  Oct 120.37  15.72  ble 5 174.95	56.14 om com Nov 120.37	60.74 munity h		(66) (67)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games	m in calcons (See 15.68)  Table Feb 120.37 (calculation 16.9 calcons 215.68	56.6 culation of Table 5 (a) Wat Mar 120.37 ted in Ap 13.75 ulated in 210.1	50.04 of (65)m of and 5a tts Apr 120.37 opendix 10.41 Appendix 198.22	48.36 only if c :  May 120.37 L, equati 7.78 dix L, eq 183.22	Jun 120.37 ion L9 of 6.57 uation L	40.4 s in the c  Jul 120.37 r L9a), a 7.1 13 or L1: 159.7	45.28 dwelling Aug 120.37 lso see 9.22 3a), also 157.48	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07	52.37  ater is fr  Oct 120.37  15.72  ble 5 174.95	56.14 om com Nov 120.37	60.74 munity h		(66) (67)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04	m in calconnections (see 120.37) (calcular 16.9) ins (calconnections) (calcular 35.04)	56.6 culation of Table 5 culation of Table 5 culation of Table 5 culation of Table 5 culated in Aple 13.75 culated in Aple 10.1 culated in Aple 13.504	50.04 of (65)m 6 and 5a ts Apr 120.37 opendix 10.41 Append 198.22 opendix 35.04	48.36 only if c  May 120.37 L, equati 7.78 dix L, equati 183.22 L, equat	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a)	45.28 dwelling Aug 120.37 lso see 9.22 3a), also 157.48	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table	52.37 ater is fr  Oct 120.37  15.72 ole 5 174.95 5	56.14 om com Nov 120.37 18.35	Dec 120.37		(66) (67) (68)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and fail	m in calconnections (see 120.37) (calcular 16.9) ins (calconnections) (calcular 35.04)	56.6 culation of Table 5 culation of Table 5 culation of Table 5 culation of Table 5 culated in Aple 13.75 culated in Aple 10.1 culated in Aple 13.504	50.04 of (65)m 6 and 5a ts Apr 120.37 opendix 10.41 Append 198.22 opendix 35.04	48.36 only if c  May 120.37 L, equati 7.78 dix L, equati 183.22 L, equat	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a)	45.28 dwelling Aug 120.37 lso see 9.22 3a), also 157.48	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table	52.37 ater is fr  Oct 120.37  15.72 ole 5 174.95 5	56.14 om com Nov 120.37 18.35	Dec 120.37		(66) (67) (68)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and fames  (70)m= 3	m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ins (calc 215.68 (calcula 35.04 as gains 3	56.6 culation of a Table 5 state of the Table 5 sta	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 of Appendix 198.22 opendix 35.04 of Appendix 35.04	48.36 only if colors May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15 35.04	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	45.28 dwelling 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04	52.37  ater is fr  Oct 120.37  15.72  ble 5 174.95 5 35.04	56.14 om com Nov 120.37 18.35	Dec 120.37 19.56 204.05		(66) (67) (68) (69)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and far  (70)m= 3  Losses e.g. even	m in calcons (See Ins (Table Feb 120.37) (Calcula 16.9) ins (Calcula 35.04) ins gains 3	56.6 culation of Table 5 culation of Table 5 culation of Table 5 culation of Table 5 culated in Aproximated in	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 Appendix 198.22 opendix 35.04 of (65)m 3 tive value	48.36 only if c ):  May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04  3 es) (Tab	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15 35.04	40.4 s in the c  Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	45.28 dwelling 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04	52.37 ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04	56.14  om com  Nov  120.37  18.35  189.95  35.04	Dec 120.37 19.56 204.05		(66) (67) (68) (69) (70)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and fan  (70)m= 3  Losses e.g. even  (71)m= -96.3	m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ins (calcula 35.04 as gains 3 vaporatio -96.3	56.6 culation of the Table 5 culated in April 13.75 culated in April 13.75 culated in April 13.04 (Table 5 culation of the Table 5 culation of the Tab	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 of Appendix 198.22 opendix 35.04 of Appendix 35.04	48.36 only if colors May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15 35.04	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	45.28 dwelling 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04	52.37  ater is fr  Oct 120.37  15.72  ble 5 174.95 5 35.04	56.14 om com Nov 120.37 18.35	Dec 120.37 19.56 204.05		(66) (67) (68) (69)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and farm  (70)m= 3  Losses e.g. even  (71)m= -96.3  Water heating	m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ins (calcula 215.68 (calcula 35.04 as gains gains gains (T	56.6 culation of the Table 5 culated in April 13.75 culated in April 13.75 culated in April 13.04 (Table 5 culated in April 13.75 cula	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 of Appendix 198.22 opendix 35.04 of Appendix 35.04 of Appendix 35.04 of Appendix 35.04	48.36 only if c ):  May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04  3 es) (Tab -96.3	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	40.4 s in the o  Jul 120.37 r L9a), a 7.1 13 or L1 159.7 or L15a) 35.04	45.28 dwelling 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04  3  -96.3	52.37 ater is fr  Oct 120.37  15.72 ole 5 174.95 5 35.04	56.14 om com  Nov 120.37  18.35  189.95  35.04  3	Dec 120.37 19.56 204.05 35.04 3		(66) (67) (68) (69) (70)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and farm  (70)m= 3  Losses e.g. even  (71)m= -96.3  Water heating  (72)m= 83.74	m in calcons (See Ins (Table Feb 120.37) (calcula 16.9) ins (calcula 35.04) ins gains 3 vaporatio 96.3 gains (Table Feb 120.37)	56.6 culation of the Table 5 culated in April 120.37 ted in April 13.75 ulated in April 135.04 (Table 5 culated in April 13.75 ulated in April 135.04 (Table 5 culated in April 13.75 culated in April 13.7	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 Appendix 198.22 opendix 35.04 of (65)m 3 tive value	48.36 only if c ):  May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04  3 es) (Tab	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	40.4 s in the o  Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04  3  -96.3	45.28 dwelling  Aug 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04  3  -96.3	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04  3  -96.3	52.37 ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3	56.14  om com  Nov  120.37  18.35  189.95  35.04  3  -96.3	60.74 munity h  Dec 120.37  19.56  204.05  35.04  3  -96.3		(66) (67) (68) (69) (70)
include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and fames  (70)m= 3  Losses e.g. even  (71)m= -96.3  Water heating  (72)m= 83.74  Total internal	m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ins (calcula 35.04 as gains 3 vaporatio -96.3 gains (T 81.09  gains =	56.6 culation of Paragraph 120.37 ted in Apr 13.75 ulated in Apr 210.1 ted in Apr 35.04 (Table 5 3 on (negation -96.3 Table 5) 76.08	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 of Appendix 198.22 opendix 35.04 of Appendix 35.04 of Appendix 35.04 of Appendix 36a) 3 dive valu -96.3	48.36 only if c ):  May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04  3 es) (Tab -96.3	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	40.4 s in the of  Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04  3  -96.3  54.3 m + (67)m	45.28 dwelling  Aug 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04  3  -96.3	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04  3  -96.3  63.59 + (69)m + (	52.37 ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3  70.38  70.0m + (7	56.14  om com  Nov  120.37  18.35  189.95  35.04  3  -96.3  77.97  1)m + (72)	Dec 120.37 19.56 204.05 35.04 3 -96.3		(66) (67) (68) (69) (70) (71)
include (57)  include (57)  5. Internal games  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances games  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and farm  (70)m= 3  Losses e.g. even  (71)m= -96.3  Water heating  (72)m= 83.74	54.49 m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ins (calcula 35.04 as gains 3 vaporatio -96.3 gains (T 81.09  gains = 375.79	56.6 culation of the Table 5 culated in April 120.37 ted in April 13.75 ulated in April 135.04 (Table 5 culated in April 13.75 ulated in April 135.04 (Table 5 culated in April 13.75 culated in April 13.7	50.04 of (65)m of and 5a ts Apr 120.37 opendix 10.41 of Appendix 198.22 opendix 35.04 of Appendix 35.04 of Appendix 35.04 of Appendix 35.04	48.36 only if c ):  May 120.37 L, equati 7.78 dix L, equ 183.22 L, equat 35.04  3 es) (Tab -96.3	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	40.4 s in the o  Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04  3  -96.3	45.28 dwelling  Aug 120.37 lso see 9.22 3a), also 157.48 ), also se 35.04  3  -96.3	45.78 or hot w  Sep 120.37 Table 5 12.38 o see Tal 163.07 ee Table 35.04  3  -96.3	52.37 ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3	56.14  om com  Nov  120.37  18.35  189.95  35.04  3  -96.3	60.74 munity h  Dec 120.37  19.56  204.05  35.04  3  -96.3		(66) (67) (68) (69) (70)

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	11.28	x	0.63	x	0.7	=	17.38	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	22.97	x	0.63	x	0.7	<b>=</b>	35.38	(75)
Northeast 0.9x	0.77	X	1.68	x	41.38	x	0.63	x	0.7	<u> </u>	63.74	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	67.96	х	0.63	x	0.7	] =	104.67	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	91.35	х	0.63	x	0.7	] =	140.7	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	97.38	X	0.63	x	0.7	=	150	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	91.1	x	0.63	x	0.7	=	140.32	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	72.63	x	0.63	x	0.7	=	111.87	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	50.42	x	0.63	x	0.7	=	77.66	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	28.07	x	0.63	x	0.7	=	43.23	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	14.2	x	0.63	x	0.7	=	21.87	(75)
Northeast <sub>0.9x</sub>	0.77	X	1.68	x	9.21	x	0.63	x	0.7	=	14.19	(75)
East 0.9x	1	X	1.52	x	19.64	x	0.63	x	0.7	=	9.12	(76)
East 0.9x	1	X	1.11	x	19.64	x	0.63	x	0.7	=	6.66	(76)
East 0.9x	1	X	1.52	x	38.42	x	0.63	x	0.7	=	17.85	(76)
East 0.9x	1	X	1.11	x	38.42	x	0.63	x	0.7	=	13.03	(76)
East 0.9x	1	X	1.52	x	63.27	x	0.63	x	0.7	=	29.39	(76)
East 0.9x	1	X	1.11	x	63.27	x	0.63	x	0.7	=	21.46	(76)
East 0.9x	1	X	1.52	x	92.28	x	0.63	x	0.7	=	42.87	(76)
East 0.9x	1	X	1.11	x	92.28	x	0.63	x	0.7	=	31.3	(76)
East 0.9x	1	X	1.52	x	113.09	x	0.63	x	0.7	=	52.54	(76)
East 0.9x	1	X	1.11	x	113.09	x	0.63	x	0.7	=	38.36	(76)
East 0.9x	1	X	1.52	X	115.77	x	0.63	x	0.7	=	53.78	(76)
East 0.9x	1	X	1.11	X	115.77	x	0.63	x	0.7	=	39.27	(76)
East 0.9x	1	X	1.52	X	110.22	X	0.63	X	0.7	=	51.2	(76)
East 0.9x	1	X	1.11	x	110.22	X	0.63	x	0.7	=	37.39	(76)
East 0.9x	1	X	1.52	x	94.68	X	0.63	X	0.7	=	43.98	(76)
East 0.9x	1	X	1.11	X	94.68	X	0.63	X	0.7	=	32.12	(76)
East 0.9x	1	X	1.52	x	73.59	x	0.63	x	0.7	=	34.18	(76)
East 0.9x	1	X	1.11	X	73.59	X	0.63	X	0.7	=	24.96	(76)
East 0.9x	1	X	1.52	X	45.59	X	0.63	X	0.7	=	21.18	(76)
East 0.9x	1	X	1.11	x	45.59	x	0.63	x	0.7	=	15.47	(76)
East 0.9x	1	X	1.52	x	24.49	X	0.63	X	0.7	=	11.38	(76)
East 0.9x	1	X	1.11	x	24.49	x	0.63	x	0.7	=	8.31	(76)
East 0.9x	1	X	1.52	X	16.15	X	0.63	X	0.7	=	7.5	(76)
East 0.9x	1	X	1.11	x	16.15	x	0.63	x	0.7	=	5.48	(76)
West 0.9x	0.77	X	2.56	x	19.64	x	0.63	x	0.7	=	15.37	(80)
West 0.9x	0.77	X	6.96	x	19.64	x	0.63	x	0.7	=	41.78	(80)
West 0.9x	0.77	X	2.56	x	38.42	x	0.63	x	0.7	=	30.06	(80)

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West	0.9x	0.77	X	6.9	6	X	38.42		X	0.63	X	0.7	=	81.72	(80)
West	0.9x	0.77	X	2.5	66	X	63.27		X	0.63	X	0.7	=	49.5	(80)
West	0.9x	0.77	X	6.9	6	X	63.27		x	0.63	X	0.7	=	134.59	(80)
West	0.9x	0.77	X	2.5	6	X	92.28		x	0.63	X	0.7	=	72.2	(80)
West	0.9x	0.77	X	6.9	16	X	92.28		x	0.63	x	0.7	=	196.29	(80)
West	0.9x	0.77	X	2.5	6	X	113.09		x	0.63	x	0.7	=	88.48	(80)
West	0.9x	0.77	X	6.9	16	X	113.09		x	0.63	x	0.7	=	240.56	(80)
West	0.9x	0.77	X	2.5	6	X	115.77		x	0.63	x	0.7	=	90.58	(80)
West	0.9x	0.77	X	6.9	16	X	115.77		x	0.63	x	0.7	=	246.25	(80)
West	0.9x	0.77	X	2.5	66	X	110.22		x	0.63	x	0.7	=	86.23	(80)
West	0.9x	0.77	x	6.9	16	X	110.22		x	0.63	x	0.7		234.44	(80)
West	0.9x	0.77	x	2.5	6	X	94.68		x	0.63	x	0.7		74.07	(80)
West	0.9x	0.77	x	6.9	16	X	94.68		x	0.63	x	0.7	<del>-</del>	201.38	(80)
West	0.9x	0.77	x	2.5	6	X	73.59		x	0.63	x	0.7	<del>=</del>	57.57	(80)
West	0.9x	0.77	x	6.9	16	X	73.59		x	0.63	x	0.7	=	156.53	(80)
West	0.9x	0.77	x	2.5	6	X	45.59		х	0.63	x	0.7	=	35.67	(80)
West	0.9x	0.77	x	6.9	16	X	45.59	一	х	0.63	x	0.7	<del>-</del>	96.97	(80)
West	0.9x	0.77	x	2.5	6	X	24.49		x	0.63	x	0.7	=	19.16	(80)
West	0.9x	0.77	x	6.9	16	X	24.49		х	0.63	x	0.7	<del>=</del> =	52.09	(80)
West	0.9x	0.77	X	2.5	66	X	16.15	一	х	0.63	x	0.7		12.64	(80)
West	0.9x	0.77	x	6.9	16	X	16.15	司	x	0.63	×	0.7		34.35	(80)
	_														_
Solar o	ains in	watts, ca	lculated	for eacl	n montl	า		(8	83)m	= Sum(74)m .	(82)m				
(83)m=	90.31	178.04	298.68	447.33	560.63	$\neg$	79.88 549.		463.	<del></del>	212.5	1 112.8	74.17		(83)
Total g	ains – i	nternal ar	nd solar	(84)m =	(73)m	+ (	33)m , watt	ts		<b>!</b>				l	
(84)m=	468.66	553.82	660.72	787.56	878.74	8	76.6 832.	79	753.	.09 652.06	535.6	3 461.18	441.52		(84)
7. Me	an inter	nal tempe	erature	(heating	seaso	n)						,	•		
				`			area from <sup>-</sup>	Tabl	le 9.	Th1 (°C)				21	(85)
•		_	•			_	ee Table 9		,	( •)					(3.37
000	Jan	Feb	Mar	Apr	May	Ť	Jun Ju		Αι	ug Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.94	0.84	_	0.66 0.5	$\rightarrow$	0.5		0.98	1	1		(86)
Moon	intorno	l tompore	turo in	living or	na T1 (	مالہ:	w etone 2 t		in T	able 0e)	l	!		l	
(87)m=	19.58	19.76	20.07	20.47	20.79	_	w steps 3 t	$\overline{}$	20.9	<del></del>	20.41	19.92	19.55		(87)
							ļ.					10.02	10.00		()
•						_	elling from			<del>`                                    </del>	10.07	10.96	10.00	1	(99)
(88)m=	19.85	19.85	19.85	19.87	19.87		9.88 19.8	58	19.8	19.87	19.87	19.86	19.86		(88)
	ation fac	<del></del>				$\overline{}$	m (see Tal	$\overline{}$	9a)			_		1	
(89)m=	1	0.99	0.98	0.92	0.78		0.56 0.38	8	0.4	4 0.76	0.96	0.99	1		(89)
Mean	interna	l tempera	ture in	the rest	of dwel	ling	T2 (follow	step	os 3	to 7 in Tabl	e 9c)			-	
(90)m=	17.97	18.23	18.68	19.26	19.67	1	9.85 19.8	37	19.8	37 19.76	19.19	18.48	17.94		(90)
										1	LA = Liv	ving area ÷ (	4) =	0.44	(91)
							`	<b>-</b> ,		(I A) ==					

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

(92)m=	18.68	18.9	19.29	19.8	20.17	20.33	20.37	20.36	20.24	19.73	19.12	18.65		(92)
Apply	/ adjustn	nent to t	he mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate			l	
(93)m=	18.68	18.9	19.29	19.8	20.17	20.33	20.37	20.36	20.24	19.73	19.12	18.65		(93)
8. Sp	ace hea	ting requ	uirement											
	i to the r					ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the u	tilisation		<del></del>					_	I _	_			1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ation fac				0.0	0.0	0.40	0.5	0.70	0.00	0.00	4		(94)
(94)m=	1	0.99	0.98	0.92	0.8	0.6	0.43	0.5	0.79	0.96	0.99	1		(94)
(95)m=	ul gains, 466.78	548.96	000 = (92)	726.31	700.97	529.22	360.23	374.71	512.04	514.6	457.57	440.17		(95)
	hly avera					l	300.23	374.71	312.04	314.0	437.37	440.17		(50)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	loss rate							<u> </u>				1.2		()
	1431.75		1267.2	1067.4	827.7	554.96	364.51	382.7	596.43	892.21	1179.59	1425.02		(97)
` '	e heating					<u> </u>		<u> </u>						, ,
(98)m=	717.94	565.49	463.24	245.58	94.28	0	0	0	0	280.94	519.86	732.73		
,								LTota	l per vear	L (kWh/vear	r) = Sum(9	8) <sub>15912</sub> =	3620.06	(98)
Cnaa	o bootin	a roauir	amont in	Is\A/lb/m2	hioor					(**************************************	,(-	- /		``` ⊐روور
•	e heatin	• •			•								46.9	(99)
	nergy rec		nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	_	t from o		مامعييمار	mantarı	a vatam					1		7(204)
	ion of sp					mentary	-	(000) 4	(004)				0	(201)
	ion of sp			-	• ,			(202) = 1	, ,				1	(202)
Fract	ion of to	tal heatii	ng from i	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Effici	ency of r	main spa	ace heati	ing syste	em 1								93.4	(206)
Effici	ency of s	seconda	ry/supple	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	– ar
Spac	e heatin	g require	ement (c		d above)	)		<u> </u>					•	
	717.94	565.49	463.24	245.58	94.28	0	0	0	0	280.94	519.86	732.73		
(211)n	n = {[(98	)m x (20	4)] } x 1	00 ÷ (20	)6)				-		•		•	(211)
, ,	768.67	605.45	495.97	262.94	100.94	0	0	0	0	300.79	556.59	784.51		
								Tota	l (kWh/yea	ar) =Sum(2	211),5,1012	=	3875.87	(211)
Spac	e heatin	g fuel (s	econdar	y), kWh/	month							!		_
•	3)m x (20	`		, , .										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		0	(215)
Water	heating	l												_
Outpu	t from w	ater hea	ter (calc	ulated a	oove)									
	200.02	174.95	182.02	161.44	156.31	137.67	131.89	147.03	148.66	169.27	180.7	195.31		
Efficie	ncy of w	ater hea	ter										80.3	(216)
(217)m=	87.99	87.79	87.3	86.1	83.82	80.3	80.3	80.3	80.3	86.32	87.56	88.07		(217)
	or water	0.												
	n = (64)				400 17	474 44	404.05	400 1	405.40	400 1	000.07	004 77	1	
(219)m=	227.32	199.28	208.5	187.5	186.47	171.44	164.25	183.1	185.13 I = Sum(2 <sup>2</sup>	196.1	206.37	221.77		٦.
								ıota	ı = 5um(2'	1981 =			2337.23	(219)

Annual totals		kWh/yea	r	kWh/yea	
Space heating fuel used, main system 1		KVVII/yea	•	3875.87	<u>'</u>
Water heating fuel used				2337.23	Ħ
Electricity for pumps, fans and electric keep-hot					_
central heating pump:			30	]	(230c)
boiler with a fan-assisted flue			45	]	(230e)
Total electricity for the above, kWh/year	sum of (230a)	)(230g) =		75	(231)
Electricity for lighting				336.1	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	<b>Energy</b> kWh/year	Emission factoring kg CO2/kWh	ctor	Emissions kg CO2/ye	-
Space heating (main system 1)			etor =		-
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh		kg CO2/ye	ar
	kWh/year	kg CO2/kWh	=	kg CO2/ye	ar (261)
Space heating (secondary)	kWh/year (211) x (215) x	0.216 0.519	=	kg CO2/ye	(261) (263)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	0.216 0.519	=	kg CO2/ye  837.19  0  504.84	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	0.216 0.519 0.216	= =	kg CO2/ye  837.19  0  504.84  1342.03	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	0.216 0.519 0.216	= = =	kg CO2/ye  837.19  0  504.84  1342.03  38.93	(261) (263) (264) (265) (267)
Space heating (secondary)  Water heating  Space and water heating  Electricity for pumps, fans and electric keep-hot  Electricity for lighting	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	0.216 0.519 0.519 0.519 0.519	= = =	kg CO2/ye  837.19  0  504.84  1342.03  38.93  174.43	(261) (263) (264) (265) (267) (268)

TER =

20.15

(273)

		User Details:				
Assessor Name:	John Simpson	Stroma Nu	mber:	STRO	006273	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.4.7	
		Property Address: 203				
Address :	2.03, 25 Old Gloucester St,	LONDON, WC1N 3AF				
1. Overall dwelling dime	ensions:					
Ground floor		Area(m²)  39.4 (1a) x	Av. Height(m	1) (2a) = [	<b>Volume(m³</b> ) 94.56	) (3a)
				<b>⊣</b> ¦		Ⅎ
First floor		34.9 (1b) x	2.86	(2b) =	99.81	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) 74.3 (4)		_		_
Dwelling volume		(3a)+(	3b)+(3c)+(3d)+(3e)+	(3n) =	194.37	(5)
2. Ventilation rate:			40401			
	main seconda heating heating	ry other	total	_	m³ per hou	r 
Number of chimneys	0 + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fa	ns		3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
					_	_
				Air ch	anges per ho	ur —
	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)$		30	÷ (5) =	0.15	(8)
Number of storeys in t	een carried out or is intended, procee ne dwelling (ns)	ea to (17), otherwise continue	irom (9) to (16)	Г	0	(9)
Additional infiltration	io arrowing (rio)		[(	(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 for masonry cons		`	0	(11)
	resent, use the value corresponding t	•		L	<u> </u>	<b>_</b> '`
	loor, enter 0.2 (unsealed) or 0	0.1 (sealed), else enter	0		0	(12)
If no draught lobby, en	ter 0.05, else enter 0			Ī	0	(13)
Percentage of windows	s and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14)	÷ 100] =	Ī	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	Ī	0	(16)
Air permeability value,	q50, expressed in cubic metro	es per hour per square	metre of envelop	oe area	5	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] +$	(8), otherwise $(18) = (16)$		Ī	0.4	(18)
Air permeability value applie	s if a pressurisation test has been do	ne or a degree air permeabil	ity is being used			
Number of sides sheltere	ed	(00) 4 [0.075]	(40)]		2	(19)
Shelter factor		$(20) = 1 - [0.075 \times$		Ţ	0.85	(20)
Infiltration rate incorporat	_	$(21) = (18) \times (20)$	=		0.34	(21)
Infiltration rate modified f	or monthly wind speed	, , , , , , , , , , , , , , , , , , ,	<del>, , , , , , , , , , , , , , , , , , , </del>			
Jan Feb	Mar Apr May Jun	Jul Aug Se	Oct Nov	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

wind racioi	(22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	
Adjusted infil	Itration rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.44	- 1	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4	]	
Calculate eff If mechani		-	rate for t	he appli	cable ca	se		-	-	-	-	-	(220)
If exhaust air			endix N. (2	3b) = (23a	ı) × Fmv (e	eguation (N	N5)) . othe	rwise (23b	) = (23a)			0	(23a) (23b)
If balanced w									, (200)			0	(23c)
a) If baland		•	•	· ·		`		,	2h)m + (	23h) <b>x</b> [	1 – (23c)		(230)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If baland	ced mech	anical ve	ntilation	without	heat red	covery (N	л ИV) (24k	(22)	2b)m + (	23b)	<u> </u>	J	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole	house ex	tract ver	tilation o	or positiv	e input	ventilatio	on from (	outside		!			
if (22b	)m < 0.5 ×	(23b), t	hen (24	c) = (23b	); other	wise (24	c) = (22l	b) m + 0.	.5 × (23b	o)		_	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natura				•	•				0.51				
<u>, , , , , , , , , , , , , , , , , , , </u>	m = 1, the 0.59	en (24d) 0.59	m = (221)	0.57	0.55	(4d)m = 0	$\frac{0.5 + [(2)]{0.55}}{}$	(2b)m² x 0.56	<del></del>	0.57	0.58	1	(24d)
` /							<u> </u>		0.57	0.57	0.56	J	(240)
Effective a (25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	x (25) 0.56	0.57	0.57	0.58	1	(25)
( )		l .			0.00	0.00	0.00	1 0.00	0.07	1 0.07	1 0.00	J	(=0)
3. Heat loss	ses and he	at loce r											
		•											
ELEMENT		SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-		A X k kJ/K
<b>ELEMENT</b> Doors	Gros	SS	Openin	gs									
	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K =	(W/				kJ/K
Doors	Gros area	SS	Openin	gs	A ,r	m <sup>2</sup> x x 1/2	W/m2	2K =   - 0.04] =	(W/				kJ/K (26)
Doors Windows Typ	Gros area pe 1 pe 2	SS	Openin	gs	A ,r 2.1 0.63	m <sup>2</sup> x x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1	W/m2 1 /[1/( 1.4 )+	2K =   $-0.04$ ] =   $-0.04$ ] =	2.1 0.84				kJ/K (26) (27)
Doors Windows Typ Windows Typ	Gros area pe 1 pe 2 pe 3	SS	Openin	gs	A ,r 2.1 0.63 3.28	x10	W/m2 1 /[1/( 1.4 )+ /[1/( 1.4 )+	2K =   - 0.04] =   - 0.04] =   - 0.04] =	2.1 0.84 4.35	K)			kJ/K (26) (27) (27)
Doors Windows Typ Windows Typ Windows Typ	Gros area pe 1 pe 2 pe 3	SS	Openin	gs	A ,r 2.1 0.63 3.28 0.78	x10	W/m2 1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	2K =   - 0.04] =   - 0.04] =   - 0.04] =   - 0.04] =	2.1 0.84 4.35 1.03	K)			kJ/K (26) (27) (27) (27)
Doors Windows Typ Windows Typ Windows Typ Windows Typ	Gros area pe 1 pe 2 pe 3	ss (m²)	Openin	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93	m <sup>2</sup>	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	2K =   - 0.04] =   - 0.04] =   - 0.04] =   - 0.04] =	(W// 2.1 0.84 4.35 1.03	K)			kJ/K (26) (27) (27) (27) (27)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Floor	Gros area pe 1 pe 2 pe 3 pe 4	ss (m²)	Openin m	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93 2.4	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	2K =   -0.04  =   -0.0	(W// 2.1 0.84 4.35 1.03 11.84 0.312	K)			kJ/K (26) (27) (27) (27) (27) (27)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Floor Walls Type1	Gros area pe 1 pe 2 pe 3 pe 4	6 6	Openin m	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93 2.4 61.98	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13	2K =   -0.04  =   -0.0	(W// 2.1 0.84 4.35 1.03 11.84 0.312	K)			kJ/K (26) (27) (27) (27) (27) (28)
Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2	Gros area  pe 1 pe 2 pe 3 pe 4  75.0 22 6.8	6 6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	13.62 2.1	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93 2.4 61.98	x10	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18	2K =   -0.04  =   -0.0	(W// 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58	K)			kJ/K (26) (27) (27) (27) (27) (28) (29)
Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Type1	Gros area  pe 1 pe 2 pe 3 pe 4  75.  22 6.8 35.	6 3	13.62 2.1 0	gs <sup>2</sup>	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18	2K =   -0.04  =   -0.04  =   -0.04  =   =   =   =   =   =	(W// 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58 0.88	K)			kJ/K (26) (27) (27) (27) (28) (29) (30)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2	Gros area  pe 1 pe 2 pe 3 pe 4  75.  22 6.8 35.	6 3	13.62 2.1 0	gs <sup>2</sup>	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3	m <sup>2</sup>	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18	2K =   -0.04  =   -0.04  =   -0.04  =   =   =   =   =   =	(W// 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58 0.88	K)			kJ/K (26) (27) (27) (27) (28) (29) (29) (30) (31)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Type2 Roof Type2 Total area of Party wall * for windows are	Gros area  pe 1  pe 2  pe 3  pe 4  75.0  22  6.8  35.3	6 3 , m²	13.6: 2.1 0 offective wi	gs 2  ndow U-va	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.1  42.9  alue calcul	m <sup>2</sup>	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18  0.13	2K =   -0.04  =   -0.04  =   -0.04  =   =   =   =   =   =   =   =   =   =	(W/ 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58 0.88 4.59	K)	kJ/m²-	K	kJ/K (26) (27) (27) (27) (28) (29) (30)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of Party wall * for windows an ** include the an	Gros area  pe 1 pe 2 pe 3 pe 4  75.  22  6.8  35.  elements  and roof windereas on both	6 3 3 , m² cows, use e sides of in	13.62 2.1 0 0	gs 2  ndow U-va	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.1  42.9  alue calcul	x1/ x1/ x1/ x1/ x1/ x x1	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.18  0.13	2K =   -0.04  =   -0.0	(W/ 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58 0.88 4.59	K)	kJ/m²-	K	kJ/K (26) (27) (27) (27) (28) (29) (30) (31) (32)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Type2 Roof Type2 Total area of Party wall * for windows are	Gros area  pe 1 pe 2 pe 3 pe 4  75.0  22  6.8  35.3  celements  and roof windles on both oss, W/K	6 3 , m <sup>2</sup> ows, use e sides of in	13.62 2.1 0 0	gs 2  ndow U-va	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.1  42.9  alue calcul	x1/ x1/ x1/ x1/ x1/ x x1	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.13  0.13	2K =   -0.04  =   -0.0	(W/ 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58 0.88 4.59	K)	kJ/m²-l	K	kJ/K (26) (27) (27) (27) (28) (29) (30) (30) (31) (32)
Doors Windows Typ Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Type2 Roof Type2 Total area of Party wall * for windows an ** include the an Fabric heat le	Gros area  pe 1 pe 2 pe 3 pe 4  75.0  22  6.8  35 elements  and roof windle reas on both oss, W/K: y Cm = S(	6 3 , m <sup>2</sup> ows, use e sides of in = S (A x	13.62 2.1 0 0 offective winternal walk	gs 2 Indow U-vals and pan	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.1  42.9  alue calculations	x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2	W/m2  1 /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ 0.13  0.18  0.13  0.13	2K =   -0.04  =   -0.0	(W// 2.1 0.84 4.35 1.03 11.84 0.312 11.16 3.58 0.88 4.59	K)	kJ/m²-l	K	kJ/K (26) (27) (27) (27) (28) (29) (30) (30) (31) (32)

an be used i	instead of a c					/							(00)
hermal br	ridges : S (	L x Y) cal	culated	using Ap	pendix I	^						10.78	(36)
	nermal bridgin	g are not kn	own (36) =	= 0.15 x (3	1)			(22)	(20)				<b>—</b> ,,
	c heat loss								(36) =	> (->		51.46	(37
	heat loss	1	<u> </u>	_			Ι.		= 0.33 × (		<u> </u>	1	
	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00
38)m= 38.	.23 37.99	37.76	36.66	36.45	35.49	35.49	35.31	35.86	36.45	36.87	37.3		(38
leat transf	fer coeffici	ent, W/K	1		T	1	1		= (37) + (3	38)m		ī	
39)m= 89.	.69 89.45	89.21	88.11	87.91	86.95	86.95	86.77	87.32	87.91	88.32	88.76		<b>—</b> .
leat loss p	parameter	(HLP), W	/m²K						Average = = (39)m ÷		12 /12=	88.11	(39
40)m= 1.2	21 1.2	1.2	1.19	1.18	1.17	1.17	1.17	1.18	1.18	1.19	1.19		_
Number of	days in m	onth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.19	(40
Ja	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
41)m= 3	31 28	31	30	31	30	31	31	30	31	30	31		(41
												-	
4. Water h	heating en	ergy requ	irement:								kWh/y	ear:	
												_	
if TFA >	occupancy 13.9, N = 13.9, N =	l + 1.76 x	ː [1 - exp	0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (¯	ΓFA -13.		35		(42
if TFA > if TFA £ Annual ave Reduce the a	13.9, N =	l + 1.76 x l /ater usaç e hot water	ge in litre usage by	es per da 5% if the a	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		9)	35	]	
if TFA > if TFA £ annual ave Reduce the a ot more that	13.9, N = 13.9, N = erage hot v annual average	I + 1.76 x  vater usage hot water r person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, I	ay Vd,av Iwelling is thot and co	erage = designed	(25 x N) to achieve	+ 36 a water us		9)	0.91	]	·
if TFA > if TFA £ Annual ave Reduce the a ot more that	13.9, N = 13.9, N = erage hot wannual average to 125 litres pe	t + 1.76 x  vater usage hot water r person per	ge in litre usage by r day (all w Apr	es per da 5% if the d vater use, I	ay Vd,av Iwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36	se target o	9) 89			·
if TFA > if TFA £ Annual ave Reduce the a not more that Ja dot water use	13.9, N = 13.9,	t + 1.76 x  vater usage hot water r person per	ge in litre usage by r day (all w Apr	es per da 5% if the d vater use, I	ay Vd,av Iwelling is hot and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 89	0.91	]   	
if TFA > if TFA £ Annual ave Reduce the a not more that  Ja dot water usa  44)m= 98.	13.9, N = 13.9, N = erage hot vannual average t 125 litres pe an Feb age in litres p	+ 1.76 x  vater usage hot water reperson per  Mar  er day for ea	ge in litre usage by r day (all w Apr ach month 88.12	es per da 5% if the d vater use, I May Vd,m = fa 84.52	ay Vd,av lwelling is not and co Jun ctor from 1	erage = designed (d)  Jul Table 1c x  80.92	(25 x N) to achieve Aug (43) 84.52	+ 36 a water us Sep	Oct  91.71  Total = Sui	9) Nov 95.31 m(44) <sub>112</sub> =	Dec 98.91	1078.96	(43
if TFA > if TFA £ Annual ave Reduce the a not more that  Ja dot water usa  44)m= 98.	13.9, N = 13.9, N = erage hot vannual average t 125 litres pe an Feb age in litres p 91 95.31	yater usage hot water reperson per Mar 91.71	ge in litre usage by r day (all w Apr ach month 88.12	es per da 5% if the a vater use, I  May $Vd, m = fa$ 84.52 $Onthly = 4$	ay Vd,av Iwelling is not and co Jun ctor from 1 80.92	erage = designed and designed a	(25 x N) to achieve  Aug (43)  84.52	+ 36 a water us Sep  88.12	Oct 91.71  Fotal = Suith (see Ta	9)  Nov  95.31  m(44) <sub>112</sub> = ables 1b, 1	98.91 c, 1d)	1078.96	(43
if TFA > if TFA £ Annual ave Reduce the a ot more that  Ja dot water usa  44)m= 98.	13.9, N = 13.9, N = erage hot vannual average t 125 litres pe an Feb age in litres p 91 95.31	yater usage hot water reperson per Mar 91.71	ge in litre usage by r day (all w Apr ach month 88.12	es per da 5% if the d vater use, I May Vd,m = fa 84.52	ay Vd,av lwelling is not and co Jun ctor from 1	erage = designed (d)  Jul Table 1c x  80.92	(25 x N) to achieve Aug (43) 84.52	+ 36 a water us  Sep  88.12  0 kWh/mon  102.82	Oct 91.71  Fotal = Sur 119.83	9)  Nov  95.31  m(44) <sub>112</sub> = sbles 1b, 1  130.8	98.91 		(43
if TFA > if TFA £ Annual ave Reduce the a not more that Hot water usa 44)m= 98. Energy conte	13.9, N = 13.9, N = erage hot vannual average t 125 litres pe an Feb age in litres p 91 95.31	yater usage hot water r person per Mar er day for ea 91.71	ge in litre usage by r day (all w Apr ach month 88.12	es per da $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ in the of $5\%$ is a second of $5\%$ in the of $5\%$ is a second of $5\%$ in the of	ay Vd,av lwelling is not and co Jun ctor from 7 80.92 190 x Vd,r 95.56	erage = designed and designed a	(25 x N) to achieve Aug (43) 84.52 07m / 3600 101.61	+ 36 a water us  Sep  88.12 0 kWh/more 102.82	Oct 91.71  Fotal = Suith (see Ta	9)  Nov  95.31  m(44) <sub>112</sub> = sbles 1b, 1  130.8	98.91 	1078.96	(43
if TFA > if TFA £ Annual ave Reduce the a not more that dot water usa 44)m= 98. Energy conte 45)m= 146 f instantaneo	13.9, N = 13.9,	yater usage hot water r person per Mar er day for ea 91.71	ge in litre usage by r day (all w  Apr ach month  88.12  culated me 115.41	es per da 5% if the of yater use, I  May  Vd,m = far  84.52  onthly = 4.  110.74	ay Vd,av lwelling is not and co Jun ctor from 7 80.92 190 x Vd,r 95.56	erage = designed ald)  Jul Table 1c x  80.92  m x nm x E  88.55	(25 x N) to achieve  Aug (43)  84.52  DTm / 3600  101.61  boxes (46)	+ 36 a water us  Sep  88.12 0 kWh/more 102.82	Oct 91.71  Fotal = Sunth (see Ta 119.83  Fotal = Sunth	9)  89  Nov  95.31  m(44) <sub>112</sub> = ables 1b, 1  130.8  m(45) <sub>112</sub> =	98.91 = c, 1d) 142.05		(43
if TFA > if TFA £ Annual ave Reduce the a not more that Hot water use 44)m= 98. Energy conte 45)m= 146 f instantaneo 46)m= 2	13.9, N = 13.9,	yater usage hot water reperson per Mar 91.71 91.71 132.37	ge in litre usage by r day (all w Apr ach month 88.12	es per da $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ if the of $5\%$ is a second of $5\%$ in the of $5\%$ is a second of $5\%$ in the of $5\%$ is a second of $5\%$ in the of	ay Vd,av lwelling is not and co  Jun ctor from 7  80.92  190 x Vd,r  95.56	erage = designed and designed a	(25 x N) to achieve Aug (43) 84.52 07m / 3600 101.61	+ 36 a water us  Sep  88.12 b kWh/mon  102.82 c) to (61)	Oct 91.71  Fotal = Sur 119.83	9)  Nov  95.31  m(44) <sub>112</sub> = sbles 1b, 1  130.8	98.91 		(43
if TFA > if TFA £ Annual ave Reduce the a tot more that dot water use 44)m= 98. Energy conte 45)m= 146 finstantaneo 46)m= 2 Vater stora	13.9, N = 13.9,	yater usage hot water reperson per Mar 91.71  91.71  132.37  ting at point 19.86	ge in litre usage by r day (all w  Apr ach month  88.12  culated me 115.41  t of use (no	es per da 5% if the a yater use, I May Vd,m = fa 84.52 onthly = 4. 110.74 o hot water 16.61	ay Vd,av lwelling is not and co Jun ctor from 1 80.92 190 x Vd,r 95.56	erage = designed (d)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28	(25 x N) to achieve  Aug (43)  84.52  DTm / 3600  101.61  boxes (46)  15.24	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42	Oct  91.71  Total = Sunth (see Tall 19.83)  Total = Sunth 17.97	9)  89  Nov  95.31  m(44) <sub>112</sub> = ables 1b, 1  130.8  m(45) <sub>112</sub> =	98.91 = c, 1d) 142.05		(44)
if TFA > if TFA £ Annual ave Reduce the a not more that dot water usa 44)m= 98. Energy conte 45)m= 146 f instantaneo 46)m= 2 Vater stora Storage vo	13.9, N = 13.9, N = 13.9, N = erage hot vannual average t 125 litres pe an Feb age in litres p .91 95.31 ent of hot wate 5.67 128.28 ous water hea 22 19.24 rage loss:	yater usage hot water reperson per Mar er day for ea 132.37 132.37 19.86	ge in litre usage by r day (all w Apr ach month 88.12 culated me 115.41 f of use (no	es per da 5% if the of yater use, I  May  Vd,m = fact  84.52  onthly = 4.  110.74  o hot water  16.61	ay Vd,av welling is not and co Jun ctor from 1 80.92 190 x Vd,r 95.56 storage),	erage = designed and ld)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28  storage	(25 x N) to achieve  Aug (43)  84.52  77m / 3600  101.61  boxes (46)  15.24  within sa	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42	Oct  91.71  Total = Sunth (see Tall 19.83)  Total = Sunth 17.97	9)  89  Nov  95.31  m(44) <sub>112</sub> = ables 1b, 1  130.8  m(45) <sub>112</sub> =	98.91 = c, 1d) 142.05 =		(44)
if TFA > if TFA £ Annual ave Reduce the a bot more that  dot water usa  44)m= 98. Energy conte  45)m= 146  f instantaneo  46)m= 2 Vater stora Storage vo f communicontherwise	13.9, N = 13.9,	H + 1.76 x  vater usage hot water r person per  Mar er day for ea  91.71  132.37  ting at point 19.86  s) includir and no ta	ge in litre usage by r day (all w  Apr ach month  88.12  culated me 115.41  t of use (no	es per da 5% if the d yater use, I  May  Vd,m = fa  84.52  onthly = 4.  110.74  o hot water  16.61  olar or W yelling, e	ay Vd,av Iwelling is not and co Jun ctor from 1 80.92 190 x Vd,r 95.56 r storage), 14.33	erage = designed (d)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28  storage ) litres in	(25 x N) to achieve  Aug (43)  84.52  07m / 3600  101.61  boxes (46)  15.24  within sa (47)	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42  ame vess	Oct 91.71  Total = Sunth (see Tall 119.83)  Total = Sunth 17.97  Sel	9)  Nov  95.31  m(44)112 = sbles 1b, 1  130.8  m(45)112 =	98.91 = c, 1d) 142.05 =		(44)
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if TFA > if TFA £ Annual ave Reduce the a not more that  dot water usa  44)m= 98. Energy conte  45)m= 146  f instantaneo  46)m= 2 Vater stora Storage vo f communication Otherwise Vater stora a) If manual	13.9, N = 13.9,	yater usage hot water reperson per Mar er day for ea 132.37 ting at point 19.86 s) includir and no tail declared I	ge in litre usage by r day (all w  Apr ach month  88.12  culated me 115.41  for use (no 17.31  ng any so ank in dw er (this ir	es per da 5% if the of yater use, I  May  Vd,m = fact  84.52  onthly = 4.  110.74  o hot water  16.61  olar or Water yelling, e includes i	ay Vd,av welling is not and co Jun ctor from 1 80.92 190 x Vd,r 95.56 storage), 14.33 /WHRS nter 110 nstantar	erage = designed (d)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28  storage 0 litres in neous co	(25 x N) to achieve  Aug (43)  84.52  07m / 3600  101.61  boxes (46)  15.24  within sa (47)	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42  ame vess	Oct 91.71  Total = Sunth (see Tall 119.83)  Total = Sunth 17.97  Sel	9)  Nov  95.31  m(44) <sub>112</sub> = 19bles 1b, 1  130.8  m(45) <sub>112</sub> =	.91  Dec  98.91  c, 1d)  142.05  21.31  0		(45) (45) (46) (47)
if TFA > if TFA £ Annual ave Reduce the a not more that  Ja dot water use 44)m= 98. Energy conte 45)m= 146 f instantaneo 46)m= 2 Vater stora Storage vo f communi Otherwise Vater stora a) If manu Temperatu	13.9, N = 13.9,	transport of the contract of t	ge in litre usage by r day (all w  Apr ach month  88.12  culated mo 115.41  t of use (no 17.31  ang any so ank in dw er (this ir oss factor 2b	es per da 5% if the of yater use, I  May  Vd,m = fat  84.52  onthly = 4.  110.74  o hot water  16.61  olar or W  velling, e ncludes i	ay Vd,av welling is not and co Jun ctor from 1 80.92 190 x Vd,r 95.56 storage), 14.33 /WHRS nter 110 nstantar	erage = designed (d)  Jul Table 1c x  80.92  88.55  enter 0 in  13.28  storage 0 litres in neous con/day):	(25 x N) to achieve  Aug (43)  84.52  07m / 3600  101.61  boxes (46)  15.24  within sa (47) ombi boil	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42  ame vess  ers) ente	Oct 91.71  Total = Sunth (see Tall 119.83)  Total = Sunth 17.97  Sel	9)  89  Nov  95.31  m(44) <sub>112</sub> = ables 1b, 1  130.8  m(45) <sub>112</sub> =	.91  Dec  98.91		(45)
if TFA > if TFA £ Annual ave Reduce the a not more that  dot water usa  44)m= 98. Energy conte  45)m= 146  f instantaneo  46)m= 2 Vater stora Storage vo f communic Otherwise Vater stora a) If manu Emperatu Emergy los	13.9, N = 13.9,	yater usage hot water reperson per Mar 91.71  132.37  19.86  19.86  3) includir and no tail hot water declared I com Table er storage	ge in litre usage by r day (all w Apr ach month 88.12  culated me 115.41  for use (no 17.31  and any so ank in dw er (this in oss facto 2b e, kWh/ye	es per da $5\%$ if the of $5\%$ is a constant.	ay Vd,av welling is not and co Jun ctor from 5 80.92 190 x Vd,r 95.56 14.33 WHRS nter 110 nstantar	erage = designed (d)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28  storage 0 litres in neous con/day):	(25 x N) to achieve  Aug (43)  84.52  07m / 3600  101.61  boxes (46)  15.24  within sa (47)	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42  ame vess  ers) ente	Oct 91.71  Total = Sunth (see Tall 119.83)  Total = Sunth 17.97  Sel	9)  89  Nov  95.31  m(44) <sub>112</sub> = ables 1b, 1  130.8  m(45) <sub>112</sub> =	.91  Dec  98.91  c, 1d)  142.05  21.31  0		(48)
if TFA > if TFA £ Annual averageduce the anot more that anot more	13.9, N = 13.9,	H + 1.76 x  Vater usage hot water reperson per Mar er day for ear 132.37  In ting at point 19.86  S) includir and no tail that water the com Table er storage declared to s factor free fa	ge in litre usage by r day (all w Apr ach month 88.12  culated me 115.41  t of use (no 17.31  ang any se ank in dw er (this in oss facte 2b cylinder om Tabi	es per da 5% if the of yater use, I  May  Vd,m = far  84.52  onthly = 4.  110.74  o hot water  16.61  olar or W yelling, e ncludes i  or is kno  ear  loss factor	ay Vd,av welling is not and co	erage = designed id)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28  storage 0 litres in neous con/day):  known:	(25 x N) to achieve  Aug (43)  84.52  07m / 3600  101.61  boxes (46)  15.24  within sa (47) ombi boil	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42  ame vess  ers) ente	Oct 91.71  Total = Sunth (see Tall 119.83)  Total = Sunth 17.97  Sel	9)  Nov  95.31  m(44) <sub>112</sub> = sbles 1b, 1  130.8  m(45) <sub>112</sub> = 19.62	.91  Dec  98.91		(44 (45 (46 (47 (48 (49 (50
if TFA > if TFA £ Annual ave Reduce the a not more that  dot water usa  44)m= 98.  Energy conte  45)m= 146  f instantaneo  46)m= 2 Vater stora Storage vo f communic Otherwise Vater stora a) If manu Emperatu Emergy los b) If manu Hot water stora f communic	13.9, N = 13.9,	water usage hot water reperson per Mar 91.71  132.37  132.37  19.86  19.86  S) includir and no tail hot water declared I com Table er storage declared os factor free see secti	ge in litre usage by r day (all w Apr ach month 88.12  culated me 115.41  t of use (no 17.31  ang any se ank in dw er (this in oss facte 2b cylinder om Tabi	es per da 5% if the of yater use, I  May  Vd,m = far  84.52  onthly = 4.  110.74  o hot water  16.61  olar or W yelling, e ncludes i  or is kno  ear  loss factor	ay Vd,av welling is not and co	erage = designed id)  Jul Table 1c x  80.92  m x nm x E  88.55  enter 0 in  13.28  storage 0 litres in neous con/day):  known:	(25 x N) to achieve  Aug (43)  84.52  07m / 3600  101.61  boxes (46)  15.24  within sa (47) ombi boil	+ 36 a water us  Sep  88.12  0 kWh/mor  102.82  0 to (61)  15.42  ame vess  ers) ente	Oct 91.71  Total = Sunth (see Tall 119.83)  Total = Sunth 17.97  Sel	9)  Nov  95.31  m(44) <sub>112</sub> = 10bles 1b, 1  130.8  m(45) <sub>112</sub> = 19.62	0.91  Dec  98.91  c, 1d)  142.05  21.31  0  0  0		(42 (43 (44 (46 (47 (48 (49 (50 (51 (52

Energy lost from wat	er storage	e, kWh/ye	ear			(47) x (51)	) x (52) x (5	53) =		0		(54)
Enter (50) or (54) in	(55)									0		(55)
Water storage loss c	alculated	for each	month			((56)m = (	(55) × (41)r	n				
(56)m= 0 0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains dedica	ted solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 0 0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit loss (	annual) fro	om Table	e 3							0		(58)
Primary circuit loss of	alculated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by factor	from Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	thermo	stat)			
(59)m= 0 0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calculate	d for each	month (	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 50.4 43.87	46.74	43.45	43.07	39.91	41.24	43.07	43.45	46.74	47	50.4		(61)
Total heat required for	or 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= 197.07 172.15	179.11	158.86	153.81	135.46	129.78	144.68	146.28	166.57	177.81	192.45		(62)
Solar DHW input calculate	d using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	contribut	ion to wate	er heating)	'	
(add additional lines	if FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	3)					
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water he	ater						•				•	
(64)m= 197.07 172.15	179.11	158.86	153.81	135.46	129.78	144.68	146.28	166.57	177.81	192.45		
<u> </u>	•	•			•	Outp	out from wa	ater heate	r (annual)₁	12	1954.03	(64)
Heat gains from water	r heating	k\A/b/m	anth 0 21	F ′ [O OF	(45)	(04)	1 . 0 0		( <b></b> )	(=0)		
Tiout gains nom wat	i neamig	, KVVII/III	onun u.z:	อ [บ.ชอ	× (45)m	ı + (61)m	า] + บ.ช x	: [(46)m	+ (57)m	+ (59)m		
(65)m= 61.37 53.62	<del></del>	49.24	47.59	41.75	× (45)m	+ (61)m 44.55	1] + 0.8 X	51.53	+ (57)m 55.24	+ (59)m 59.83	] 	(65)
	55.7	49.24	47.59	41.75	39.75	44.55	45.05	51.53	55.24	59.83		(65)
(65)m= 61.37 53.62 include (57)m in ca	55.7	49.24 of (65)m	47.59 only if c	41.75	39.75	44.55	45.05	51.53	55.24	59.83		(65)
(65)m= 61.37 53.62 include (57)m in ca 5. Internal gains (se	55.7 alculation	49.24 of (65)m 5 and 5a	47.59 only if c	41.75	39.75	44.55	45.05	51.53	55.24	59.83		(65)
include (57)m in ca  5. Internal gains (so  Metabolic gains (Tab	55.7 alculation ee Table 5 le 5), Wat	49.24 of (65)m 5 and 5a	47.59 only if c	41.75	39.75 s in the o	44.55 dwelling	45.05 or hot w	51.53 ater is fr	55.24 om com	59.83		(65)
include (57)m in ca  5. Internal gains (see  Metabolic gains (Tab	55.7 alculation ee Table 5 le 5), Wat Mar	49.24 of (65)m 5 and 5a	47.59 only if c	41.75 ylinder i	39.75	44.55	45.05	51.53	55.24	59.83 munity h		(65)
(65)m= 61.37 53.62 include (57)m in ca  5. Internal gains (sa  Metabolic gains (Tab  Jan Feb  (66)m= 117.29 117.29	55.7 sloulation ee Table 5 le 5), Wat Mar 9 117.29	49.24 of (65)m 5 and 5a tts Apr 117.29	47.59 only if c : May 117.29	Jun	39.75 s in the o	44.55 dwelling Aug 117.29	45.05 or hot w Sep 117.29	51.53 ater is fr	55.24 om com	59.83 munity h		
include (57)m in ca  5. Internal gains (56)  Metabolic gains (Tab  Jan Feb  (66)m= 117.29 117.29  Lighting gains (calculation)	55.7 sloulation ee Table 5 le 5), Wat Mar 9 117.29	49.24 of (65)m 5 and 5a tts Apr 117.29	47.59 only if c : May 117.29	Jun	39.75 s in the o	44.55 dwelling Aug 117.29	45.05 or hot w Sep 117.29	51.53 ater is fr	55.24 om com	59.83 munity h		
(65)m= 61.37 53.62 include (57)m in ca 5. Internal gains (state of the first of the	55.7 alculation ee Table 5 le 5), Wat Mar 117.29 lated in A	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28	47.59 only if c ):  May 117.29 L, equati 7.69	41.75 ylinder i	39.75 s in the o	Aug 117.29 Iso see	45.05 or hot w Sep 117.29 Table 5	51.53 ater is fr  Oct 117.29	55.24 om com Nov 117.29	59.83 munity h		(66)
(65)m= 61.37 53.62 include (57)m in ca  5. Internal gains (sa  Metabolic gains (Tab  Jan Feb  (66)m= 117.29 117.29  Lighting gains (calcu (67)m= 18.81 16.7  Appliances gains (calcu	55.7 slculation ee Table 5 le 5), Wat Mar 117.29 lated in A 13.58 lculated ir	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eq	Jun 117.29 ion L9 o 6.49 uation L	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1	Aug 117.29 Iso see 9.12 3a), also	45.05 or hot w Sep 117.29 Table 5 12.23 o see Tal	51.53 ater is fr  Oct 117.29 15.53 ble 5	55.24 om com Nov 117.29	59.83 munity h		(66)
include (57)m in ca include (57)m in ca 5. Internal gains (57) Metabolic gains (Tab Jan Feb (66)m= 117.29 117.29 Lighting gains (calcu (67)m= 18.81 16.7 Appliances gains (ca (68)m= 207.12 209.2	55.7 alculation ee Table ( le 5), War Mar 117.29 ated in Al 13.58 lculated ir 203.85	49.24 of (65)m 5 and 5a tits Apr 117.29 opendix 10.28 n Append 192.32	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eq	Jun 117.29 ion L9 o 6.49 uation L	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95	44.55 dwelling Aug 117.29 lso see 9.12 3a), also 152.8	45.05 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22	51.53  ater is fr  Oct 117.29  15.53  ole 5 169.75	55.24 om com Nov 117.29	59.83 munity h		(66) (67)
include (57)m in ca 5. Internal gains (so 5. Internal gains (Tab Jan Feb Jan Feb (66)m= 117.29 117.29 Lighting gains (calcu (67)m= 18.81 16.7 Appliances gains (ca (68)m= 207.12 209.29 Cooking gains (calculate)	55.7 slculation ee Table 5 le 5), Wat Mar 117.29 sated in Al 13.58 lculated ir 203.85	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, equati 177.77 L, equat	Jun 117.29 ion L9 o 6.49 uation L 164.09	39.75 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a)	44.55 dwelling 117.29 lso see 9.12 3a), also 152.8	45.05 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table	51.53 ater is fr  Oct 117.29 15.53 ole 5 169.75 5	55.24 om com Nov 117.29 18.13	59.83 munity h		(66) (67) (68)
include (57)m in ca 5. Internal gains (so Metabolic gains (Tab Jan Feb (66)m= 117.29 117.29 Lighting gains (calcu (67)m= 18.81 16.7 Appliances gains (ca (68)m= 207.12 209.2 Cooking gains (calcu (69)m= 34.73 34.73	55.7 slculation ee Table 5 le 5), Wat Mar 0 117.29 ated in A 13.58 lculated ir 7 203.85 lated in A 34.73	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eq	Jun 117.29 ion L9 o 6.49 uation L	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95	44.55 dwelling Aug 117.29 lso see 9.12 3a), also 152.8	45.05 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22	51.53  ater is fr  Oct 117.29  15.53  ole 5 169.75	55.24 om com Nov 117.29	59.83 munity h		(66) (67)
include (57)m in care include includ	55.7  alculation  ee Table (  le 5), Wat  Mar  117.29  lated in A  13.58  lculated ir  203.85  lated in A  34.73  as (Table (	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eq 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73	Aug 117.29 Iso see 9.12 3a), also 152.8 ), also se 34.73	45.05 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	51.53  ater is fr  Oct 117.29  15.53  ble 5 169.75  5 34.73	55.24 om com Nov 117.29 18.13	59.83 munity h  Dec 117.29 19.33 197.98		(66) (67) (68) (69)
include (57)m in care include (58)m include include (56)m include in	55.7 alculation ee Table 6 le 5), Wat Mar 117.29 lated in A 13.58 lculated ir 203.85 lated in A 34.73 as (Table 6	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73 5a) 3	47.59 only if colors May 117.29 L, equati 7.69 dix L, equat 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	39.75 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a)	44.55 dwelling 117.29 lso see 9.12 3a), also 152.8	45.05 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table	51.53 ater is fr  Oct 117.29 15.53 ole 5 169.75 5	55.24 om com Nov 117.29 18.13	59.83 munity h		(66) (67) (68)
include (57)m in care include (58)m include (58)m include (57)m include (58)m include (58)m include (58)m include (59)m include (57)m in	55.7  alculation  ee Table ( le 5), War  Mar  117.29  ated in A  13.58  Iculated ir  203.85  lated in A  34.73  as (Table (  3  ion (negan)	49.24 of (65)m 5 and 5a tits Apr 117.29 opendix 10.28 n Appendix 192.32 ppendix 34.73 5a) 3 tive valu	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eq 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73	44.55 dwelling 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73	45.05 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	51.53 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73	55.24  om com  Nov  117.29  18.13  184.3	59.83 munity h  Dec 117.29  19.33  197.98		(66) (67) (68) (69) (70)
include (57)m in care include (57)m include [57]m include [58]m in	55.7  alculation  ee Table (  le 5), Wat  Mar  117.29  lated in A  13.58  lculated ir A  203.85  lated in A  34.73  is (Table (  3  ion (negal)  3 -93.83	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73 5a) 3	47.59 only if colors May 117.29 L, equati 7.69 dix L, equat 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73	Aug 117.29 Iso see 9.12 3a), also 152.8 ), also se 34.73	45.05 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	51.53  ater is fr  Oct 117.29  15.53  ble 5 169.75  5 34.73	55.24 om com Nov 117.29 18.13	59.83 munity h  Dec 117.29 19.33 197.98		(66) (67) (68) (69)
include (57)m in care include (57)m include [57]m include [58]m in	55.7  alculation  ee Table 5  le 5), Wat  Mar  117.29  lated in A  13.58  lculated ir A  203.85  lated in A  34.73  s (Table 5  -93.83  (Table 5)	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73 5a) 3 tive valu -93.83	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eqi 177.77 L, equati 34.73  as) (Tab	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73 3	39.75 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73	44.55 dwelling 117.29 lso see 9.12 3a), also 152.8 34.73	45.05 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73  3  -93.83	51.53 ater is fr  Oct 117.29 15.53 ole 5 169.75 5 34.73	55.24 om com Nov 117.29 18.13 184.3 34.73	59.83 munity h  Dec 117.29  19.33  197.98  34.73		(66) (67) (68) (69) (70) (71)
include (57)m in care include (57)m include (58)m include (58)m include (59)m include (57)m in	55.7 alculation be Table (19) ated in Applicated in Applic	49.24 of (65)m 5 and 5a tits Apr 117.29 opendix 10.28 n Appendix 192.32 ppendix 34.73 5a) 3 tive valu	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eq 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73 3 lle 5) -93.83	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73  3  -93.83	44.55 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73  3  -93.83	45.05 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73  3  -93.83	51.53 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73 3 -93.83	55.24  om com  Nov  117.29  18.13  184.3  34.73  3  -93.83	59.83 munity h  Dec 117.29  19.33  197.98  34.73  3  -93.83		(66) (67) (68) (69) (70)
include (57)m in care include (57)m include (57)m include (58)m include (57)m include (58)m include (58)m include (59)m include (57)m in	55.7 alculation ee Table ( le 5), Wat Mar 117.29 lated in A 13.58 lculated ir 7 203.85 lated in A 34.73 ls (Table ( 3 3) ion (nega 6 -93.83 (Table 5) 74.86	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73 5a) 3 tive valu -93.83	47.59 only if co ):  May 117.29 L, equati 7.69 dix L, equ 177.77 L, equati 34.73  as) (Tab -93.83	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73  3 ile 5) -93.83	39.75 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73  3  -93.83  53.43	44.55 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 34.73  3  -93.83  59.88 1+ (68)m -	45.05 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73  3  -93.83  62.57 + (69)m + (	51.53 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73 3  -93.83  69.26  70)m + (7	55.24  om com  Nov  117.29  18.13  34.73  3  -93.83  76.73  1)m + (72)	59.83 munity h  Dec 117.29  19.33  197.98  34.73  3  -93.83		(66) (67) (68) (69) (70) (71)
include (57)m in care include (57)m include (58)m include (58)m include (59)m include (57)m in	55.7 alculation ee Table ( le 5), Wat Mar 117.29 lated in A 13.58 lculated ir 7 203.85 lated in A 34.73 ls (Table ( 3 3) ion (nega 6 -93.83 (Table 5) 74.86	49.24 of (65)m 5 and 5a tts Apr 117.29 opendix 10.28 n Append 192.32 ppendix 34.73 5a) 3 tive valu -93.83	47.59 only if c ):  May 117.29 L, equati 7.69 dix L, eqi 177.77 L, equati 34.73  as) (Tab	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73 3 lle 5) -93.83	39.75 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73  3  -93.83	44.55 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73  3  -93.83	45.05 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73  3  -93.83	51.53 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73 3 -93.83	55.24  om com  Nov  117.29  18.13  184.3  34.73  3  -93.83	59.83 munity h  Dec 117.29  19.33  197.98  34.73  3  -93.83		(66) (67) (68) (69) (70) (71)

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

Orientatio	n:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East (	).9x	1	x	0.63	x	19.64	x	0.63	x	0.7	=	3.78	(76)
East (	).9x	1	x	0.78	x	19.64	х	0.63	x	0.7	] =	4.68	(76)
East (	).9x	1	x	0.63	x	38.42	x	0.63	x	0.7	<u> </u>	7.4	(76)
East (	).9x	1	x	0.78	x	38.42	х	0.63	x	0.7	] =	9.16	(76)
East (	).9x	1	x	0.63	x	63.27	x	0.63	x	0.7	<b>=</b>	12.18	(76)
East (	).9x	1	x	0.78	X	63.27	X	0.63	x	0.7	=	15.08	(76)
East (	).9x	1	x	0.63	X	92.28	x	0.63	x	0.7	=	17.77	(76)
East (	).9x	1	x	0.78	x	92.28	x	0.63	x	0.7	=	22	(76)
East (	).9x	1	x	0.63	x	113.09	x	0.63	x	0.7	=	21.77	(76)
East (	).9x	1	x	0.78	x	113.09	x	0.63	x	0.7	=	26.96	(76)
East (	).9x	1	x	0.63	x	115.77	x	0.63	x	0.7	=	22.29	(76)
East (	).9x	1	x	0.78	x	115.77	x	0.63	x	0.7	=	27.6	(76)
East (	).9x	1	x	0.63	x	110.22	x	0.63	x	0.7	=	21.22	(76)
East (	).9x	1	x	0.78	x	110.22	x	0.63	x	0.7	=	26.27	(76)
East (	).9x	1	x	0.63	x	94.68	x	0.63	x	0.7	=	18.23	(76)
East (	).9x	1	x	0.78	x	94.68	x	0.63	x	0.7	=	22.57	(76)
East (	).9x	1	X	0.63	X	73.59	x	0.63	X	0.7	=	14.17	(76)
East (	).9x	1	x	0.78	x	73.59	x	0.63	x	0.7	=	17.54	(76)
East (	).9x	1	X	0.63	X	45.59	X	0.63	X	0.7	=	8.78	(76)
East (	).9x	1	x	0.78	x	45.59	x	0.63	x	0.7	=	10.87	(76)
East (	).9x	1	x	0.63	x	24.49	x	0.63	x	0.7	=	4.72	(76)
East (	).9x	1	x	0.78	X	24.49	X	0.63	X	0.7	=	5.84	(76)
East (	).9x	1	X	0.63	X	16.15	X	0.63	X	0.7	=	3.11	(76)
East (	).9x	1	X	0.78	X	16.15	X	0.63	X	0.7	=	3.85	(76)
West	).9x	0.77	X	3.28	X	19.64	X	0.63	X	0.7	=	19.69	(80)
West	).9x	0.77	X	8.93	x	19.64	x	0.63	x	0.7	=	53.6	(80)
West	).9x	0.77	X	3.28	X	38.42	X	0.63	X	0.7	=	38.51	(80)
West	).9x	0.77	X	8.93	x	38.42	x	0.63	x	0.7	=	104.85	(80)
West	).9x	0.77	X	3.28	x	63.27	x	0.63	x	0.7	=	63.43	(80)
West	).9x	0.77	X	8.93	x	63.27	x	0.63	x	0.7	=	172.68	(80)
West	).9x	0.77	X	3.28	x	92.28	x	0.63	x	0.7	=	92.5	(80)
West	).9x	0.77	X	8.93	X	92.28	x	0.63	X	0.7	] =	251.84	(80)
West	).9x	0.77	X	3.28	x	113.09	x	0.63	X	0.7	=	113.37	(80)
West	).9x	0.77	X	8.93	x	113.09	x	0.63	x	0.7	=	308.64	(80)
West	).9x	0.77	X	3.28	X	115.77	X	0.63	X	0.7	=	116.05	(80)
West (	).9x	0.77	X	8.93	X	115.77	x	0.63	x	0.7	=	315.95	(80)
West (	).9x	0.77	X	3.28	x	110.22	x	0.63	x	0.7	=	110.48	(80)
West (	).9x	0.77	X	8.93	x	110.22	x	0.63	x	0.7	=	300.8	(80)
West	).9x	0.77	X	3.28	x	94.68	x	0.63	x	0.7	] =	94.9	(80)

West	0.9x	0.77	X	8.8	93	X	9	4.68	X		0.63	x	0.7	=	258.38	(80)
West	0.9x	0.77	X	3.2	28	x	7	3.59	X		0.63	x [	0.7	=	73.77	(80)
West	0.9x	0.77	X	8.8	93	x	7	3.59	X		0.63	x	0.7	=	200.83	(80)
West	0.9x	0.77	X	3.2	28	x	4	5.59	x		0.63	x [	0.7	=	45.7	(80)
West	0.9x	0.77	X	8.9	93	x	4	5.59	X		0.63	x [	0.7	=	124.42	(80)
West	0.9x	0.77	Х	3.2	28	x	2	4.49	x		0.63	x	0.7	=	24.55	(80)
West	0.9x	0.77	х	8.8	93	x	2	4.49	x		0.63	x	0.7	=	66.83	(80)
West	0.9x	0.77	x	3.2	28	x	1	6.15	x		0.63	x	0.7		16.19	(80)
West	0.9x	0.77	X	8.8	93	x	1	6.15	x		0.63	x	0.7	=	44.08	(80)
						•			_							
Solar g	gains in v	vatts, ca	alculated	d for eac	h month				(83)m	ı = Sı	um(74)m .	(82)m				
(83)m=	81.75	159.92	263.37	384.11	470.74	48	31.89	458.78	394	.08	306.31	189.76	101.93	67.23		(83)
Total g	ains – ir	iternal a	nd sola	r (84)m =	= (73)m	+ (8	33)m	, watts		•			•		-	
(84)m=	451.35	526.87	616.86	716.29	781.35	77	71.64	735.36	677	.07	600.52	505.49	442.28	426.14		(84)
7. Me	an interr	nal temp	erature	(heating	season	)										
				eriods ii			area f	rom Tab	ole 9.	. Th′	1 (°C)				21	(85)
•		•	٠.	living are		-				,	( - /					` ′
· · · · · · · · · · · · · · · · · · ·	Jan	Feb	Mar	Apr	May	Ė	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec	]	
(86)m=	1	1	0.99	0.95	0.85	$\vdash$	).67	0.51	0.5	Ť	0.83	0.97	1	1	1	(86)
Moan	internal	tompor	atura in	living ar	oa T1 /f/	مالد	w cto	ns 3 to 7	I 7 in T	able	. 0c)		1	l	1	
(87)m=	19.69	19.85	20.14	20.51	20.81	_	0.95	20.99	20.	_	20.87	20.47	20.01	19.66	1	(87)
	L		<u> </u>	<u> </u>	<u>l</u>				<u> </u>				1 =0.0	1	J	(- /
•				periods in	1	_				$\overline{}$	<u> </u>	40.00	1 40 00	1000	7	(00)
(88)m=	19.91	19.92	19.92	19.93	19.93	1	9.94	19.94	19.	95	19.94	19.93	19.93	19.92	]	(88)
Utilisa	ation fact	or for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)				_		-	
(89)m=	1	0.99	0.98	0.93	0.8	C	).58	0.39	0.4	<b>1</b> 5	0.76	0.96	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	ing	T2 (fc	ollow ste	eps 3	to 7	' in Tabl	e 9c)				
(90)m=	18.17	18.41	18.83	19.37	19.75	Ť	9.91	19.94	19.	$\overline{}$	19.84	19.32	18.65	18.14	1	(90)
										•	f	LA = Livi	ng area ÷ (4	4) =	0.46	(91)
Moon	internal	tompor	atura (fo	or the wh	olo dwo	llin	~\ _ fl	Λ <b>ν</b> Τ1	. (1	fl	۸) ی T2					
(92)m=	18.87	19.07	19.43	or the wh	20.23	_	9) = 11 0.39	20.42	20.		20.31	19.85	19.28	18.84	1	(92)
			<u> </u>	n interna									10.20	10.04	J	(/
(93)m=	18.87	19.07	19.43	19.89	20.23	_	0.39	20.42	20.		20.31	19.85	19.28	18.84	1	(93)
	ace heat	ina reau	Jiremen'	t t												
		·			re obtair	ned	at ste	ep 11 of	Tabl	le 9b	o, so tha	t Ti.m=	(76)m an	d re-cal	culate	
				using Ta							,	,	()			
	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fact	or for g	ains, hm	n:											_	
(94)m=	1	0.99	0.98	0.93	0.81	C	0.62	0.45	0.5	51	0.79	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm ,	, W = (9	4)m x (8	4)m										_	
(95)m=	449.61	522.48	602.77	665.23	635.66	4	80.7	328.77	342	.33	472.44	485.78	438.9	424.89		(95)
Month	nly avera	ige exte	rnal tem	perature	from T	able	e 8								-	
(96)m=	4.3	4.9	6.5	8.9	11.7	1	14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	r	al temp	erature,	Lm	, W =	=[(39)m	x [(9	3)m-	- (96)m	]			-	
(97)m=	1306.65	1267.89	1153.8	968.71	750.19	50	03.61	332.36	348	.73	542.44	812.9	1075.52	1299.47	]	(97)

Space heating require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m= 637.64 500.91	409.96	218.51	85.21	0	0	0	0	243.38	458.37	650.69		_
						Tota	l per year	(kWh/yea	r) = Sum(9	8) <sub>15,912</sub> =	3204.67	(98)
Space heating require	ement in	kWh/m²	<sup>2</sup> /year								43.13	(99)
9a. Energy requiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space heating:			/							г		7(204)
Fraction of space hea				ementary	system		(201) -			Į	0	(201)
Fraction of space hea		•	` '			(202) = 1	` '	(202)] _		ļ	1	(202)
Fraction of total heati	•	•				(204) = (2	02) <b>x</b> [1 –	(203)] =		ļ	1	(204)
Efficiency of main spa					- 0/					Į	93.4	(206)
Efficiency of seconda				· ·		1	1	1	1		0	(208)
Jan Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating require 637.64 500.91	409.96	218.51	85.21	)   0	0	0	0	243.38	458.37	650.69		
$(211)$ m = {[(98)m x (20		<u> </u>	<u> </u>						1.00.07	000.00		(211)
682.69 536.31	438.93	233.95	91.23	0	0	0	0	260.58	490.76	696.67		(211)
						Tota	l I (kWh/yea	ar) =Sum(2	1 211) <sub>15,101</sub>	<u> </u>	3431.12	(211)
Space heating fuel (s	econdar	y), kWh/	month							L		_
= {[(98)m x (201)] } x 1	00 ÷ (20	(8)										
(215)m = 0 0	0	0	0	0	0	0	0	0	0	0		_
						Lota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	<u></u>	0	(215)
Water heating Output from water hea	ter (calc	ulated a	hove)									
197.07 172.15	179.11	158.86	153.81	135.46	129.78	144.68	146.28	166.57	177.81	192.45		
Efficiency of water hea	ter			•		•			•	·	80.3	(216)
(217)m= 87.79 87.58	87.07	85.85	83.63	80.3	80.3	80.3	80.3	86	87.33	87.88		(217)
Fuel for water heating,												
$(219)m = (64)m \times 100$ (219)m = 224.48  196.56	205.71 ÷ (217)	m 185.04	183.91	168.7	161.62	180.17	182.16	193.67	203.6	218.99		
` '	ļ	ļ		ļ	ļ	Tota	l = Sum(2	19a) <sub>112</sub> =			2304.62	(219)
Annual totals								k'	Wh/yeaı		kWh/yea	<b>—</b> '
Space heating fuel use	ed, main	system	1						-		3431.12	
Water heating fuel use	ed										2304.62	
Electricity for pumps, f	ans and	electric	keep-ho	t						_		
central heating pump	:									30		(2300
boiler with a fan-assis										45		(230
Total electricity for the			r			SIIM	of (230a).	(230a) -			75	(231)
•	above, i	xvvii/yea	ıı			Juill	5. <sub>(200a)</sub> .	(200g) =			75	=
Electricity for lighting										L	332.11	(232)
12a. CO2 emissions	<ul><li>Individ</li></ul>	ual heat	ing syste	ems inclu	uding mi	cro-CHF						

Energy

kWh/year

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**Emissions** 

kg CO2/year

**Emission factor** 

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216 =	741.12 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	497.8 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1238.92 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	172.37 (268)
Total CO2, kg/year	sum	of (265)(271) =	1450.21 (272)

TER = 19.52 (273)

			User D	etails:						
Assessor Name:	John Simpson			Strom	a Num	ber:		STRO	0006273	
Software Name:	Stroma FSAP 2			Softwa				Versio	n: 1.0.4.7	
				Address		R				
Address :	1.01, 25 Old Glou	ucester St,	LONDO	N, WC1	N 3AF					
1. Overall dwelling dim	iensions:		A	- ( 2)		A I I .	· ( / )		Malana a frais	) \
Ground floor				a(m²)	[(10) v	AV. He	ight(m)	7(20)	Volume(m <sup>3</sup>	<u>-</u>
				65.6	(1a) x		3	(2a) =	196.8	(3a)
Total floor area TFA = (	1a)+(1b)+(1c)+(1d)+	(1e)+(1r	ו) [	65.6	(4)					
Dwelling volume					(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	196.8	(5)
2. Ventilation rate:	main	seconda	***	other		total			m³ nor hou	
	main heating	heating	-	otner		total			m³ per hou	_
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 f	ans					3	X	10 =	30	(7a)
Number of passive vent	:S					0	x	10 =	0	(7b)
Number of flueless gas	fires				F	0	x	40 =	0	(7c)
J										(. %
								Air ch	nanges per ho	our
Infiltration due to chimne	eys, flues and fans =	(6a)+(6b)+(7	'a)+(7b)+(	7c) =		30		÷ (5) =	0.15	(8)
If a pressurisation test has		nded, procee	d to (17),	otherwise (	continue fr	rom (9) to	(16)			
Number of storeys in	the dwelling (ns)								0	(9)
Additional infiltration	0.051		0.05 (				[(9)	-1]x0.1 =	0	(10)
Structural infiltration:	U.25 for steel or timb present, use the value col				•	uction			0	(11)
	nings); if equal user 0.35	responding to	The great	or wan arc	a (anoi					
If suspended wooden	floor, enter 0.2 (unse	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, e	nter 0.05, else enter	0							0	(13)
Percentage of window	ws and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	-	(45)		0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value  If based on air permeab	•		•	•	•	etre of e	envelope	area	15	(17)
Air permeability value appl	-					is beina u	sed		0.9	(18)
Number of sides shelter			.0 0. 4 40,	y. 00 a po	v		000		2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ating shelter factor			(21) = (18	) x (20) =				0.77	(21)
Infiltration rate modified	for monthly wind spe	eed								
Jan Feb	Mar Apr Ma	ay 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 Factor (22a)m //										
Wind Factor (22a)m = $(22a)$ m =	22)m ÷ 4 1.23	3 0.95	0.95	0.92	1	1.08	1.12	1.18	]	
(££a)III— 1.21 1.20	1.20 1.1 1.00	0.90	0.90	0.82	L '	1.00	1.12	1.10	J	

Adjusted infiltration rate (allowing for shelter a	nd wind spe	ed) = (21a) x	(22a)m					
0.98 0.96 0.94 0.84 0.82	0.73	0.73	0.77	0.82	0.86	0.9		
Calculate effective air change rate for the app	licable case	! 	!			!		
If mechanical ventilation:	)a)			\ (00-\			0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23				) = (23a)			0	(23b)
If balanced with heat recovery: efficiency in % allowing				DL \ //	201.)	4 (00)	0	(23c)
a) If balanced mechanical ventilation with he	eat recovery	$\frac{(MVHR)}{0}$ $\frac{(248)}{0}$	$\frac{a)m = (22)}{a}$	2b)m + (2 0	23b) × [	1 – (23c)   0	+ 100j 	(24a)
b) If balanced mechanical ventilation withou					_	0		(244)
(24b)m= 0 0 0 0 0			0	0	230)	0	l	(24b)
c) If whole house extract ventilation or posit				<u> </u>			l	(= .5)
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$	•			5 × (23b	)			
(24c)m= 0 0 0 0 0	0	0 0	0	0	0	0	]	(24c)
d) If natural ventilation or whole house posit	ive input ven	ntilation from	loft				ı	
if $(22b)m = 1$ , then $(24d)m = (22b)m$ oth	erwise (24d)	m = 0.5 + [(2	2b)m² x	0.5]				
(24d)m= 0.98 0.96 0.94 0.86 0.84	0.77	0.75	0.79	0.84	0.87	0.91		(24d)
Effective air change rate - enter (24a) or (24	b) or (24c) o	or (24d) in box	x (25)			,	•	
(25)m= 0.98 0.96 0.94 0.86 0.84	0.77	0.75	0.79	0.84	0.87	0.91		(25)
3. Heat losses and heat loss parameter:								
ELEMENT Gross Openings area (m²) m²	Net Area A ,m²	U-val W/m2		A X U (W/ł	۲)	k-value kJ/m²-l		A X k kJ/K
Doors	2.1	x 1.8		3.78	$\neg$			(26)
Windows Type 1	1.58	x1/[1/( 1.6 )+	0.04] =	2.38	=			(27)
Windows Type 1 Windows Type 2	1.58	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+	L					(27) (27)
• •		_	0.04] =	2.38				, ,
Windows Type 2	1.5	x1/[1/( 1.6 )+	0.04] = [	2.38				(27)
Windows Type 2 Windows Type 3	1.5	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+	[0.04] = [0.04] = [0.04] = [0.04]	2.38 2.26 3.31				(27) (27)
Windows Type 2 Windows Type 3 Windows Type 4	1.5 2.2 1.8	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix}$	2.38 2.26 3.31 2.71				(27) (27) (27)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	1.5 2.2 1.8	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix}$	2.38 2.26 3.31 2.71 2.71 2.78			<b>-</b>	(27) (27) (27) (27) (27)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	1.5 2.2 1.8 1.8	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.38 2.26 3.31 2.71 2.71				(27) (27) (27) (27) (27) (28)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1  52.3  12.48	1.5 2.2 1.8 1.8 1.85 65.6	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x 0.25 x 0.3	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95				(27) (27) (27) (27) (27) (28) (29)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85	1.5 2.2 1.8 1.8 1.85 65.6 39.82 8.25	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x 0.25 x 0.3 x 0.28	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31				(27) (27) (27) (27) (27) (28) (29)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1	1.5  2.2  1.8  1.8  1.85  65.6  39.82  8.25  20.1	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x0.25 x 0.3 x 0.28 x 0.3	0.04] = [ 0.04] = [ 0.04] = [ 0.04] = [ 0.04] = [ = 0.04] = [ = = [ = = [	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31 6.03				(27) (27) (27) (27) (27) (28) (29) (29)
Windows Type 2         Windows Type 3         Windows Type 4         Windows Type 5         Windows Type 6         Floor         Walls Type1       52.3         Walls Type2       10.1         Walls Type3       22.2         Walls Type4       12.6	1.5  2.2  1.8  1.8  1.85  65.6  39.82  8.25  20.1  12.6	x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x1/[1/( 1.6 )+ x 0.25 x 0.3 x 0.28	$\begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix} 0.04 \end{bmatrix} $	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31				(27) (27) (27) (27) (27) (28) (29) (29) (29)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1 Walls Type4 12.6 0 Total area of elements, m²	1.5 2.2 1.8 1.8 1.85 65.6 39.82 8.25 20.1 12.6 162.8	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x 0.25 x 0.3 x 0.28 x 0.3	0.04] = [ 0.04]	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31 6.03 3.53				(27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (31)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1 Walls Type4 12.6 0 Total area of elements, m² Party wall	1.5  2.2  1.8  1.8  1.85  65.6  39.82  8.25  20.1  12.6  162.8  16.3	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x 0.25 x 0.3 x 0.28 x 0.3 x 0.28 x 0.28	0.04] = [ 0.04]	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31 6.03 3.53	s given in	paragraph		(27) (27) (27) (27) (27) (28) (29) (29) (29)
Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1 Walls Type4 12.6 0 Total area of elements, m²	1.5 2.2 1.8 1.8 1.85 65.6 39.82 8.25 20.1 12.6 162.8 16.3	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x 0.25 x 0.3 x 0.28 x 0.3 x 0.28 x 0.28	0.04] = [ 0.04]	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31 6.03 3.53	s given in	paragraph		(27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (31)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1 Walls Type4 12.6 0 Total area of elements, m² Party wall * for windows and roof windows, use effective window U-	1.5 2.2 1.8 1.8 1.85 65.6 39.82 8.25 20.1 12.6 162.8 16.3	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x 0.25 x 0.3 x 0.28 x 0.3 x 0.28 x 0.28	0.04] = [ 0.04]	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31 6.03 3.53	s given in	paragraph	3.2 68.8	(27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (31) (32)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1 Walls Type4 12.6 0 Total area of elements, m² Party wall * for windows and roof windows, use effective window U-1** include the areas on both sides of internal walls and page	1.5 2.2 1.8 1.8 1.85 65.6 39.82 8.25 20.1 12.6 162.8 16.3	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x 0.25 x 0.3 x 0.28 x 0.3 x 0.28 x 0.28 x 0.28	$\begin{array}{l} \cdot 0.04] = \begin{bmatrix} \\ \cdot 0.04\end{bmatrix} =$	2.38 2.26 3.31 2.71 2.71 2.78 16.4 11.95 2.31 6.03 3.53			Γ	(27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (31) (32)
Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Floor Walls Type1 52.3 12.48 Walls Type2 10.1 1.85 Walls Type3 22.2 2.1 Walls Type4 12.6 0 Total area of elements, m² Party wall  * for windows and roof windows, use effective window U-1* include the areas on both sides of internal walls and particular to the sides of t	1.5  2.2  1.8  1.8  1.85  65.6  39.82  8.25  20.1  12.6  162.8  16.3  value calculated rititions	x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x1/[1/(1.6)+ x 0.25 x 0.3 x 0.28 x 0.3 x 0.28 x 0.28 x 0.28 x 0.28 x 0.28	0.04] = [ $0.04$ ] = [ $0.04$	2.38 2.26 3.31 2.71 2.78 16.4 11.95 2.31 6.03 3.53 3.26 1e)+0.04] a	2) + (32a). Medium	(32e) =	68.8	(27) (27) (27) (27) (27) (28) (29) (29) (29) (31) (32)

can be used instead of a detailed calculation.	
The small side of O. (I. N.) and a late I wise Asset II. K.	4.42 (36)
if details of thermal bridging are not known (36) = 0.15 x (31)	
	3.22 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(20)
(38)m= 63.53 62.33 61.14 55.59 54.55 49.72 49.72 48.82 51.58 54.55 56.65 58.85	(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m	
(39)m= 156.75   155.55   154.37   148.81   147.77   142.94   142.94   142.04   144.8   147.77   149.88   152.07	0.04 (20)
Heat loss parameter (HLP), W/m <sup>2</sup> K	8.81 (39)
(40)m= 2.39 2.37 2.35 2.27 2.25 2.18 2.18 2.17 2.21 2.25 2.28 2.32	
Average = $Sum(40)_{112}/12=$ Number of days in month (Table 1a)	.27 (40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(41)m= 31 28 31 30 31 30 31 30 31 30 31	(41)
4. Water heating energy requirement: kWh/year:	
Assumed occupancy, N 2.13	(40)
Assumed occupancy, N $= 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	
(44)m= 93.39 89.99 86.6 83.2 79.81 76.41 76.41 79.81 83.2 86.6 89.99 93.39	
	18.81 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)	
(45)m= 138.5 121.13 124.99 108.97 104.56 90.23 83.61 95.94 97.09 113.15 123.51 134.13	
	35.82 (45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	(10)
(46)m= 20.77   18.17   18.75   16.35   15.68   13.53   12.54   14.39   14.56   16.97   18.53   20.12   Water storage loss:	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel 0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)	
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)	
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day):  0	(48)
Temperature factor from Table 2b  0	(49)
Energy lost from water storage, kWh/year (48) x (49) = 0 b) If manufacturer's declared cylinder loss factor is not known:	(50)
Hot water storage loss factor from Table 2 (kWh/litre/day)	(51)
If community heating see section 4.3	
Volume factor from Table 2a  Temperature factor from Table 2b  0	(52) (53)

Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53	·	0		(54) (55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$		0		(55)
(56)m= 0 0 0 0 0 0 0	0 0	0 0	0		(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] =	÷ (50), else (57)m = (56)m	where (H11) is fro	m Append	x H	
(57)m= 0 0 0 0 0 0 0	0 0	0 0	0		(57)
Primary circuit loss (annual) from Table 3			0		(58)
Primary circuit loss calculated for each month (59)m = $(58) \div$	` '				
(modified by factor from Table H5 if there is solar water he	<del></del>				(50)
(59)m =	0 0	0 0	0		(59)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (60)$	(41)m				
(61)m= 47.59 41.42 44.13 41.03 40.67 37.68 38.9	94 40.67 41.03	44.13 44.38	47.59		(61)
Total heat required for water heating calculated for each mor	$nth (62)m = 0.85 \times (4)$	5)m + (46)m +	(57)m +	(59)m + (61)m	
(62)m= 186.09 162.55 169.12 150 145.23 127.91 122.5		157.28 167.89	181.72		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quant	• , ,	contribution to wate	er heating)		
(add additional lines if FGHRS and/or WWHRS applies, see	<del>'i '' '</del>	0 0			(63)
(63)m= 0 0 0 0 0 0 0	0 0	0 0	0		(63)
Output from water heater	55 400 04 400 40	457.00 407.00	404.70		
(64)m= 186.09 162.55 169.12 150 145.23 127.91 122.5		157.28   167.89	181.72	1845.08	(64)
Heat make from water booting DANIs (month 0.05 / 10.05 v. /45		er heater (annual) <sub>1</sub>	'		(04)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45	)	(46)111 + (57)111	+ (59)111	1	
(65)m=   57.95   50.63   52.59   46.49   44.93   39.42   37.5	54 42.07 42.54	· · · · · ·	<del>``</del>	•	(65)
(65)m= 57.95 50.63 52.59 46.49 44.93 39.42 37.5		48.65 52.16	56.49		(65)
include (57)m in calculation of (65)m only if cylinder is in the		48.65 52.16	56.49		(65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):		48.65 52.16	56.49		(65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	ne dwelling or hot wat	48.65 52.16 ter is from com	56.49 munity h		(65)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul	ne dwelling or hot wat	48.65 52.16 ter is from com Oct Nov	56.49 munity h	eating	
include (57)m in calculation of (65)m only if cylinder is in the second	Aug Sep	48.65 52.16 ter is from com	56.49 munity h	eating	(65)
include (57)m in calculation of (65)m only if cylinder is in the second	Aug Sep 74 106.74 106.74 105.74 106.74 106.74	48.65 52.16  ter is from com  Oct Nov  106.74 106.74	56.49 munity h	eating	(66)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 106.74 10	Aug Sep 74 106.74 106.74 10.11 13.57	48.65 52.16  ter is from com  Oct Nov  106.74 106.74  17.22 20.1	56.49 munity h	eating	
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 106.74 10	Aug Sep 74 106.74 106.74 ), also see Table 5 8 10.11 13.57 L13a), also see Tabl	48.65 52.16  ter is from com  Oct Nov  106.74 106.74  17.22 20.1	56.49 munity h  Dec 106.74	eating	(66)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep 74 106.74 106.74 ), also see Table 5 8 10.11 13.57 L13a), also see Tabl 76 137.82 142.71	As.65         52.16           Ster is from com           Oct         Nov           106.74         106.74           17.22         20.1           6         5           153.11         166.24	56.49 munity h	eating	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 106.74 10	Aug Sep 74 106.74 106.74 106.74 106.74 13.57 L13a), also see Table 5 137.82 142.71 5a), also see Table 5	As.65         52.16           Ster is from com           Oct         Nov           106.74         106.74           17.22         20.1           6         5           153.11         166.24	56.49 munity h  Dec 106.74	eating	(66) (67)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 106.74 10	Aug Sep 74 106.74 106.74 106.74 106.74 13.57 L13a), also see Table 5 137.82 142.71 5a), also see Table 5	48.65         52.16           ter is from com           Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24	56.49 munity h  Dec 106.74  21.43	eating	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 106.74 10	Aug Sep 74 106.74 106.74  1, also see Table 5 8 10.11 13.57  L13a), also see Tabl 76 137.82 142.71  5a), also see Table 5 67 33.67 33.67	48.65         52.16           ter is from com           Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24	56.49 munity h  Dec 106.74  21.43	eating	(66) (67) (68)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep 74 106.74 106.74  1, also see Table 5 8 10.11 13.57  L13a), also see Tabl 76 137.82 142.71  5a), also see Table 5 67 33.67 33.67	Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24           33.67         33.67	56.49 munity h  Dec 106.74  21.43  178.58	eating	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep 74 106.74 106.74  1, also see Table 5 8 10.11 13.57  L13a), also see Table 76 137.82 142.71  5a), also see Table 5 37 33.67 33.67	Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24           33.67         33.67	56.49 munity h  Dec 106.74  21.43  178.58	eating	(66) (67) (68) (69)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep 74 106.74 106.74  1, also see Table 5 8 10.11 13.57  L13a), also see Table 76 137.82 142.71  5a), also see Table 5 37 33.67 33.67	Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24           3         33.67         33.67	56.49 munity h  Dec 106.74  21.43  178.58  33.67	eating	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan	Aug Sep 74 106.74 106.74 106.74 106.74 13.57 13.57 142.71 5a), also see Table 5 7 33.67 33.67 33.67 33.9 -85.39 -85.39	Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24           3         33.67         33.67	56.49 munity h  Dec 106.74  21.43  178.58  33.67	eating	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep 74 106.74 106.74 106.74 106.74 13.57 13.57 142.71 5a), also see Table 5 7 33.67 33.67 33.67 33.9 -85.39 -85.39	Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24           3         33.67           3         3           -85.39         -85.39           65.4         72.45	56.49 munity h  Dec 106.74  21.43  178.58  33.67  3  -85.39	eating	(66) (67) (68) (69) (70)
include (57)m in calculation of (65)m only if cylinder is in the state of the state	Aug Sep 74 106.74 106.74  75, also see Table 5  8 10.11 13.57  L13a), also see Table 5  67 33.67 33.67  3 3  3 3  39 -85.39 -85.39  45 56.54 59.08  67)m + (68)m + (69)m + (70)	Oct         Nov           106.74         106.74           17.22         20.1           e 5         153.11         166.24           3         33.67           3         3           -85.39         -85.39           65.4         72.45	56.49 munity h  Dec 106.74  21.43  178.58  33.67  3  -85.39	eating	(66) (67) (68) (69) (70)

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

Orientat	tion:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.5	x	10.63	x	0.72	x	0.7	] =	5.57	(74)
North	0.9x	0.77	x	1.85	x	10.63	x	0.72	х	0.7	=	6.87	(74)
North	0.9x	0.77	x	1.5	x	20.32	x	0.72	х	0.7	=	10.65	(74)
North	0.9x	0.77	x	1.85	x	20.32	х	0.72	x	0.7	] =	13.13	(74)
North	0.9x	0.77	x	1.5	x	34.53	x	0.72	х	0.7	=	18.09	(74)
North	0.9x	0.77	X	1.85	x	34.53	X	0.72	х	0.7	=	22.31	(74)
North	0.9x	0.77	x	1.5	x	55.46	x	0.72	х	0.7	=	29.06	(74)
North	0.9x	0.77	x	1.85	x	55.46	X	0.72	x	0.7	=	35.84	(74)
North	0.9x	0.77	x	1.5	x	74.72	x	0.72	х	0.7	=	39.14	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.72	x	0.7	=	48.28	(74)
North	0.9x	0.77	x	1.5	x	79.99	x	0.72	x	0.7	=	41.9	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.72	x	0.7	=	51.68	(74)
North	0.9x	0.77	x	1.5	x	74.68	x	0.72	x	0.7	=	39.12	(74)
North	0.9x	0.77	x	1.85	x	74.68	x	0.72	x	0.7	=	48.25	(74)
North	0.9x	0.77	x	1.5	x	59.25	x	0.72	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.72	X	0.7	=	38.28	(74)
North	0.9x	0.77	x	1.5	x	41.52	x	0.72	x	0.7	=	21.75	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.72	x	0.7	=	26.83	(74)
North	0.9x	0.77	x	1.5	x	24.19	x	0.72	x	0.7	=	12.67	(74)
North	0.9x	0.77	x	1.85	x	24.19	x	0.72	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	1.5	x	13.12	x	0.72	x	0.7	=	6.87	(74)
North	0.9x	0.77	x	1.85	x	13.12	x	0.72	X	0.7	=	8.48	(74)
North	0.9x	0.77	x	1.5	x	8.86	x	0.72	X	0.7	=	4.64	(74)
North	0.9x	0.77	x	1.85	x	8.86	x	0.72	X	0.7	=	5.73	(74)
East	0.9x	1	x	2.2	x	19.64	X	0.72	X	0.7	=	15.09	(76)
East	0.9x	1	x	1.8	x	19.64	X	0.72	x	0.7	=	12.35	(76)
East	0.9x	3	X	1.8	x	19.64	X	0.72	x	0.7	=	37.04	(76)
East	0.9x	1	X	2.2	x	38.42	X	0.72	x	0.7	=	29.52	(76)
East	0.9x	1	x	1.8	x	38.42	X	0.72	X	0.7	=	24.15	(76)
East	0.9x	3	X	1.8	x	38.42	X	0.72	X	0.7	=	72.46	(76)
East	0.9x	1	x	2.2	x	63.27	X	0.72	X	0.7	=	48.62	(76)
East	0.9x	1	x	1.8	x	63.27	X	0.72	x	0.7	=	39.78	(76)
East	0.9x	3	X	1.8	x	63.27	X	0.72	x	0.7	=	119.34	(76)
East	0.9x	1	X	2.2	x	92.28	X	0.72	x	0.7	=	70.91	(76)
East	0.9x	1	x	1.8	x	92.28	X	0.72	X	0.7	=	58.02	(76)
East	0.9x	3	X	1.8	x	92.28	x	0.72	x	0.7	=	174.05	(76)
East	0.9x	1	X	2.2	x	113.09	x	0.72	x	0.7	=	86.9	(76)
East	0.9x	1	X	1.8	x	113.09	x	0.72	x	0.7	=	71.1	(76)
East	0.9x	3	X	1.8	×	113.09	X	0.72	X	0.7	] =	213.3	(76)

Foot	۰. ۲									1 1							1(70)
East	0.9x	1	_	X	2.2		X	115		X	0.72		X	0.7	=	88.96	(76)
East	0.9x	1	_	X	1.8		X	115	.77	X	0.72		X	0.7	=	72.78	(76)
East	0.9x	3	_	X	1.8		X	115	.77	X	0.72		X	0.7	=	218.35	(76)
East	0.9x	1		X	2.2		X	110	.22	X	0.72		X	0.7	=	84.69	(76)
East	0.9x	1		X	1.8		X	110	.22	X	0.72		X	0.7	=	69.29	(76)
East	0.9x	3		X	1.8		X	110	.22	X	0.72		X	0.7	=	207.88	(76)
East	0.9x	1		X	2.2		X	94.	68	X	0.72		X	0.7	=	72.75	(76)
East	0.9x	1		X	1.8		X	94.	68	X	0.72		X	0.7	=	59.52	(76)
East	0.9x	3		X	1.8		X	94.	68	X	0.72		X	0.7	=	178.57	(76)
East	0.9x	1		X	2.2		X	73.	59	X	0.72		X	0.7	=	56.55	(76)
East	0.9x	1		X	1.8		X	73.	59	X	0.72		X	0.7	=	46.26	(76)
East	0.9x	3		X	1.8		x	73.	59	X	0.72		x	0.7	=	138.79	(76)
East	0.9x	1		X	2.2		X	45.	59	X	0.72		x	0.7	=	35.03	(76)
East	0.9x	1		X	1.8		x	45.	59	X	0.72		X	0.7	=	28.66	(76)
East	0.9x	3		X	1.8		X	45.	59	X	0.72		X	0.7	=	85.98	(76)
East	0.9x	1		x	2.2		x	24.	49	X	0.72		X	0.7	=	18.82	(76)
East	0.9x	1		x	1.8		x	24.	49	X	0.72		X	0.7	=	15.4	(76)
East	0.9x	3		x	1.8		x	24.	49	X	0.72		x	0.7	=	46.19	(76)
East	0.9x	1		x	2.2		x	16.	15	X	0.72		x	0.7	=	12.41	(76)
East	0.9x	1		x	1.8		x	16.	15	X	0.72		x	0.7	=	10.15	(76)
East	0.9x	3		x	1.8		x	16.	15	X	0.72		X	0.7	=	30.46	(76)
West	0.9x	0.54		x	1.58		x	19.	64	x	0.72		х	0.7	=	7.6	(80)
West	0.9x	0.54		x	1.58		x	38.	42	x	0.72		х	0.7	=	14.87	(80)
West	0.9x	0.54		x	1.58		x	63.	27	x	0.72		x	0.7	=	24.49	(80)
West	0.9x	0.54		x	1.58		x	92.	28	х	0.72		x	0.7		35.71	(80)
West	0.9x	0.54		x	1.58		x	113	.09	x	0.72		х	0.7	=	43.77	(80)
West	0.9x	0.54		x	1.58		x	115	.77	x	0.72		x	0.7	=	44.8	(80)
West	0.9x	0.54		x	1.58		x	110	.22	x	0.72		x	0.7		42.66	(80)
West	0.9x	0.54		x	1.58		x	94.	68	х	0.72		х	0.7		36.64	(80)
West	0.9x	0.54		x	1.58		x	73.	59	X	0.72		x	0.7	=	28.48	(80)
West	0.9x	0.54		x	1.58		x	45.	59	х	0.72		х	0.7	=	17.64	(80)
West	0.9x	0.54		x	1.58		x	24.	49	х	0.72		x	0.7	=	9.48	(80)
West	0.9x	0.54		x	1.58		x	16.	15	x	0.72		x	0.7		6.25	(80)
	L												_				
Solar	ains in	watts, ca	lculat	ed	for each	mont	h			(83)m	= Sum(74)	)m(	82)m				
(83)m=	84.52	164.79	272.6	3	403.58	502.49	) 5	18.49	491.9	416	.8 318.	66 1	195.62	105.23	69.65		(83)
Total g	ains – i	nternal a	nd so	lar	(84)m =	(73)m	1 + (	83)m , v	watts							_	
(84)m=	428.1	505.43	600.2	7	711.05	789.78	3 7	86.46	747.91	679.	29 592.	04 4	189.37	422.04	403.61		(84)
7. Me	an inter	nal temp	eratui	re (	heating	seasc	n)										
Temp	erature	during h	eating	j pe	eriods in	the liv	/ing	area fro	m Tab	ole 9,	Th1 (°C	)				21	(85)
Utilisa	ation fac	tor for ga	ains fo	or li	ving area	a, h1,	m (s	ee Tabl	e 9a)								
	Jan	Feb	Ма	r_	Apr	May	/	Jun	Jul	Aı	ug Se	р	Oct	Nov	Dec		

(86)m= 1 0.99 0.99 0.96 0.91 0.81 0.69 0.74 0.91 0.98 0.99 1 (	36)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	
(87)m= 18.44 18.65 19.07 19.67 20.22 20.67 20.86 20.82 20.45 19.74 19.03 18.46	B <b>7</b> )
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)	
(88)m= 19.09 19.1 19.11 19.16 19.17 19.22 19.22 19.23 19.2 19.17 19.15 19.13	38)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)	
	39)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)	
	90)
$fLA = Living area \div (4) = 0.37$	91)
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2	
	92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate	,
	93)
8. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate	
the utilisation factor for gains using Table 9a	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Utilisation factor for gains, hm:  (94)m= 0.99 0.99 0.97 0.94 0.86 0.72 0.55 0.62 0.85 0.96 0.99 0.99 (0.97)	94)
Useful gains, hmGm , W = (94)m x (84)m	- ,
	95)
Monthly average external temperature from Table 8	
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]	
	97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	
(98)m= 1217.31 999.22 895.11 569.52 320.29 0 0 0 548.97 882.47 1204.66	20)
	98)
Space heating requirement in kWh/m²/year 101.18	99)
9a. Energy requirements – Individual heating systems including micro-CHP)	
Space heating:	204)
	201)
	202)
	204)
	206)
Efficiency of secondary/supplementary heating system, %	208)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec   kWh/year	
Space heating requirement (calculated above)	
1217.31     999.22     895.11     569.52     320.29     0     0     0     548.97     882.47     1204.66	
	211)
1383.31 1135.48 1017.18 647.18 363.96 0 0 0 623.83 1002.81 1368.93	24.43
Total (kWh/year) = Sum(211) <sub>15,1012</sub> 7542.67	211)

Space heatin = {[(98)m x (20	•		• •	month									
$= \{[(90) \text{III } \times (20)] $ (215)m= 0	0	00 + (20	0	0	0	0	0	0	0	0	0		
				ı			Tota	al (kWh/yea	ar) =Sum(2	215) <sub>15,101</sub>		0	(215)
Water heating	-										'		<del>_</del>
Output from w	ater hea	ter (calc	<u>ulated a</u>	bove) 145.23	127.91	122.55	136.61	138.12	157.28	167.89	181.72		
Efficiency of w				1	1	1	1 .00.01	1.002		101.00	102	88	(216)
(217)m= 88	88	88	88	88	88	88	88	88	88	88	88		(217)
Fuel for water (219)m = (64)				•	•	•	•	•	•	•	•	•	
(219)m= 211.46	184.72	192.19	170.46	165.04	145.35	139.26	155.24	156.96	178.73	190.79	206.5		_
							Tota	al = Sum(2				2096.68	(219)
Annual totals Space heating		ad main	evetam	1					k'	Wh/yea	r	<b>kWh/year</b> 7542.67	, 
			System	1									-
Water heating			.1									2096.68	
Electricity for p	•		electric	keep-no	τ							ı	,
central heatir											30		(230c)
boiler with a f											45		(230e) ¬
Total electricity		above, l	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electricity for I	ighting											368.26	(232)
12a. CO2 em	issions	– Individ	ual heat	ing syste	ems incl	uding mi	cro-CHF	D .					
						ergy /h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	
Space heating	(main s	system 1	)		(21	1) x			0.2	16	=	1629.22	(261)
Space heating	(secon	dary)			(21	5) x			0.5	19	=	0	(263)
Water heating					(21	9) x			0.2	16	=	452.88	(264)
Space and wa	ter heat	ing			(26	1) + (262)	+ (263) +	(264) =				2082.1	(265)
Electricity for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	38.93	(267)
Electricity for I	ighting				(23)	2) x			0.5	19	=	191.12	(268)
Total CO2, kg/	/year							sum o	f (265)(2			2312.15	コ
Dwelling CO2	•	ion Rate	<b>!</b>					(272)	÷ (4) =			35.25	(273)
El rating (secti												72	(274)
(2.301.	,											12	```'

			User D	otoila:						
A constant North	laha O'aaa		User L		- NI			OTDO	000070	
Assessor Name:	John Simpso Stroma FSA			Strom Softwa					006273	
Software Name:	Stroma FSA		u a sa a safa s					versio	n: 1.0.4.7	
A 1 1	0.04.05.014		i i	Address		:K				
Address :	•	Gloucester St,	LONDO	N, WC1	N 3AF					
1. Overall dwelling dime	ensions:		•	( 0)					W 1 / 6	
Ground floor				a(m²)	(4 -)	Av. He	eight(m)	_	Volume(m <sup>3</sup>	<u>-</u>
Ground noor			8	0.37	(1a) x		3	(2a) =	241.11	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1	d)+(1e)+(1r	n) 8	0.37	(4)					
Dwelling volume					(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	241.11	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	ır
Number of chimneys	0	+ 0	<b>]</b> + [	0	] = [	0	X	40 =	0	(6a)
Number of open flues	0	+ 0	ī + F	0	j = F	0	x	20 =	0	(6b)
Number of intermittent fa	ins	J			,	3	X	10 =	30	(7a)
Number of passive vents	<b>.</b>				F	0	x	10 =	0	(7b)
•					Ļ			40 =		=
Number of flueless gas f	ires					0		40 =	0	(7c)
								Air ch	anges per ho	our
Infiltration due to chimne	vs flues and far	ns = (6a)+(6b)+(7	7a)+(7b)+(	7c) =	Г	30		÷ (5) =	0.12	(8)
If a pressurisation test has l	•				continue fr			- (3) =	0.12	(0)
Number of storeys in t			( /, -			(5)	()		0	(9)
Additional infiltration	3 ( 1)						[(9)	)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or t	imber frame or	0.35 fo	r masoni	v constr	ruction	L(×)		0	(11)
if both types of wall are p	resent, use the value	e corresponding to			•					` ′
deducting areas of openi	• ,		4 /	حاد الد				1		<b></b>
If suspended wooden	•	,	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	•								0	(13)
Percentage of window	s and doors drai	ught stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	_			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed	l in cubic metre	s per ho	our per s	quare m	etre of e	envelope	e area	15	(17)
If based on air permeabi	lity value, then (*	$18) = [(17) \div 20] + (8)$	8), otherwi	ise (18) = (	16)				0.87	(18)
Air permeability value applie	es if a pressurisation	test has been dor	ne or a deg	gree air pe	rmeability	is being u	sed			
Number of sides sheltered	ed								2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorpora	_			(21) = (18	) x (20) =				0.74	(21)
Infiltration rate modified	<del> </del>	<u> </u>				<u> </u>	1	_	Ī	
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp			· · · · ·			•	1	1	ı	
(22)m= 5.1 5	4.9 4.4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ∸ 4									
(00-) 4 07 4 05		1.00 0.05	0.05	I 0.00		1	1 440	1 440	İ	

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter ar	nd wind s	speed) =	(21a) x	(22a)m					
0.95	0.93	0.91	0.82	0.8	0.71	0.71	0.69	0.74	0.8	0.84	0.87		
Calculate effe		_	rate for t	he appli	cable ca	se						0	(23
If exhaust air h			endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(23
If balanced with	h heat reco	overy: effic	iency in %	allowing	for in-use f	actor (fron	n Table 4h	) =				0	(23
a) If balance	ed mech	anical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	`
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	ed mech	anical ve	entilation	without	heat red	covery (I	MV) (24b	o)m = (22	2b)m + (2	23b)		•	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)r				•	-				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)r					ve input erwise (2				0.5]				
(24d)m= 0.95	0.93	0.91	0.83	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.88		(24
Effective air	change	rate - er	nter (24a	) or (24l	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.95	0.93	0.91	0.83	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.88		(25
3. Heat losse	s and he	eat loss	paramete	er:									
ELEMENT	Gros area		Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	≺)	k-value kJ/m²-		A X k kJ/K
Doors					2.1	X	1.8	= [	3.78				(26
Windows Type	e 1				1.58	<sub>x</sub> 1	/[1/( 1.6 )+	0.04] =	2.38				(27
Windows Type	e 2				1.44	x1	/[1/( 1.6 )+	0.04] =	2.17				(27
Nindows Type	e 3				1.44	x1	/[1/( 1.6 )+	0.04] =	2.17				(27
Windows Type	e 4				1.62	x1	/[1/( 1.6 )+	0.04] =	2.44				(27
Nindows Type	e 5				1.62	x1	/[1/( 1.6 )+	0.04] =	2.44				(27
Windows Type	e 6				1.85	x1	/[1/( 1.6 )+	0.04] =	2.78				(27
Windows Type	e 7				0.9	x1	/[1/( 1.6 )+	0.04] =	1.35				(27
Floor					14.1	X	0.22	=	3.102				(28
Nalls Type1	53	3	12.3	3	40.62	<u>x</u>	0.3	=	12.19				(29
Walls Type2	18.	9	2.75		16.15	5 X	0.28	=	4.52				(29
Walls Type3	15.	9	2.1		13.8	X	0.28	=	3.86				(29
Total area of e	elements	, m²			101.9	)							(31
Party wall					25.8	X	0.2	=	5.16				(32
for windows and it include the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragrapl	3.2	
abric heat los	ss, W/K	= S (A x	U)				(26)(30	) + (32) =				55.37	(33
Heat capacity								((28)	(30) + (32	2) + (32a).	(32e) =	0	(34
Thermal mass	•	,		•					tive Value:			250	(35
For design assess	sments wh	ere the de	tails of the	construct	ion are no	t known pi	ecisely the	e indicative	values of	TMP in T	able 1f		

can be u	ısed instea	ad of a dei	tailed calc	ulation.										
					using Ap	pendix I	K						15.29	(36)
	_	•	•		= 0.15 x (3	•								(\/
Total fa	abric hea	at loss							(33) +	(36) =			70.65	(37)
Ventila	tion hea	it loss ca	alculated	l monthly	y				(38)m	= 0.33 × (	(25)m x (5)			<del></del>
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	75.51	74.12	72.76	66.38	65.18	59.62	59.62	58.59	61.76	65.18	67.6	70.13		(38)
Heat tr	ansfer c	oefficier	nt, W/K		-	-	-		(39)m	= (37) + (37)	38)m	-	-	
(39)m=	146.16	144.77	143.41	137.03	135.83	130.27	130.27	129.24	132.41	135.83	138.25	140.78	]	
Heat Ic	ss para	meter (H	HLP), W/	′m²K			-			Average = = (39)m ÷	Sum(39)₁ · (4)	12 /12=	137.02	(39)
(40)m=	1.82	1.8	1.78	1.7	1.69	1.62	1.62	1.61	1.65	1.69	1.72	1.75		
Numbe	er of day	s in mor	nth (Tab	le 1a)					•	Average =	Sum(40) <sub>1</sub>	12 /12=	1.7	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
'						•	•				•		•	
4. Wa	iter heat	ing ener	gy requi	rement:								kWh/y	ear:	
A													1	
if TF	ed occu A > 13.9 A £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	ΓFA -13.		47		(42)
Annua	l averag	e hot wa						(25 x N)				2.86	]	(43)
		_			5% if the d ater use, l	_	_	to achieve	a water us	se target o	f		4	
not more					<u> </u>		•	1 ,			T		1	
Hot water	Jan er usage in	Feb	Mar day for ea	Apr	May Vd,m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	102.14	98.43	94.72	91	87.29	83.57	83.57	87.29	91	94.72	98.43	102.14	1	
(44)111=	102.14	30.43	94.72	91	07.29	03.37	03.37	07.29	-		m(44) <sub>112</sub> =		1114.31	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600					1114.51	(/
(45)m=	151.48	132.48	136.71	119.19	114.36	98.69	91.45	104.94	106.19	123.76	135.09	146.7	]	
						!				Total = Su	m(45) <sub>112</sub> =		1461.03	(45)
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=	22.72	19.87	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22		(46)
	storage		includin	a any c	olar or M	WHDC	etoraga	within sa	me vec	col			1	(47)
•		, ,			velling, e		_		aille ves	9 <u>C</u> I		0		(47)
	-	_			_			mbi boil	ers) ente	er '0' in (	47)			
	storage			(1)					, ,	(	,			
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
Tempe	rature fa	actor fro	m Table	2b								0	]	(49)
			storage	-				(48) x (49)	) =			0	]	(50)
•				-	oss fact								1	(E.)
		_	tactor fr ee section		e 2 (kW	n/ntre/da	1y <i>)</i>					0	J	(51)
	e factor	-		1.0								0	]	(52)
			m Table	2b								0	1	(53)
													•	

Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53) =	0			(54) (55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$				(00)
(56)m= 0 0 0 0 0 0	0 0 0	0	0		(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷	(50), else (57)m = (56)m wher	e (H11) is fror	n Appendi	x H	
(57)m= 0 0 0 0 0 0	0 0 0	0	0		(57)
Primary circuit loss (annual) from Table 3		0	)		(58)
Primary circuit loss calculated for each month $(59)$ m = $(58) \div (59)$ m	, ,				
(modified by factor from Table H5 if there is solar water hea	ting and a cylinder them	<del>-                                    </del>	0		(59)
		0	0		(39)
Combi loss calculated for each month (61)m = (60) $\div$ 365 × (4	<del>i                                    </del>		50.00		(64)
(61)m= 50.96 45.3 48.27 44.88 44.48 41.21 42.59		<u> </u>	50.96	(=0) (0.1)	(61)
Total heat required for water heating calculated for each month	<del></del>	<del>-                                    </del>		(59)m + (61)m	(60)
(62)m= 202.44 177.79 184.98 164.07 158.84 139.9 134.0			197.66		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quan (add additional lines if FGHRS and/or WWHRS applies, see A		ution to water	r heating)		
(63)m= 0 0 0 0 0 0 0 0		0	0		(63)
Output from water heater					()
(64)m= 202.44 177.79 184.98 164.07 158.84 139.9 134.04	1 149.42 151.07 172.0	2 183.63	197.66		
(6),	Output from water hea			2015.84	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)			L		1, ,
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05	<del>                                     </del>	<del></del>	61.52	,	(65)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05	46.01 46.53 53.22	2 57.05	61.52		(65)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the	46.01 46.53 53.22	2 57.05	61.52		(65)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):	46.01 46.53 53.22	2 57.05	61.52		(65)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the	46.01 46.53 53.22	57.05 from comr	61.52		(65)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	46.01 46.53 53.22 de dwelling or hot water is	57.05 from comm	61.52 munity h		(65)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul	46.01 46.53 53.22 e dwelling or hot water is  Aug Sep Oct 123.49 123.49 123.4	57.05 from comm	61.52 munity h		
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.49 123.49 123.49 123.49 123.49 123.49 123.49	46.01 46.53 53.22 e dwelling or hot water is  Aug Sep Oct 123.49 123.49 123.4	57.05 from comr	61.52 munity h		
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.49 123.49 123.49 123.49 123.49 123.49 123.49 123.49 123.49 123.49 123.49 123.49	46.01   46.53   53.22   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.53   46.01   46.0	57.05 from comr	61.52 munity h		(66)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.49 1	46.01 46.53 53.22  e dwelling or hot water is  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5	2 57.05 from commercial Nov 9 123.49	61.52 munity h		(66)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.49 1	Aug Sep Oct  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5  162.46 168.22 180.4	2 57.05 from commercial Nov 9 123.49	61.52 munity h  Dec 123.49		(66) (67)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final state of the first of the fi	Aug Sep Oct  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5  162.46 168.22 180.4  a), also see Table 5	2 57.05 from commercial stress of the stress	61.52 munity h  Dec 123.49		(66) (67)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug Sep Oct  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5  1 162.46 168.22 180.4  a), also see Table 5	2 57.05 from commercial stress of the stress	Dec 123.49 25.66 210.5		(66) (67) (68)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug Sep Oct  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5  1 162.46 168.22 180.4  a), also see Table 5	2 57.05 from commercial stress of the stress	Dec 123.49 25.66 210.5		(66) (67) (68)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final state of the first of the fi	Aug Sep Oct 123.49 123.49 123.4 also see Table 5 12.1 16.24 20.63 13a), also see Table 5 1 162.46 168.22 180.4 a), also see Table 5 35.35 35.35 35.35	2 57.05 from communication in the second sec	Dec 123.49 25.66 210.5		(66) (67) (68) (69)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug Sep Oct  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5  162.46 168.22 180.4  a), also see Table 5  35.35 35.35 35.35	2 57.05 from communication in the second sec	Dec 123.49 25.66 210.5		(66) (67) (68) (69)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug Sep Oct  Aug Sep Oct  123.49 123.49 123.4  also see Table 5  12.1 16.24 20.63  13a), also see Table 5  162.46 168.22 180.4  a), also see Table 5  35.35 35.35 35.35	2 57.05 from communication in the second sec	Dec 123.49 25.66 35.35		(66) (67) (68) (69) (70)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final pains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.49 1	Aug Sep Oct	8 195.95 35.35 3 -98.79	Dec 123.49 25.66 35.35		(66) (67) (68) (69) (70)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug Sep Oct	8 195.95 3 35.35 3 79.24	123.49  25.66  210.5  35.35  3  -98.79		(66) (67) (68) (69) (70)
(65)m= 63.11 55.38 57.52 50.85 49.15 43.12 41.05 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug Sep Octobrolle Aug Sep Octob	8 195.95  3 35.35  3 79.24  (71)m + (72)r	123.49  25.66  210.5  35.35  3  -98.79		(66) (67) (68) (69) (70)

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

Orientati	on:	Access Factor Table 6d	,	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	X	1.44	x	10.63	x	0.72	x	0.7	=	10.7	(74)
North	0.9x	0.77	X	1.85	x	10.63	x	0.72	x	0.7	=	6.87	(74)
North	0.9x	0.77	X	1.44	x	20.32	x	0.72	x	0.7	=	20.44	(74)
North	0.9x	0.77	X	1.85	x	20.32	x	0.72	x	0.7	=	13.13	(74)
North	0.9x	0.77	X	1.44	x	34.53	x	0.72	x	0.7	=	34.73	(74)
North	0.9x	0.77	X	1.85	x	34.53	x	0.72	x	0.7	=	22.31	(74)
North	0.9x	0.77	X	1.44	x	55.46	x	0.72	x	0.7	=	55.79	(74)
North	0.9x	0.77	X	1.85	x	55.46	X	0.72	X	0.7	=	35.84	(74)
North	0.9x	0.77	X	1.44	x	74.72	X	0.72	x	0.7	=	75.16	(74)
North	0.9x	0.77	X	1.85	X	74.72	X	0.72	X	0.7	=	48.28	(74)
North	0.9x	0.77	X	1.44	x	79.99	X	0.72	X	0.7	=	80.46	(74)
North	0.9x	0.77	X	1.85	x	79.99	X	0.72	X	0.7	=	51.68	(74)
North	0.9x	0.77	X	1.44	X	74.68	X	0.72	X	0.7	=	75.12	(74)
North	0.9x	0.77	X	1.85	x	74.68	X	0.72	X	0.7	=	48.25	(74)
North	0.9x	0.77	X	1.44	x	59.25	X	0.72	x	0.7	=	59.6	(74)
North	0.9x	0.77	X	1.85	x	59.25	X	0.72	X	0.7	=	38.28	(74)
North	0.9x	0.77	X	1.44	x	41.52	X	0.72	X	0.7	=	41.76	(74)
North	0.9x	0.77	X	1.85	x	41.52	X	0.72	X	0.7	=	26.83	(74)
North	0.9x	0.77	X	1.44	x	24.19	X	0.72	X	0.7	=	24.33	(74)
North	0.9x	0.77	X	1.85	x	24.19	X	0.72	X	0.7	=	15.63	(74)
North	0.9x	0.77	X	1.44	x	13.12	X	0.72	X	0.7	=	13.2	(74)
North	0.9x	0.77	X	1.85	x	13.12	X	0.72	X	0.7	=	8.48	(74)
North	0.9x	0.77	X	1.44	x	8.86	x	0.72	x	0.7	=	8.92	(74)
North	0.9x	0.77	X	1.85	x	8.86	x	0.72	X	0.7	=	5.73	(74)
East	0.9x	1	X	1.44	x	19.64	x	0.72	x	0.7	] =	9.88	(76)
East	0.9x	1	X	1.62	X	19.64	X	0.72	X	0.7	=	11.11	(76)
East	0.9x	3	X	1.62	X	19.64	X	0.72	X	0.7	=	33.34	(76)
East	0.9x	1	X	1.44	X	38.42	X	0.72	X	0.7	=	19.32	(76)
East	0.9x	1	X	1.62	x	38.42	X	0.72	X	0.7	=	21.74	(76)
East	0.9x	3	X	1.62	x	38.42	X	0.72	X	0.7	=	65.22	(76)
East	0.9x	1	X	1.44	X	63.27	X	0.72	X	0.7	=	31.82	(76)
East	0.9x	1	X	1.62	X	63.27	X	0.72	X	0.7	=	35.8	(76)
East	0.9x	3	X	1.62	x	63.27	X	0.72	X	0.7	=	107.4	(76)
East	0.9x	1	X	1.44	x	92.28	X	0.72	X	0.7	=	46.41	(76)
East	0.9x	1	X	1.62	x	92.28	X	0.72	X	0.7	=	52.21	(76)
East	0.9x	3	X	1.62	x	92.28	X	0.72	X	0.7	=	156.64	(76)
East	0.9x	1	X	1.44	x	113.09	x	0.72	X	0.7	=	56.88	(76)
East	0.9x	1	X	1.62	x	113.09	X	0.72	X	0.7	=	63.99	(76)
East	0.9x	3	X	1.62	X	113.09	X	0.72	X	0.7	] =	191.97	(76)

East	East	۰.۰.		1		1		1 1		1		ı		7(70)
East		<u> </u>		] ]		X 1		] ]				= 		≓ `
East		<u> </u>		X		X	115.77	X	0.72	X	0.7	= 		╡ .
East		<u> </u>	3	<u>!</u> ]		X		] ]				= 		╡ .
Bast		<u> </u>	1	X		X		X		X		=		≓ `
East		<u>_</u>	1	X		X	110.22	X	0.72	X	0.7	=	62.36	╡ .
East		<u> </u>	3	X	1.62	X	110.22	X	0.72	X	0.7	=	187.09	╡ .
East		0.9x	1	X	1.44	X	94.68	X	0.72	X	0.7	=	47.62	(76)
East		0.9x	1	X	1.62	X	94.68	X	0.72	X	0.7	=	53.57	(76)
East		0.9x	3	X	1.62	X	94.68	X	0.72	X	0.7	=	160.71	(76)
East	East	0.9x	1	X	1.44	X	73.59	X	0.72	X	0.7	=	37.01	(76)
East	East	0.9x	1	X	1.62	X	73.59	X	0.72	X	0.7	=	41.64	(76)
East	East	0.9x	3	X	1.62	X	73.59	X	0.72	X	0.7	=	124.91	(76)
East 0.9x 3 x 1.62 x 45.59 x 0.72 x 0.7 = 77.39 765  East 0.9x 1 x 1.44 x 224.49 x 0.72 x 0.7 = 12.32 766  East 0.9x 1 x 1.62 x 24.49 x 0.72 x 0.7 = 13.86 76  East 0.9x 3 x 1.62 x 24.49 x 0.72 x 0.7 = 13.86 76  East 0.9x 3 x 1.62 x 24.49 x 0.72 x 0.7 = 41.57 76  East 0.9x 1 x 1.44 x 16.15 x 0.72 x 0.7 = 41.57 76  East 0.9x 1 x 1.62 x 16.15 x 0.72 x 0.7 = 8.12 76  East 0.9x 1 x 1.62 x 16.15 x 0.72 x 0.7 = 9.14 76  East 0.9x 1 x 1.62 x 16.15 x 0.72 x 0.7 = 9.14 76  East 0.9x 3 x 1.62 x 16.15 x 0.72 x 0.7 = 9.14 76  East 0.9x 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 7.6 (80)  West 0.9x 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 14.87 80  West 0.9x 0.54 x 1.58 x 38.42 x 0.72 x 0.7 = 14.87 80  West 0.9x 0.54 x 1.58 x 63.27 x 0.72 x 0.7 = 12.08 80  West 0.9x 0.54 x 1.58 x 63.27 x 0.72 x 0.7 = 19.88 (80)  West 0.9x 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 19.88 (80)  West 0.9x 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 19.88 (80)  West 0.9x 0.54 x 1.58 x 19.84 x 0.72 x 0.7 = 19.88 (80)  West 0.9x 0.54 x 1.58 x 19.84 x 0.72 x 0.7 = 19.89 (80)  West 0.9x 0.54 x 1.58 x 19.84 x 0.72 x 0.7 = 19.89 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 29.01 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 35.51 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 35.55 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 35.55 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.64 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.84 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.84 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.84 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.84 (80)  West 0.9x 0.54 x 1.58 x 113.09 x 0.72 x 0.7 = 36.84 (80)  West 0.9x 0.54 x 1.58 x 19.84 x 0.72 x 0.7 = 36.84 (80)  West 0.9x 0.54 x 1.58 x 19.84 x 0.72 x 0.7 = 36.84 (80)	East	0.9x	1	X	1.44	X	45.59	X	0.72	X	0.7	=	22.93	(76)
East	East	0.9x	1	X	1.62	x	45.59	x	0.72	X	0.7	=	25.8	(76)
East	East	0.9x	3	x	1.62	X	45.59	X	0.72	X	0.7	=	77.39	(76)
East 0.9x 3	East	0.9x	1	X	1.44	X	24.49	X	0.72	x	0.7	=	12.32	(76)
East 0.9x 1 x 1.44 x 16.15 x 0.72 x 0.7 = 8.12 (76)  East 0.9x 3 x 1.62 x 16.15 x 0.72 x 0.7 = 9.14 (76)  East 0.9x 3 x 1.62 x 16.15 x 0.72 x 0.7 = 9.14 (76)  West 0.9x 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 7.6 (80)  West 0.9x 0.54 x 1.58 x 36.42 x 0.72 x 0.7 = 6.17 (80)  West 0.9x 0.54 x 1.58 x 36.42 x 0.72 x 0.7 = 14.87 (80)  West 0.9x 0.77 x 0.9 x 36.42 x 0.72 x 0.7 = 12.08 (80)  West 0.9x 0.77 x 0.9 x 36.42 x 0.72 x 0.7 = 12.08 (80)  West 0.9x 0.77 x 0.9 x 36.42 x 0.72 x 0.7 = 12.08 (80)  West 0.9x 0.77 x 0.9 x 36.42 x 0.72 x 0.7 = 12.08 (80)  West 0.9x 0.77 x 0.9 x 63.27 x 0.72 x 0.7 = 19.89 (80)  West 0.9x 0.77 x 0.9 x 63.27 x 0.72 x 0.7 = 19.89 (80)  West 0.9x 0.54 x 1.58 x 92.28 x 0.72 x 0.7 = 35.71 (80)  West 0.9x 0.77 x 0.9 x 92.28 x 0.72 x 0.7 = 29.01 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 29.01 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 35.55 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 35.55 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 36.39 (80)  West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 36.64 (80)  West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 36.64 (80)  West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.99 x 94.68 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.99 x 94.68 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.99 x 94.68 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.99 x 94.68 x 0.72 x 0.7 = 29.76 (80)  West 0.9x 0.77 x 0.99 x 94.68 x 0.72 x 0.7 = 29.76 (80)	East	0.9x	1	X	1.62	x	24.49	X	0.72	x	0.7	=	13.86	(76)
East 0.9% 1 x 1.62 x 16.15 x 0.72 x 0.7 = 9.14 76) East 0.9% 3 x 1.62 x 16.15 x 0.72 x 0.7 = 27.42 76) West 0.9% 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 7.6 80) West 0.9% 0.54 x 1.58 x 36.42 x 0.72 x 0.7 = 6.17 80) West 0.9% 0.54 x 1.58 x 36.42 x 0.72 x 0.7 = 14.87 80) West 0.9% 0.54 x 1.58 x 36.42 x 0.72 x 0.7 = 12.08 80) West 0.9% 0.77 x 0.9 x 36.42 x 0.72 x 0.7 = 12.08 80) West 0.9% 0.77 x 0.9 x 36.42 x 0.72 x 0.7 = 12.08 80) West 0.9% 0.54 x 1.58 x 63.27 x 0.7 = 12.08 80) West 0.9% 0.77 x 0.9 x 63.27 x 0.7 = 24.49 80) West 0.9% 0.77 x 0.9 x 63.27 x 0.7 = 19.89 80) West 0.9% 0.77 x 0.9 x 63.27 x 0.7 = 19.89 80) West 0.9% 0.77 x 0.9 x 92.28 x 0.7 = 35.71 80) West 0.9% 0.77 x 0.9 x 92.28 x 0.7 = 35.71 80) West 0.9% 0.77 x 0.9 x 113.09 x 0.7 = 29.01 80) West 0.9% 0.77 x 0.9 x 113.09 x 0.7 = 44.8 80) West 0.9% 0.77 x 0.9 x 113.09 x 0.7 = 35.55 80) West 0.9% 0.77 x 0.9 x 113.09 x 0.7 = 35.55 80) West 0.9% 0.77 x 0.9 x 113.09 x 0.7 = 36.4 80) West 0.9% 0.77 x 0.9 x 113.09 x 0.7 = 44.8 80) West 0.9% 0.77 x 0.9 x 110.22 x 0.7 = 36.39 80) West 0.9% 0.77 x 0.9 x 110.22 x 0.7 = 36.64 80) West 0.9% 0.77 x 0.9 x 110.22 x 0.7 = 36.64 80) West 0.9% 0.77 x 0.9 x 110.22 x 0.7 = 36.64 80) West 0.9% 0.77 x 0.9 x 110.2 x 0.7 = 36.64 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 x 0.7 x 0.7 = 29.76 80) West 0.9% 0.77 x 0.9 x 94.68 x 0.7 x 0.7 x 0.7 x 0.7 = 29.76 80)	East	0.9x	3	X	1.62	x	24.49	X	0.72	x	0.7	=	41.57	(76)
East 0.9x 3 x 1.62 x 16.15 x 0.72 x 0.7 = 27.42 (76) West 0.9x 0.54 x 1.58 x 19.64 x 0.72 x 0.7 = 7.6 (80) West 0.9x 0.57 x 0.9 x 19.64 x 0.72 x 0.7 = 6.17 (80) West 0.9x 0.54 x 1.58 x 38.42 x 0.72 x 0.7 = 14.87 (80) West 0.9x 0.77 x 0.9 x 38.42 x 0.72 x 0.7 = 12.08 (80) West 0.9x 0.77 x 0.9 x 38.42 x 0.72 x 0.7 = 12.08 (80) West 0.9x 0.77 x 0.9 x 38.42 x 0.72 x 0.7 = 12.08 (80) West 0.9x 0.77 x 0.9 x 63.27 x 0.72 x 0.7 = 14.87 (80) West 0.9x 0.77 x 0.9 x 63.27 x 0.72 x 0.7 = 19.89 (80) West 0.9x 0.77 x 0.9 x 92.28 x 0.72 x 0.7 = 35.71 (80) West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 29.01 (80) West 0.9x 0.77 x 0.9 x 113.09 x 0.72 x 0.7 = 35.55 (80) West 0.9x 0.77 x 0.9 x 115.77 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 115.77 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 115.77 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 115.77 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 115.77 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 115.77 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 115.8 x 110.22 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 36.39 (80) West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 36.46 (80) West 0.9x 0.77 x 0.9 x 110.22 x 0.72 x 0.7 = 36.64 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 28.48 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 29.76 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 28.48 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 28.48 (80) West 0.9x 0.77 x 0.9 x 94.68 x 0.72 x 0.7 = 28.48 (80)	East	0.9x	1	x	1.44	x	16.15	x	0.72	x	0.7	=	8.12	(76)
West         0.9x         0.54         x         1.58         x         19.64         x         0.72         x         0.7         =         7.6         (80)           West         0.9x         0.77         x         0.9         x         19.64         x         0.72         x         0.7         =         6.17         (80)           West         0.9x         0.54         x         1.58         x         38.42         x         0.72         x         0.7         =         6.17         (80)           West         0.9x         0.54         x         1.58         x         38.42         x         0.72         x         0.7         =         14.87         (80)           West         0.9x         0.54         x         1.58         x         63.27         x         0.72         x         0.7         =         12.449         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         19.89         (80)           West         0.9x         0.77         x         0.9         x         113.09	East	0.9x	1	x	1.62	x	16.15	x	0.72	x	0.7	=	9.14	(76)
West         0.9x         0.77         x         0.9         x         19.64         x         0.72         x         0.7         =         6.17         (80)           West         0.9x         0.54         x         1.58         x         38.42         x         0.72         x         0.7         =         14.87         (80)           West         0.9x         0.77         x         0.9         x         38.42         x         0.72         x         0.7         =         14.87         (80)           West         0.9x         0.54         x         1.58         x         63.27         x         0.72         x         0.7         =         24.49         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         19.89         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.77         x         0.9         x         113.09 <t< td=""><td>East</td><td>0.9x</td><td>3</td><td>x</td><td>1.62</td><td>x</td><td>16.15</td><td>x</td><td>0.72</td><td>x</td><td>0.7</td><td>=</td><td>27.42</td><td>(76)</td></t<>	East	0.9x	3	x	1.62	x	16.15	x	0.72	x	0.7	=	27.42	(76)
West         0.9x         0.54         x         1.58         x         38.42         x         0.72         x         0.7         =         14.87         (80)           West         0.9x         0.77         x         0.9         x         38.42         x         0.72         x         0.7         =         12.08         (80)           West         0.9x         0.54         x         1.58         x         63.27         x         0.72         x         0.7         =         24.49         (80)           West         0.9x         0.54         x         1.58         x         63.27         x         0.72         x         0.7         =         24.49         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         35.71         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.77         x         0.9         x         113.09	West	0.9x	0.54	x	1.58	x	19.64	X	0.72	x	0.7	=	7.6	(80)
West         0.9x         0.77         x         0.9         x         38.42         x         0.72         x         0.7         =         12.08         (80)           West         0.9x         0.54         x         1.58         x         63.27         x         0.72         x         0.7         =         24.49         (80)           West         0.9x         0.77         x         0.9         x         63.27         x         0.72         x         0.7         =         24.49         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         19.89         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.77         x         0.9         x         113.09         <	West	0.9x	0.77	x	0.9	x	19.64	x	0.72	x	0.7	=	6.17	(80)
West         0.9x         0.54         x         1.58         x         63.27         x         0.72         x         0.7         =         24.49         (80)           West         0.9x         0.77         x         0.9         x         63.27         x         0.72         x         0.7         =         19.89         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         35.71         (80)           West         0.9x         0.77         x         0.9         x         92.28         x         0.72         x         0.7         =         35.71         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.77         x         0.9         x         113.09         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.54         x         1.58         x         115.77         <	West	0.9x	0.54	x	1.58	x	38.42	x	0.72	x	0.7	=	14.87	(80)
West         0.9x         0.77         x         0.9         x         63.27         x         0.72         x         0.7         =         19.89         (80)           West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         35.71         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         43.77         (80)           West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.54         x         1.58         x         110.22	West	0.9x	0.77	x	0.9	x	38.42	X	0.72	x	0.7	=	12.08	(80)
West         0.9x         0.54         x         1.58         x         92.28         x         0.72         x         0.7         =         35.71         (80)           West         0.9x         0.77         x         0.9         x         92.28         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         43.77         (80)           West         0.9x         0.77         x         0.9         x         113.09         x         0.72         x         0.7         =         43.77         (80)           West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.54         x         1.58         x         110.22	West	0.9x	0.54	X	1.58	X	63.27	X	0.72	x	0.7	=	24.49	(80)
West         0.9x         0.77         x         0.9         x         92.28         x         0.72         x         0.7         =         29.01         (80)           West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         43.77         (80)           West         0.9x         0.77         x         0.9         x         113.09         x         0.72         x         0.7         =         43.77         (80)           West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.54         x         1.58         x         110.22         x         0.72         x         0.7         =         42.66         (80)           West         0.9x         0.54         x         1.58         x         94.68	West	0.9x	0.77	X	0.9	x	63.27	X	0.72	x	0.7	=	19.89	(80)
West         0.9x         0.54         x         1.58         x         113.09         x         0.72         x         0.7         =         43.77         (80)           West         0.9x         0.77         x         0.9         x         113.09         x         0.72         x         0.7         =         35.55         (80)           West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.77         x         0.9         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.54         x         1.58         x         110.22         x         0.72         x         0.7         =         42.66         (80)           West         0.9x         0.54         x         1.58         x         94.68         x         0.72         x         0.7         =         34.65         (80)           West         0.9x         0.54         x         1.58         x         73.59	West	0.9x	0.54	x	1.58	x	92.28	x	0.72	x	0.7	=	35.71	(80)
West         0.9x         0.77         x         0.9         x         113.09         x         0.72         x         0.7         =         35.55         (80)           West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.77         x         0.9         x         115.77         x         0.72         x         0.7         =         36.39         (80)           West         0.9x         0.54         x         1.58         x         110.22         x         0.72         x         0.7         =         36.39         (80)           West         0.9x         0.54         x         1.58         x         110.22         x         0.72         x         0.7         =         34.65         (80)           West         0.9x         0.54         x         1.58         x         94.68         x         0.72         x         0.7         =         29.76         (80)           West         0.9x         0.54         x         1.58         x         73.59	West	0.9x	0.77	x	0.9	x	92.28	X	0.72	x	0.7	=	29.01	(80)
West         0.9x         0.54         x         1.58         x         115.77         x         0.72         x         0.7         =         44.8         (80)           West         0.9x         0.77         x         0.9         x         115.77         x         0.72         x         0.7         =         36.39         (80)           West         0.9x         0.54         x         1.58         x         110.22         x         0.72         x         0.7         =         36.66         (80)           West         0.9x         0.77         x         0.9         x         110.22         x         0.72         x         0.7         =         34.65         (80)           West         0.9x         0.54         x         1.58         x         94.68         x         0.72         x         0.7         =         36.64         (80)           West         0.9x         0.54         x         1.58         x         73.59         x         0.72         x         0.7         =         28.48         (80)           West         0.9x         0.54         x         1.58         x         73.59	West	0.9x	0.54	x	1.58	x	113.09	X	0.72	x	0.7	=	43.77	(80)
West         0.9x         0.77         x         0.9         x         115.77         x         0.72         x         0.7         =         36.39         (80)           West         0.9x         0.54         x         1.58         x         110.22         x         0.72         x         0.7         =         42.66         (80)           West         0.9x         0.77         x         0.9         x         110.22         x         0.72         x         0.7         =         34.65         (80)           West         0.9x         0.54         x         1.58         x         94.68         x         0.72         x         0.7         =         36.64         (80)           West         0.9x         0.54         x         1.58         x         73.59         x         0.72         x         0.7         =         28.48         (80)           West         0.9x         0.54         x         1.58         x         73.59         x         0.72         x         0.7         =         23.13         (80)           West         0.9x         0.54         x         1.58         x         45.59	West	0.9x	0.77	x	0.9	x	113.09	X	0.72	x	0.7	=	35.55	(80)
West       0.9x       0.54       x       1.58       x       110.22       x       0.72       x       0.7       =       42.66       (80)         West       0.9x       0.77       x       0.9       x       110.22       x       0.72       x       0.7       =       34.65       (80)         West       0.9x       0.54       x       1.58       x       94.68       x       0.72       x       0.7       =       29.76       (80)         West       0.9x       0.54       x       1.58       x       73.59       x       0.72       x       0.7       =       28.48       (80)         West       0.9x       0.77       x       0.9       x       73.59       x       0.72       x       0.7       =       23.13       (80)         West       0.9x       0.54       x       1.58       x       45.59       x       0.72       x       0.7       =       17.64       (80)	West	0.9x	0.54	x	1.58	x	115.77	X	0.72	x	0.7	=	44.8	(80)
West         0.9x         0.77         x         0.9         x         110.22         x         0.72         x         0.7         =         34.65         (80)           West         0.9x         0.54         x         1.58         x         94.68         x         0.72         x         0.7         =         36.64         (80)           West         0.9x         0.54         x         1.58         x         73.59         x         0.72         x         0.7         =         28.48         (80)           West         0.9x         0.77         x         0.9         x         73.59         x         0.72         x         0.7         =         28.48         (80)           West         0.9x         0.54         x         1.58         x         45.59         x         0.72         x         0.7         =         23.13         (80)           West         0.9x         0.54         x         1.58         x         45.59         x         0.72         x         0.7         =         17.64         (80)	West	0.9x	0.77	x	0.9	x	115.77	X	0.72	x	0.7	=	36.39	(80)
West       0.9x       0.54       x       1.58       x       94.68       x       0.72       x       0.7       =       36.64       (80)         West       0.9x       0.77       x       0.9       x       94.68       x       0.72       x       0.7       =       29.76       (80)         West       0.9x       0.54       x       1.58       x       73.59       x       0.72       x       0.7       =       28.48       (80)         West       0.9x       0.77       x       0.9       x       73.59       x       0.72       x       0.7       =       23.13       (80)         West       0.9x       0.54       x       1.58       x       45.59       x       0.72       x       0.7       =       17.64       (80)	West	0.9x	0.54	x	1.58	x	110.22	X	0.72	x	0.7	=	42.66	(80)
West       0.9x       0.77       x       0.9       x       94.68       x       0.72       x       0.7       =       29.76       (80)         West       0.9x       0.54       x       1.58       x       73.59       x       0.72       x       0.7       =       28.48       (80)         West       0.9x       0.77       x       0.9       x       73.59       x       0.72       x       0.7       =       23.13       (80)         West       0.9x       0.54       x       1.58       x       45.59       x       0.72       x       0.7       =       17.64       (80)	West	0.9x	0.77	x	0.9	x	110.22	X	0.72	x	0.7	=	34.65	(80)
West       0.9x       0.54       x       1.58       x       73.59       x       0.72       x       0.7       =       28.48       (80)         West       0.9x       0.77       x       0.9       x       73.59       x       0.72       x       0.7       =       23.13       (80)         West       0.9x       0.54       x       1.58       x       45.59       x       0.72       x       0.7       =       17.64       (80)	West	0.9x	0.54	x	1.58	x	94.68	x	0.72	x	0.7	=	36.64	(80)
West       0.9x       0.77       x       0.9       x       73.59       x       0.72       x       0.7       =       23.13       (80)         West       0.9x       0.54       x       1.58       x       45.59       x       0.72       x       0.7       =       17.64       (80)	West	0.9x	0.77	x	0.9	x	94.68	x	0.72	x	0.7	=	29.76	(80)
West 0.9x 0.54 x 1.58 x 45.59 x 0.72 x 0.7 = 17.64 (80)	West	0.9x	0.54	x	1.58	x	73.59	x	0.72	x	0.7	=	28.48	(80)
	West	0.9x	0.77	x	0.9	x	73.59	x	0.72	x	0.7	] =	23.13	(80)
West 0.9x 0.77 x 0.9 x 45.59 x 0.72 x 0.7 = 14.33 (80)	West	0.9x	0.54	x	1.58	x	45.59	x	0.72	x	0.7	=	17.64	(80)
	West	0.9x	0.77	x	0.9	x	45.59	x	0.72	x	0.7	=	14.33	(80)

West	0.9x	0.54		x [	4.5		X		24.49	1 x		0.70	T x	0.7		0.49	(80)
West	0.9x	0.54	=	^ L x Г	0.9		×	$\vdash$	24.49	] ^ ] <sub>x</sub>		0.72	-	0.7		9.48	(80)
West	0.9x	0.77		^ L x [	1.5		x	_	6.15	] ^ ] x		0.72	<b>┤</b>	0.7		6.25	(80)
West	0.9x	0.54		^ L x [	0.9	==	x	_	6.15	] ^ ] x		0.72	^   x	0.7	<del></del>	5.08	(80)
	0.5%	0.77		^ L	0.8	,	^	<u>'</u>	0.10	] ^		0.72	^	0.7		5.06	(00)
Solar ga	ains in	watts, ca	alculate	ed f	for each	n month	า			(83)m	า = Sเ	um(74)m	(82)m				
(83)m=	85.67	166.8	276.45	$\overline{}$	411.62	515.59	$\overline{}$	33.59	505.56	426		323.77	198.0	5 106.59	70.65		(83)
Total ga	ains – i	nternal a	nd sol	ar (	(84)m =	(73)m	+ (	83)m	, watts						_	_	
(84)m=	478.72	556.93	651.59		763.43	843.91	8	339.6	797.84	725	.63	635.9	533.7	2 468.9	452.54		(84)
7. Mea	an inter	nal temp	erature	e (h	neating	seasoi	n)										
Tempe	erature	during h	eating	ре	riods in	the liv	ing	area	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisat	tion fac	tor for g	ains fo	r liv	ing are	a, h1,n	n (s	ee Ta	ble 9a)								
	Jan	Feb	Mar		Apr	May		Jun	Jul	Α	ug	Sep	Oc	Nov	Dec		
(86)m=	1	1	0.99		0.97	0.91		0.79	0.65	0.7	71	0.91	0.98	1	1		(86)
Mean	interna	l temper	ature ir	ı liv	ving are	ea T1 (f	follo	w ste	ps 3 to 7	in T	able	e 9c)		-	-		
(87)m=	18.95	19.14	19.5	T	20.03	20.48	7	20.82	20.94	20.	91	20.64	20.06	19.46	18.98		(87)
Tempe	erature	during h	eating	pe	riods in	rest o	f dv	vellina	from Ta	ble 9	<b>-</b> 9. Tł	n2 (°C)		•	•	_	
(88)m=	19.46	19.47	19.48	Ť	19.54	19.55	_	19.6	19.6	19.		19.58	19.55	19.53	19.5		(88)
L I Itilieat	tion fac	tor for g	ains foi	rre	et of du	vellina	h2	m (se	a Tahla	(a)					·	_	
(89)m=	1	0.99	0.98	Ť	0.95	0.87	$\overline{}$	0.68	0.47	0.5	54	0.84	0.97	0.99	1	7	(89)
L	intorno	l tompor			l	of dural	الل	T2 /f	allow etc	L	<u> </u>		o 0o)		_	_	
(90)m=	17.65	l temper	18.2	T	18.76	19.2	Ť	12 (10 19.51	19.58	19.		19.37	e 90) 18.8°	18.2	17.71	7	(90)
(50)	17.00	17.04	10.2		10.70	10.2		10.01	10.00					/ing area ÷		0.39	(91)
	. ,							` .							` '	0.00	(
Mean (92)m=	18.15	l temper	ature (1	$\overline{}$	19.25	19.69	$\overline{}$	<u>19) = f1</u> 20.02	20.11	+ (1		A) × 12 19.87	19.29	18.69	18.21	1	(92)
` ′ _		nent to the		ㅗ					l						10.21	_	(32)
(93)m=	18.15	18.35	18.71	$\overline{}$	19.25	19.69	$\overline{}$	20.02	20.11	20		19.87	19.29		18.21	7	(93)
		iting requ															
					peratur	e obtai	nec	at ste	ep 11 of	Tabl	le 9b	o, so that	t Ti,m	=(76)m aı	nd re-cal	culate	
the util	lisation	factor fo	or gains	s us	sing Ta	ble 9a	_							-	1	7	
L	Jan	Feb	Mar		Apr	May		Jun	Jul	A	ug	Sep	Oc	Nov	Dec		
	tion fac	tor for g		m:	0.05	0.00	_	0.70			1	0.00		1		7	(0.4)
(94)m=	1	0.99	0.98		0.95	0.88		0.72	0.54	0.6	51	0.86	0.97	0.99	1		(94)
_	gains, 476.52	hmGm , 552.35	639.74	Ť	726.15	738.78	Te	04.87	432.81	441	01	545.38	518.3	5 465.34	450.9	7	(95)
		age exte							402.01		.01	040.00	010.0	3 400.04	400.0		(00)
(96)m=	4.3	4.9	6.5	T	8.9	11.7	$\overline{}$	14.6	16.6	16	.4	14.1	10.6	7.1	4.2	1	(96)
L	oss rate	e for mea		na					l	<u> </u>		I – (96)m	1			_	
		1947.02		_	1418.73		_	06.14	457.26	478	<del>-</del> - 1	763.4	1180.6	7 1602.29	1971.61		(97)
Space	heatin	g require	ement f	or	each m	onth, k	Wr	n/mon	th = 0.02	24 x	(97)	m – (95)	)m] x	(41)m	· ·	_	
(98)m=	1152.04	937.21	826.35		498.66	258.06		0	0	C	)	0	492.7	7 818.61	1131.4		
											Total	per year (	(kWh/y	ear) = Sum(	98) <sub>15,912</sub> =	6115.1	(98)
Space	heatin	g require	ement i	n k	:Wh/m²	/year										76.09	(99)

9a. Energy requirements -	- Individual h	neating sy	ystems i	ncluding	micro-C	CHP)					
Space heating:						,					<b></b>
Fraction of space heat from			mentary	system		(004)				0	(201)
Fraction of space heat from	•	` ,			(202) = 1		, <u>.</u>			1	(202)
Fraction of total heating f	•				(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space										88	(206)
Efficiency of secondary/s	upplementa	ry heating	g systen	า, %	,					0	(208)
<u> </u>	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement		<del> </del>					100.77	040.04	1404.4	l	
	6.35 498.66	258.06	0	0	0	0	492.77	818.61	1131.4		
$(211)$ m = {[(98)m x (204)]	<u> </u>	1			Ι ,		550.00	000.04	1005.00	I	(211)
1309.13 1065.02 93	9.04 566.65	293.25	0	0	0 Tota	0 L(k\\\b\\\a	559.96 ar) =Sum(2	930.24	1285.69	00.40.00	7(244)
Consortion final (see		/ tl-			TOLA	ii (KVVII/yea	ai) =3uiii(2	2 1 1) <sub>15,101</sub>	2	6948.98	(211)
Space heating fuel (seco = {[(98)m x (201)]} x 100	• , .	rnonth									
(215)m =	0 0	0	0	0	0	0	0	0	0		
		Į.	Į	<u> </u>	Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,101</sub>	<u></u>	0	(215)
Water heating											_
Output from water heater										Ī	
	4.98 164.07	158.84	139.9	134.04	149.42	151.07	172.02	183.63	197.66		<b>–</b>
Efficiency of water heater		T 00		l	T 00		I 00	T 00	T 00	88	(216
, <u> </u>	88 88	88	88	88	88	88	88	88	88		(217
Fuel for water heating, kW (219)m = (64)m x 100 ÷											
` ' <del>                                   </del>	10.2 186.44	180.5	158.98	152.31	169.79	171.67	195.48	208.67	224.61		
	•				Tota	I = Sum(2	19a) <sub>112</sub> =		•	2290.73	(219
Annual totals							k'	Wh/yea	r	kWh/yea	<u>-</u>
Space heating fuel used,	main system	1								6948.98	╛
Water heating fuel used										2290.73	
Electricity for pumps, fans	and electric	keep-ho	t								
central heating pump:									30		(230
boiler with a fan-assisted	flue								45		(230
Total electricity for the abo		ar			sum	of (230a).	(230g) =			75	(231)
•	,, you	A1				,	· • • • • • • • • • • • • • • • • • • •				= '
Electricity for lighting										440.97	(232)
12a. CO2 emissions – In	dividual heat	ting syste	ems incli	uding mi	cro-CHF	)					
				<b>ergy</b> /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main syste	em 1)		(21	1) x			0.2	16	=	1500.98	(261)
Space heating (secondary	<b>'</b> )		(21	5) x			0.5	19	=	0	(263)
Water heating	•		(219	9) x			0.2		=	494.8	(264)
								1		434.0	(204)
Space and water heating			(26	1) + (262)	+ (263) + (	264) –	0.2			1995.78	(265)

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93	(267)
Electricity for lighting	(232) x	0.519 =	228.86	(268)
Total CO2, kg/year		sum of (265)(271) =	2263.57	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	28.16	(273)
El rating (section 14)			76	(274)

			User D	Details:						
Assessor Name:	John Simpson			Strom	a Num	ber:		STRO	0006273	
Software Name:	Stroma FSAP 2	2012		Softwa	are Ve	rsion:		Versio	n: 1.0.4.7	
				Address		R				
Address :	3.01, 25 Old Glo	ucester St,	LONDO	N, WC1	N 3AF					
1. Overall dwelling dim	nensions:		_							
One world floor				a(m²)	44. 3		ight(m)	٦,, ,	Volume(m	<u>-</u>
Ground floor				80.6	(1a) x	2	2.83	(2a) =	228.1	(3a)
Total floor area TFA = (	1a)+(1b)+(1c)+(1d)+	·(1e)+(1r	n) [	80.6	(4)					
Dwelling volume					(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	228.1	(5)
2. Ventilation rate:	main	seconda	***	other		total			m³ per hou	.,
	heating	heating	-	other	, ,	totai		40	m° per not	_
Number of chimneys	0 +	0	╛╵┖	0	<u> </u>	0	X	40 =	0	(6a)
Number of open flues	0 +	0	_ + _	0	_ = [	0	x 2	20 =	0	(6b)
Number of intermittent f	ans					3	X ·	10 =	30	(7a)
Number of passive vent	ts				Ī	0	x .	10 =	0	(7b)
Number of flueless gas	fires				F	0	X 4	40 =	0	(7c)
					<u>L</u>					
								Air ch	nanges per h	our —
Infiltration due to chimn	-					30		÷ (5) =	0.13	(8)
If a pressurisation test has		ended, procee	d to (17),	otherwise (	continue fr	om (9) to	(16)			<b>—</b> (0)
Number of storeys in Additional infiltration	the aweiling (hs)						[(0)]	-1]x0.1 =	0	(9)
Structural infiltration:	0.25 for steel or timb	er frame or	· 0 35 fo	r masoni	v constr	ruction	[(9)]	-1]XU.1 =	0	(11)
	present, use the value co				•	dollori			0	(11)
deducting areas of oper	nings); if equal user 0.35									
If suspended wooden	,	•	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, e	•								0	(13)
Percentage of window	ws and doors draugh	it stripped		0.05 10.0	(4.4)4	1001			0	(14)
Window infiltration Infiltration rate				0.25 - [0.2] (8) + (10)	. ,	-	± (15) =		0	(15)
Air permeability value	a GEO expressed in	cubic motro	oc par ba					aroa	0	(16)
If based on air permeat	•		•	•	•	elle ol e	rivelope	alea	15	(17)
Air permeability value appl	-					is beina u	sed		0.88	(10)
Number of sides shelter			•	,	,	J			2	(19)
Shelter factor				(20) = 1 -	[0.0 <b>75</b> x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ating shelter factor			(21) = (18	x (20) =				0.75	(21)
Infiltration rate modified	for monthly wind sp	eed							_	
Jan Feb	Mar Apr M	ay 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 Factor (22a)m = (	22)m ÷ 4									
(22a)m = 1.27   1.25	1.23 1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18	]	
,,									j	

O.96 O.96  Calculate effective If mechanical ve If exhaust air heat pu If balanced with heat a) If balanced me (24a)m= 0 C b) If balanced me (24b)m= 0 C c) If whole house if (22b)m < 0	air change ntilation: mp using App recovery: effice echanical vechanical vech	endix N, (2 ciency in % entilation	(3b) = (23a allowing f	a) × Fmv (e for in-use f at recove	equation (Nactor (from	0.69 N5)) , othe	0.75	0.81	0.84	0.88		
If mechanical ve If exhaust air heat pu If balanced with heat a) If balanced me (24a)m= 0 0 b) If balanced me (24b)m= 0 0 c) If whole house if (22b)m < 0	ntilation: mp using App recovery: effic echanical vo echanical vo	endix N, (2 ciency in % entilation	(3b) = (23a allowing f with he	a) × Fmv (e for in-use f at recove	equation (Nactor (from	N5)) , othe						
a) If balanced with heat a) If balanced mo (24a)m= 0 0 b) If balanced mo (24b)m= 0 0 c) If whole house if (22b)m < 0	recovery: efficechanical vo	ciency in % entilation	allowing f	for in-use f	actor (from	N5)) , othe					0	(23
a) If balanced mo (24a)m= 0 0  b) If balanced mo (24b)m= 0 0  c) If whole house if (22b)m < 0	echanical vo	entilation 0	with he	at recove			rwise (23b	) = (23a)			0	(23
(24a)m= 0 0 b) If balanced mo (24b)m= 0 0 c) If whole house if (22b)m < 0	o echanical ve	0	i	1	(B. 43. (I	n Table 4h	) =				0	(23
b) If balanced mo (24b)m= 0 0 c) If whole house if (22b)m < 0	chanical v		0		ery (MVI	HR) (24a	a)m = (22	2b)m + (	23b) <b>×</b> [	1 – (23c)	÷ 100]	
c) If whole house if (22b)m < 0		entilation		0	0	0	0	0	0	0		(24
c) If whole house if (22b)m < 0	0		without	heat red	covery (N	ИV) (24b	)m = (22	2b)m + (2	23b)			
if (22b)m < 0		0	0	0	0	0	0	0	0	0		(24
				•				5 × (23b	)			
(24c)m = 0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural vent if (22b)m = 1								0.5]			'	
(24d)m= 0.96 0.9	4 0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89		(24
Effective air char	ige rate - e	nter (24a	) or (24h	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.96 0.9	4 0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.86	0.89		(25)
3. Heat losses an	d heat loss	paramete	er:									
<b>ELEMENT</b>	Gross rea (m²)	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	<b>〈</b> )	k-value kJ/m²-ł		A X k kJ/K
Doors				2.1	х	1.8	=	3.78				(26)
Windows Type 1				1.58	x1,	/[1/( 1.6 )+	0.04] =	2.38				(27
Windows Type 2				1.3	x1,	/[1/( 1.6 )+	0.04] =	1.95				(27
Windows Type 3				1.02	x1,	/[1/( 1.6 )+	0.04] =	1.53				(27
Windows Type 4				1.39	x1,	/[1/( 1.6 )+	0.04] =	2.09				(27
Windows Type 5				1.02	x1,	/[1/( 1.6 )+	0.04] =	1.53				(27
Windows Type 6				1.85	x1,	/[1/( 1.6 )+	0.04] =	2.78				(27
Windows Type 7				0.9	x1,	/[1/( 1.6 )+	0.04] =	1.35				(27
Walls Type1	58.5	9.74		48.76	3 x	0.3	─	14.63				(29
Walls Type2	15.1	2.75	5	12.35	5 x	0.28	<b>=</b> i	3.46	7 7		7 F	(29
Walls Type3	12.7	2.1	=	10.6	x	0.28	<u> </u>	2.97	7 7		7 F	(29
Roof Type1	52.8	0	=	52.8	x	0.16	<u> </u>	8.45	7 7		7 F	(30
Roof Type2	27.8	0		27.8	x	0.18	<b>=</b>	5	7 7		<b>-</b>	(30
Total area of eleme	nts, m²			166.9	9							(31
Party wall				24.1	x	0.2		4.82			$\neg$	(32
* for windows and roof ** include the areas on				alue calcul	l ated using		 /[(1/U-valu		s given in	paragraph	3.2	
Fabric heat loss, W	/K = S (A x	(U)				(26)(30)	+ (32) =				61.89	(33
Heat capacity Cm	S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34
Thermal mass para	meter (TM	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35

can be u	ısed instea	ad of a det	tailed calcı	ulation.										
			x Y) cal		using Ap	pendix I	K						25.04	(36)
if details	of therma	ıl bridging	are not kn	own (36) =	= 0.15 x (3	1)								<b>_</b>
Total fa	abric hea	at loss							(33) +	(36) =			86.92	(37)
Ventila	tion hea		alculated	l monthly	У		1		` ′		(25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(2.2)
(38)m=	71.99	70.65	69.35	63.2	62.06	56.71	56.71	55.72	58.77	62.06	64.38	66.81		(38)
Heat tr	ansfer c		nt, W/K							= (37) + (37)	38)m		Ī	
(39)m=	158.91	157.58	156.27	150.13	148.98	143.63	143.63	142.64	145.69	148.98	151.3	153.73		7,00
Heat Id	ss para	meter (F	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39)₁ · (4)	12 /12=	150.12	(39)
(40)m=	1.97	1.96	1.94	1.86	1.85	1.78	1.78	1.77	1.81	1.85	1.88	1.91		_
Numbe	ar of day	re in mor	nth (Tabl	(12 ما					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.86	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
, ,							<u> </u>	<u> </u>			<u> </u>			
4 Wa	iter heat	ing ener	gy requi	rement								kWh/ye	ear:	
													Jan.	
if TF	ed occu A > 13.9 A £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		47		(42)
		•	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		92	2.96		(43)
		_				_	_	to achieve	a water us	se target o	f			` /
not more	. 1		person per			i .	•		_		l	_	Ī	
Hot wate	Jan ar usaga ir	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1c v	Aug	Sep	Oct	Nov	Dec		
ı	102.26	98.54	94.82	91.1	87.38	83.66	83.66	87.38	91.1	94.82	98.54	102.26		
(44)m=	102.20	90.04	94.02	91.1	07.30	03.00	03.00	07.30		<u> </u>	m(44) <sub>112</sub> =		1115.53	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600					1110.00	(\.,
(45)m=	151.64	132.63	136.86	119.32	114.49	98.8	91.55	105.05	106.31	123.89	135.24	146.86		
										Total = Su	m(45) <sub>112</sub> =	-	1462.64	(45)
İ								boxes (46					I	
(46)m= Water	22.75 storage	19.89	20.53	17.9	17.17	14.82	13.73	15.76	15.95	18.58	20.29	22.03		(46)
	_		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
•		,	nd no ta	•			_							` '
	-	•			•			mbi boil	ers) ente	er '0' in (	47)			
	storage												•	
,			eclared l		or is kno	wn (kWł	n/day):					0		(48)
•			m Table									0		(49)
•			storage eclared o	-		or is not		(48) x (49)	) =			0		(50)
Hot wa	iter stora	age loss	factor fr	om Tabl								0		(51)
		-	ee sectio	on 4.3									1	(=a)
	e factor		ble 2a m Table	2h							_	0		(52) (53)
· onipo			14010	-~								U	1	(00)

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ Enter (50) or (54) in (55)	(54) (55)
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	(55)
(56)m= 0 0 0 0 0 0 0 0 0 0 0	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	
(57)m= 0 0 0 0 0 0 0 0 0 0 0 0	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	<b>(50)</b>
(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 50.96 45.35 48.32 44.93 44.53 41.26 42.63 44.53 44.93 48.32 48.59 50.96	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 202.6   177.98   185.18   164.25   159.02   140.06   134.18   149.58   151.24   172.21   183.83   197.82	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)  (63)m= 0 0 0 0 0 0 0 0 0 0 0	(63)
	(03)
Output from water heater (64)m= 202.6 177.98 185.18 164.25 159.02 140.06 134.18 149.58 151.24 172.21 183.83 197.82	
	(64)
	(04)
Heat gains from water heating, kWh/month $0.25$ $'$ $[0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m] (65)m = 63.16   55.44   57.59   50.91   49.2   43.16   41.1   46.06   46.58   53.27   57.12   61.57$	(65)
	(00)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	(00)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	(66)
(67)m= 25.95 23.05 18.75 14.19 10.61 8.96 9.68 12.58 16.89 21.44 25.02 26.68	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
Appliances gains (calculated in Appendix E, equation E13 of E13a), also see Table 3	(66)
(68)m= 220 69 222 98 217 21 204 92 189 42 174 84 165 1 162 81 168 58 180 87 196 38 210 95	(67)
(68)m= 220.69 222.98 217.21 204.92 189.42 174.84 165.1 162.81 168.58 180.87 196.38 210.95	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	(67) (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37	(67) (68) (69)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37   Pumps and fans gains (Table 5a)  (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	(67) (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37   Pumps and fans gains (Table 5a)  (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	(67) (68) (69) (70)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 3	(67) (68) (69)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 3	(67) (68) (69) (70) (71)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 3	(67) (68) (69) (70)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 35.37 3	(67) (68) (69) (70) (71)

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

Orienta	tion:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	X	1.3	x	10.63	x	0.72	x	0.7	=	4.83	(74)
North	0.9x	0.77	x	1.85	x	10.63	х	0.72	x	0.7	<b>=</b>	6.87	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.72	x	0.7	=	9.23	(74)
North	0.9x	0.77	x	1.85	x	20.32	х	0.72	x	0.7	=	13.13	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.72	x	0.7	=	15.68	(74)
North	0.9x	0.77	x	1.85	x	34.53	x	0.72	x	0.7	=	22.31	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.72	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.85	x	55.46	x	0.72	x	0.7	=	35.84	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.72	x	0.7	=	33.92	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.72	x	0.7	=	48.28	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.72	x	0.7	=	36.32	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.72	x	0.7	=	51.68	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.72	X	0.7	=	33.91	(74)
North	0.9x	0.77	x	1.85	x	74.68	X	0.72	X	0.7	=	48.25	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.72	x	0.7	=	26.9	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.72	X	0.7	=	38.28	(74)
North	0.9x	0.77	x	1.3	x	41.52	X	0.72	X	0.7	=	18.85	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.72	x	0.7	=	26.83	(74)
North	0.9x	0.77	X	1.3	X	24.19	X	0.72	X	0.7	=	10.98	(74)
North	0.9x	0.77	X	1.85	x	24.19	X	0.72	X	0.7	=	15.63	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.72	x	0.7	=	5.96	(74)
North	0.9x	0.77	X	1.85	X	13.12	X	0.72	X	0.7	=	8.48	(74)
North	0.9x	0.77	X	1.3	X	8.86	x	0.72	x	0.7	=	4.02	(74)
North	0.9x	0.77	X	1.85	x	8.86	x	0.72	x	0.7	=	5.73	(74)
East	0.9x	2	X	1.02	X	19.64	X	0.72	X	0.7	=	13.99	(76)
East	0.9x	2	X	1.39	X	19.64	X	0.72	x	0.7	=	19.07	(76)
East	0.9x	2	X	1.02	X	19.64	x	0.72	X	0.7	=	13.99	(76)
East	0.9x	2	X	1.02	X	38.42	х	0.72	X	0.7	=	27.38	(76)
East	0.9x	2	X	1.39	X	38.42	х	0.72	X	0.7	=	37.31	(76)
East	0.9x	2	X	1.02	X	38.42	х	0.72	X	0.7	=	27.38	(76)
East	0.9x	2	X	1.02	X	63.27	X	0.72	x	0.7	=	45.08	(76)
East	0.9x	2	X	1.39	X	63.27	х	0.72	X	0.7	=	61.44	(76)
East	0.9x	2	X	1.02	X	63.27	х	0.72	X	0.7	=	45.08	(76)
East	0.9x	2	X	1.02	X	92.28	X	0.72	x	0.7	=	65.75	(76)
East	0.9x	2	X	1.39	x	92.28	x	0.72	x	0.7	=	89.6	(76)
East	0.9x	2	X	1.02	x	92.28	x	0.72	x	0.7	=	65.75	(76)
East	0.9x	2	X	1.02	x	113.09	x	0.72	x	0.7	=	80.58	(76)
East	0.9x	2	X	1.39	x	113.09	x	0.72	x	0.7	=	109.81	(76)
East	0.9x	2	X	1.02	×	113.09	x	0.72	X	0.7	=	80.58	(76)

Foot	۰. ۲		1		1		1		1		1		7(70)
East	0.9x	2	X	1.02	X	115.77	X	0.72	X	0.7	=	82.49	(76)
East	0.9x	2	X	1.39	X	115.77	X	0.72	X	0.7	=	112.41	(76)
East	0.9x	2	X	1.02	X	115.77	X	0.72	X	0.7	=	82.49	(76)
East	0.9x	2	X	1.02	X	110.22	X	0.72	X	0.7	=	78.53	(76)
East -	0.9x	2	X	1.39	X	110.22	X	0.72	X	0.7	=	107.02	(76)
East	0.9x	2	X	1.02	X	110.22	X	0.72	X	0.7	=	78.53	(76)
East	0.9x	2	X	1.02	X	94.68	X	0.72	X	0.7	=	67.46	(76)
East	0.9x	2	X	1.39	X	94.68	X	0.72	X	0.7	=	91.93	(76)
East	0.9x	2	X	1.02	X	94.68	X	0.72	X	0.7	=	67.46	(76)
East	0.9x	2	X	1.02	X	73.59	X	0.72	X	0.7	=	52.43	(76)
East	0.9x	2	X	1.39	X	73.59	X	0.72	X	0.7	=	71.45	(76)
East	0.9x	2	x	1.02	X	73.59	X	0.72	X	0.7	=	52.43	(76)
East	0.9x	2	x	1.02	x	45.59	x	0.72	x	0.7	=	32.48	(76)
East	0.9x	2	x	1.39	x	45.59	X	0.72	x	0.7	=	44.27	(76)
East	0.9x	2	X	1.02	x	45.59	X	0.72	x	0.7	=	32.48	(76)
East	0.9x	2	x	1.02	x	24.49	X	0.72	x	0.7	=	17.45	(76)
East	0.9x	2	x	1.39	x	24.49	X	0.72	x	0.7	=	23.78	(76)
East	0.9x	2	x	1.02	x	24.49	X	0.72	x	0.7	=	17.45	(76)
East	0.9x	2	x	1.02	x	16.15	x	0.72	x	0.7	=	11.51	(76)
East	0.9x	2	x	1.39	x	16.15	x	0.72	x	0.7	=	15.68	(76)
East	0.9x	2	x	1.02	x	16.15	x	0.72	x	0.7	=	11.51	(76)
West	0.9x	0.54	x	1.58	x	19.64	x	0.72	x	0.7	j =	7.6	(80)
West	0.9x	0.77	x	0.9	x	19.64	x	0.72	x	0.7	=	6.17	(80)
West	0.9x	0.54	x	1.58	x	38.42	x	0.72	x	0.7	=	14.87	(80)
West	0.9x	0.77	x	0.9	x	38.42	x	0.72	x	0.7	=	12.08	(80)
West	0.9x	0.54	x	1.58	x	63.27	X	0.72	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	0.9	x	63.27	X	0.72	x	0.7	=	19.89	(80)
West	0.9x	0.54	x	1.58	x	92.28	X	0.72	x	0.7	=	35.71	(80)
West	0.9x	0.77	x	0.9	x	92.28	X	0.72	x	0.7	=	29.01	(80)
West	0.9x	0.54	x	1.58	x	113.09	x	0.72	x	0.7	=	43.77	(80)
West	0.9x	0.77	x	0.9	x	113.09	x	0.72	x	0.7	=	35.55	(80)
West	0.9x	0.54	x	1.58	x	115.77	x	0.72	x	0.7	=	44.8	(80)
West	0.9x	0.77	x	0.9	x	115.77	x	0.72	x	0.7	=	36.39	(80)
West	0.9x	0.54	x	1.58	x	110.22	x	0.72	x	0.7	=	42.66	(80)
West	0.9x	0.77	x	0.9	x	110.22	X	0.72	x	0.7	j =	34.65	(80)
West	0.9x	0.54	х	1.58	x	94.68	x	0.72	x	0.7	j =	36.64	(80)
West	0.9x	0.77	x	0.9	x	94.68	x	0.72	x	0.7	j =	29.76	(80)
West	0.9x	0.54	x	1.58	x	73.59	x	0.72	x	0.7	j =	28.48	(80)
West	0.9x	0.77	x	0.9	x	73.59	x	0.72	x	0.7	j =	23.13	(80)
West	0.9x	0.54	x	1.58	x	45.59	x	0.72	x	0.7	j   =	17.64	(80)
West	0.9x	0.77	x	0.9	x	45.59	x	0.72	X	0.7	=	14.33	(80)

West	0.9x	0.54	×	1.5	:0	x		24.49	l <sub>x</sub>		0.72	x	0.7		9.48	(80)
West	0.9x	0.54	$=$ $\hat{x}$	0.		X		24.49	] ^   x		0.72	$\frac{1}{x}$	0.7	<del>-</del> -	7.7	(80)
West	0.9x	0.54	×	1.5		x		6.15	] ^ ] x		0.72		0.7		6.25	(80)
West	0.9x	0.77	×	0.	==	x	_	6.15	] 		0.72	X	0.7		5.08	(80)
	L	0.11		<u> </u>	<u> </u>		<u> </u>	0.10	I		0.72		0.1		0.00	(\
Solar ga	ains in	watts, ca	alculated	for eac	h month	1			(83)m	n = Sı	um(74)m .	(82)m				
(83)m=	72.53	141.36	233.97	346.85	432.49	4	46.58	423.55	358	.43	273.61	167.8	2 90.28	59.78		(83)
Total ga	ains – i	nternal a	nd sola	(84)m =	= (73)m	+ (	83)m	, watts							-	
(84)m=	467.18	533	610.44	699.78	761.76	7	53.44	716.68	658	.85	586.88	504.8	5 454.12	443.28		(84)
7. Mea	an inter	nal temp	erature	(heating	seasor	1)										
Tempe	erature	during h	eating p	eriods ir	n the livi	ng	area f	from Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisat	tion fac	tor for g	ains for	living are	ea, h1,m	า (s	ee Ta	ble 9a)							-	_
L	Jan	Feb	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oc	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.94		0.85	0.73	0.7	78	0.93	0.99	1	1		(86)
Mean i	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	in T	able	e 9c)					
(87)m=	18.78	18.96	19.31	19.83	20.31	2	20.71	20.89	20.	85	20.52	19.9	19.3	18.81		(87)
Tempe	erature	during h	eating p	eriods ir	n rest of	dw	velling	from Ta	ble 9	9, Tł	n2 (°C)					
(88)m=	19.35	19.36	19.37	19.43	19.44	$\overline{}$	19.48	19.48	19.		19.46	19.44	19.42	19.4		(88)
Utilisat	tion fac	tor for g	ains for	rest of d	wellina.	h2	.m (se	ee Table	9a)	•			•		_	
(89)m=	1	0.99	0.99	0.97	0.91	$\overline{}$	0.75	0.54	0.6	61	0.88	0.98	0.99	1		(89)
L Mean i	interna	l temper	ature in	the rest	of dwell	ina	T2 (f	ollow etc	ne 3	to 7	7 in Tahl			·!	_	
(90)m=	17.4	17.59	17.94	18.49	18.96	Ť	19.34	19.46	19.		19.19	18.59	17.96	17.46	7	(90)
(33)				<u> </u>				<u> </u>					/ing area ÷		0.39	(91)
Maga	:	1 40 00 0 0 0	ata /fa	ماديد مادس	مام مان	.11:	اء (م	I A T4	. /4	£I	Λ\ Το					
(92)m=	17.94	l temper	18.47	19.01	19.48	_	19.87	20.01	+ ( I 19.		19.7	19.1	18.48	17.98	1	(92)
` ′		nent to the		l	ļ			l		!				17.00		(- )
(93)m=	17.94	18.12	18.47	19.01	19.48	т —	19.87	20.01	19.	T	19.7	19.1	18.48	17.98	]	(93)
8. Spa	ice hea	ting requ	ıiremen													
						nec	d at ste	ep 11 of	Tabl	le 9b	o, so tha	t Ti,m	=(76)m a	nd re-cal	culate	
the util		factor fo			l e	_	_		Ι.		_		1	1 -	7	
1.14:1: 4	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oc	Nov	Dec		
(94)m=	1	tor for ga	0.98	0.96	0.91	Т	0.78	0.62	0.6	38	0.89	0.98	0.99	1	7	(94)
_	nains	hmGm ,			<u> </u>		0.70	0.02			0.00	0.50	0.55	<u> </u>	_	(0.)
	465.03	528.97	601.11	673.6	691.14	5	91.08	442.01	445	.55	521.45	492.5	6 450.82	441.63		(95)
_	ly aver	age exte	rnal tem	ı perature	from T	abl	le 8	Į	<u> </u>	!			!			
(96)m=	4.3	4.9	6.5	8.9	11.7	$\overline{}$	14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat Id	oss rate	e for mea	an interr	al temp	erature,	Lm	າ , W =	=[(39)m :	x [(9:	3)m-	– (96)m	]			_	
(97)m=	2166.75	2082.89	1870.36	1518.1	1159.2	7	757.3	489.68	512	.38	816.5	1266.2	29 1722.05	2118.4		(97)
Space	heatin	g require	ement fo	r each n	nonth, k	Wr	n/mont	th = 0.02	24 x	[(97)	m – (95	)m] x	(41)m		<b>-</b>	
(98)m=	1266.08	1044.24	944.32	608.04	348.23		0	0	C	)	0	575.6	6 915.29	1247.52		_
										Total	l per year	(kWh/y	ear) = Sum(	98) <sub>15,912</sub> =	6949.37	(98)
Space	heatin	g require	ement in	kWh/m²	²/year										86.22	(99)

9a. Energy requiremer	nts – Ind	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating:										,		_
Fraction of space hea			. , ,	mentary	•						0	(201)
Fraction of space hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total heating	ng from	main sys	stem 1			(204) = (204)	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main spa	ace heat	ing syste	em 1								88	(206)
Efficiency of seconda	ry/suppl	ementar	y heating	g system	ı, %						0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating require	· `	i										
1266.08 1044.24		608.04	348.23	0	0	0	0	575.66	915.29	1247.52		
$(211)$ m = {[(98)m x (20				0		0		05440	10101	4447.00		(211)
1438.73 1186.63	1073.09	690.95	395.72	0	0	0 Tota	0 L(k\\\h\\\e2	654.16 ar) =Sum(2	1040.1	1417.63	7897.02	(211)
Space heating fuel (c	ocondor	v) k\/h/	month			rota	i (Kvvii) you	ar) =0arri(2	- ' '/15,1012		7697.02	(211)
Space heating fuel (see $= \{[(98)m \times (201)]\} \times 1$		• •	monun									
(215)m = 0 0	0	0	0	0	0	0	0	0	0	0		
						Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water heating										•		
Output from water hea				140.00	10110	4 40 50	454.04	170.01	400.00	407.00		
202.6 177.98 Efficiency of water hea	185.18	164.25	159.02	140.06	134.18	149.58	151.24	172.21	183.83	197.82	00	(216)
(217)m= 88 88	88	88	88	88	88	88	88	88	88	88	88	(217)
Fuel for water heating,			00	00	- 00	00	00	00	00	00		(=,
(219)m = $(64)$ m x 100												
(219)m= 230.23 202.25	210.43	186.64	180.7	159.15	152.48	169.98	171.86	195.69	208.9	224.79		_
						Tota	I = Sum(2 <sup>-</sup>				2293.13	(219)
Annual totals Space heating fuel use	ed main	system	1					k۱	Wh/year	· [	kWh/year 7897.02	٦
		oyotom:	•							<u> </u>		_  
Water heating fuel use											2293.13	╛
Electricity for pumps, fa	ans and	electric	keep-ho	į								
central heating pumps	:									30		(230c)
boiler with a fan-assis	sted flue									45		(230e)
												_
Total electricity for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Total electricity for the Electricity for lighting	above, I	kWh/yea	r			sum	of (230a).	(230g) =			75 458.37	(231)
Electricity for lighting		-		ems inclu	uding mi			(230g) =				╡
		-									458.37	(232)
Electricity for lighting		-		En	uding mi <b>ergy</b> /h/year				ion fac	tor		(232)
Electricity for lighting	– Individ	ual heati		<b>En</b> kW	ergy			Emiss	ion fac 2/kWh	tor =	458.37 Emissions	(232)
Electricity for lighting 12a. CO2 emissions -	– Individ ystem 1	ual heati		<b>En</b> kW (211	<b>ergy</b> /h/year			Emiss kg CO2	ion fac 2/kWh	,	458.37  Emissions kg CO2/yea	(232)
Electricity for lighting  12a. CO2 emissions -  Space heating (main s  Space heating (second	– Individ ystem 1	ual heati		En kW (211	<b>ergy</b> /h/year			Emiss kg CO2 0.22 0.52	ion fac 2/kWh	=	458.37 <b>Emissions</b> kg CO2/yea  1705.76	(232) ar (261) (263)
Electricity for lighting  12a. CO2 emissions -  Space heating (main s	– Individ system 1) dary)	ual heati		En kW (211 (215	ergy /h/year () × (5) ×			Emiss kg CO2	ion fac 2/kWh	=	458.37  Emissions kg CO2/yea	(232)

Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	237.89	(268)
Total CO2, kg/year		sum of (265)(271) =	2477.89	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	30.74	(273)
El rating (section 14)			74	(274)

# 14 Appendix C – Energy Efficient Worksheets

The following DER Worksheets are taken from the SAP 2012 software for each dwelling in accordance with current London Plan policy – these are following inclusion of the energy efficiency measures, but before inclusion of the photovoltaic systems proposed.

			lloor D	) otoilo						
Assessor Name: Software Name:	John Simpson Stroma FSAP 20 <sup>2</sup>		User D	Strom Softwa	are Vei				0006273 on: 1.0.4.7	
Address :	1.01, 25 Old Glouce			Address						
1. Overall dwelling dime	•	octor Ct,	201120	11, 11011	107.11					
3			Are	a(m²)		Av. He	ight(m)		Volume(m³	)
Ground floor				65.6	(1a) x		3	(2a) =	196.8	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1r	n) [	65.6	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	.(3n) =	196.8	(5)
2. Ventilation rate:										
		econdar neating	У	other		total			m³ per hou	r
Number of chimneys	0 +	0	+	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	] + [	0	] = [	0	x 2	20 =	0	(6b)
Number of intermittent far	ns					3	<b>x</b> '	10 =	30	(7a)
Number of passive vents					Ē	0	x -	10 =	0	(7b)
Number of flueless gas fir	res				F	0	x 4	40 =	0	(7c)
					<u>L</u>					
								Air ch	nanges per ho	our 
Infiltration due to chimney						30		÷ (5) =	0.15	(8)
If a pressurisation test has be Number of storeys in the		ed, procee	d to (17),	otherwise (	continue fr	om (9) to	(16)			<b>—</b> (0)
Additional infiltration	ie dweiling (115)						[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.	25 for steel or timber	frame or	0 35 fo	r masoni	v constr	uction	[(0)	1]XO.1 =	0	(11)
if both types of wall are pr	resent, use the value corres				•	dollor.			0	(/
deducting areas of opening	• / .	lad) ar O	1 (200)	ad) alaa	ontor O					7(40)
If suspended wooden f If no draught lobby, ent	•	iea) or u	. i (seaie	ea), eise	enter 0				0	(12)
Percentage of windows		trinned							0	(13)
Window infiltration	s and doors draught s	пррса		0.25 - [0.2	x (14) ÷ 1	001 =			0	(15)
Infiltration rate				(8) + (10)			+ (15) =		0	(16)
Air permeability value,	q50, expressed in cul	oic metre	s per ho	our per s	guare m	etre of e	envelope	area	5	(17)
If based on air permeabili			•	•	•		•		0.4	(18)
Air permeability value applies	s if a pressurisation test ha	s been dor	ne or a de	gree air pe	rmeability	is being u	sed			
Number of sides sheltere	d								2	(19)
Shelter factor				(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	-			(21) = (18	) x (20) =				0.34	(21)
Infiltration rate modified for	<del></del>	1						1	1	
1 1	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	1	1		_			•		1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter ar	nd wind s	speed) =	: (21a) x	(22a)m					
0.44	0.43	0.42	0.38	0.37	0.32	0.32	0.32	0.34	0.37	0.38	0.4		
Calculate effe		_	rate for t	he appli	icable ca	se	-			-			(23
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (	N5)) . othe	rwise (23b	) = (23a)			0	(23
If balanced with									, (,			0	(23
a) If balance		-	-	_					2h)m + (	23b) <b>x</b> [	1 – (23c)		(20
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
b) If balance	ed mech	anical ve	entilation	without	heat red	covery (I	u MV) (24t	p)m = (22)	2b)m + (2	 23b)	<u> </u>	l	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h				•	-				F (22h		•	•	
(24c)m = 0	0.5 7	0	then (24d	0 = (231)	), others	MISE (24	$\frac{1}{1} = (221)$	0	0	0	0	1	(24
d) If natural										U			(= :
,			m = (22k)	•					0.5]				
(24d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(24
Effective air	change	rate - er	nter (24a	or (24l	b) or (24	c) or (24	ld) in bo	x (25)	•		•		
(25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(25
3. Heat losse	s and he	eat loss i	naramete	ār.									
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	<b>&lt;</b> )	k-value kJ/m²-		A X k kJ/K
Doors					2.1	x	1.4		2.94	,			(26
Windows Type	e 1				1.58	x1	/[1/( 1.4 )+	0.04] =	2.09	Ħ			(27
Windows Type	e 2				1.5	x1	/[1/( 1.4 )+	0.04] =	1.99	Ħ			(27
Windows Type	e 3				2.2	x1	/[1/( 1.4 )+	0.04] =	2.92				(27
Windows Type	e 4				1.8	x1	/[1/( 1.4 )+	0.04] =	2.39	=			(27
Windows Type	e 5				1.8	x1	/[1/( 1.4 )+	0.04] =	2.39				(27
Windows Type	e 6				1.85	x1	/[1/( 1.4 )+	0.04] =	2.45				(27
Floor					65.6	x	0.2	— i	13.12	<b>=</b>			(28
Walls Type1	52.	3	12.48	3	39.82	<u> </u>	0.26	<del>-</del>	10.35	F i		<b>i</b> i	(29
Walls Type2	10.		1.85		8.25	×	0.18	<del>-</del>	1.49	F i		<b>i</b> i	(29
Walls Type3	22.	2	2.1		20.1	×	0.26	<del>-</del>	5.23	F i		<b>i</b> i	(29
Walls Type4	12.	6	0		12.6	×	0.18	<del>-</del>	2.27	F i		<b>i</b> i	(29
Total area of e	elements	s, m²			162.8	<u> </u>							(31
Party wall					16.3	=	0	ー - I	0	<b>—</b> [		<b>–</b>	(32
* for windows and ** include the are					alue calcul					ıs given in	paragraph	 1 3.2	
Fabric heat lo				o unu pai	auorio		(26)(30)	) + (32) =				54.39	(33
Heat capacity		•	- /						(30) + (32	2) + (32a).	(32e) =	0	(34
Thermal mass		` ,	⊃ = Cm ÷	- TFA) iı	n kJ/m²K			., ,	tive Value:	, , ,	, ,	250	(35)
For design asses	•	•		•			recisely the	e indicative	e values of	TMP in T	able 1f		`

Can be used instead of a detailed calculation.  Thermal bridges: S (L x Y) calculated using Appendix K  if details of thermal bridging are not known (36) = 0.15 x (31)  Total fabric heat loss  Ventilation heat loss calculated monthly  (38)m = 0.33 x (25)m x (5)     Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Total fabric heat loss
Ventilation heat loss calculated monthly  (38)m = 0.33 x (25)m x (5)  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  (38)m= 38.65 38.41 38.17 37.07 36.86 35.9 35.9 35.72 36.27 36.86 37.28 37.72  Heat transfer coefficient, W/K  (39)m= 117.46 117.22 116.98 115.88 115.67 114.71 114.71 114.53 115.08 115.67 116.09 116.53  Average = Sum(39) <sub>112</sub> /12= 115.88 (39)  Heat loss parameter (HLP), W/m²K  (40)m= (39)m ÷ (4)  (40)m= 1.79 1.79 1.78 1.77 1.76 1.75 1.75 1.75 1.75 1.76 1.77 1.78  Average = Sum(40) <sub>112</sub> /12= 1.77 (40)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
(38)m= 38.65 38.41 38.17 37.07 36.86 35.9 35.9 35.72 36.27 36.86 37.28 37.72 (38)  Heat transfer coefficient, W/K  (39)m= 117.46 117.22 116.98 115.88 115.67 114.71 114.71 114.53 115.08 115.67 116.09 116.53  Average = Sum(39) <sub>112</sub> /12= 115.88 (39)  Heat loss parameter (HLP), W/m²K  (40)m= 1.79 1.79 1.78 1.77 1.76 1.75 1.75 1.75 1.75 1.76 1.77 1.78  Average = Sum(40) <sub>112</sub> /12= 1.77 (40)
Heat transfer coefficient, W/K  (39)m= 117.46 117.22 116.98 115.88 115.67 114.71 114.71 114.53 115.08 115.67 116.09 116.53  Average = Sum(39) <sub>112</sub> /12= 115.88 (39)  Heat loss parameter (HLP), W/m²K  (40)m= 1.79 1.79 1.78 1.77 1.76 1.75 1.75 1.75 1.75 1.76 1.77 1.78  Average = Sum(40) <sub>112</sub> /12= 1.77 (40)
(39)m= 117.46 117.22 116.98 115.88 115.67 114.71 114.71 114.53 115.08 115.67 116.09 116.53  Average = Sum(39) <sub>112</sub> /12= 115.88 (39)  Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)  (40)m= 1.79 1.79 1.78 1.77 1.76 1.75 1.75 1.75 1.76 1.77 1.78  Average = Sum(40) <sub>112</sub> /12= 1.77 (40)
Heat loss parameter (HLP), W/m <sup>2</sup> K (40)m = $(39)$ m ÷ (4) (40)m = $1.79$ 1.78 1.77 1.76 1.75 1.75 1.75 1.76 1.77 1.78 Average = Sum(40) <sub>112</sub> /12= 1.77 (40)
Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)  (40)m= 1.79 1.79 1.78 1.77 1.76 1.75 1.75 1.75 1.76 1.77 1.78  Average = Sum(40) <sub>112</sub> /12= 1.77 (40)
Average = $Sum(40)_{112}/12 = 1.77$ (40)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(41)m= 31 28 31 30 31 30 31 30 31 30 31 (41)
4. Water heating energy requirement: kWh/year:
Assumed occupancy, N 2.13 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \text{ x (TFA } - 13.9)2)] + 0.0013 \text{ x (TFA } - 13.9)$ if TFA £ 13.9, N = 1
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)
(44)m= 93.39 89.99 86.6 83.2 79.81 76.41 76.41 79.81 83.2 86.6 89.99 93.39
Total = Sum(44) <sub>112</sub> = 1018.81 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)
(45)m= 138.5 121.13 124.99 108.97 104.56 90.23 83.61 95.94 97.09 113.15 123.51 134.13
Total = $Sum(45)_{112}$ = 1335.82 (45)  If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)
(46)m= 20.77   18.17   18.75   16.35   15.68   13.53   12.54   14.39   14.56   16.97   18.53   20.12   (46) Water storage loss:
Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)
If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:
a) If manufacturer's declared loss factor is known (kWh/day):  0 (48)
Temperature factor from Table 2b  0 (49)
Energy lost from water storage, kWh/year (48) x (49) = 110 (50) b) If manufacturer's declared cylinder loss factor is not known:
Hot water storage loss factor from Table 2 (kWh/litre/day)  0.02  (51)
If community heating see section 4.3
Volume factor from Table 2a  1.03  (52)  Tomporature factor from Table 2b
Temperature factor from Table 2b 0.6 (53)

Energy lost from wa	_	e, kWh/ye	ear			(47) x (51	) x (52) x (5	53) =	1.	03		(54)
Enter (50) or (54) ir									1.	03		(55)
Water storage loss	alculated	for each	month			((56)m = (	(55) × (41)r	n			ı	
(56)m= 32.01 28.9		30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contains dedic	ated solar sto	orage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 32.01 28.9	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit loss	annual) fro	om Table	∋ 3							0		(58)
Primary circuit loss			,	,	` '	` '						
(modified by facto	_	i				<del></del>	<del>'                                    </del>				l	
(59)m= 23.26 21.0	1 23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss calculate	ed for each	month (	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 0 0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat required	or water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × (	45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 193.77 171.0	6 180.27	162.47	159.84	143.72	138.89	151.22	150.58	168.43	177.01	189.4		(62)
Solar DHW input calcula	ed using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	on to wate	er heating)		
(add additional lines	if FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	3)					
(63)m = 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water h	eater											
(64)m= 193.77 171.0	6 180.27	162.47	159.84	143.72	138.89	151.22	150.58	168.43	177.01	189.4		_
						Outp	out from wa	ater heate	r (annual)₁	12	1986.66	(64)
Heat gains from wat	er heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n1 + 0 8 x	[(46)m	+ (57)m	+ (59)m	1	
	_	•		- L	()	(0 .)	1 0.0 /	(40)111	' (07)	' (00)	J	
(65)m= 90.27 80.2	<del></del>	79.03	78.99	72.8	72.02	76.12	75.08	81.84	83.86	88.82	]	(65)
(65)m= 90.27 80.2 include (57)m in c	2 85.78	79.03	78.99	72.8	72.02	76.12	75.08	81.84	83.86	88.82		(65)
	2 85.78 alculation	79.03 of (65)m	78.99 only if c	72.8	72.02	76.12	75.08	81.84	83.86	88.82		(65)
include (57)m in c	85.78 alculation	79.03 of (65)m 5 and 5a	78.99 only if c	72.8	72.02	76.12	75.08	81.84	83.86	88.82		(65)
include (57)m in c	85.78 alculation ee Table 5	79.03 of (65)m 5 and 5a	78.99 only if c	72.8	72.02	76.12	75.08	81.84	83.86	88.82		(65)
include (57)m in c 5. Internal gains (s Metabolic gains (Ta	85.78 alculation ee Table 5 ble 5), Wat o Mar	79.03 of (65)m 5 and 5a	78.99 only if c ):	72.8 ylinder i	72.02 s in the o	76.12 dwelling	75.08 or hot w	81.84 ater is fr	83.86 om com	88.82 munity h		(65)
include (57)m in c  5. Internal gains (5)  Metabolic gains (Ta  Jan Fe	85.78 alculation ee Table 5 ble 5), Wat marked Mar 4 106.74	79.03 of (65)m 5 and 5a tts Apr 106.74	78.99 only if c : May 106.74	72.8  ylinder is  Jun  106.74	72.02 s in the 0	76.12 dwelling Aug 106.74	75.08 or hot w Sep 106.74	81.84 ater is fr	83.86 om com	88.82 munity h		
include (57)m in control of the cont	85.78 alculation ee Table 5 ole 5), Wat o Mar 4 106.74 ulated in A	79.03 of (65)m 5 and 5a tts Apr 106.74	78.99 only if c : May 106.74	72.8  ylinder is  Jun  106.74	72.02 s in the 0	76.12 dwelling Aug 106.74	75.08 or hot w Sep 106.74	81.84 ater is fr	83.86 om com	88.82 munity h		
include (57)m in comparison of the comparison of	85.78 alculation ee Table 5 ole 5), Wat o Mar 4 106.74 allated in Ap	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12	78.99 only if c ):  May 106.74 L, equati 6.82	72.8  ylinder is  Jun  106.74  ion L9 0  5.76	72.02 s in the o Jul 106.74 r L9a), a 6.22	Aug 106.74 Iso see 8.09	75.08 or hot w Sep 106.74 Table 5	81.84 ater is fr  Oct 106.74	83.86 om com Nov 106.74	88.82 munity h		(66)
include (57)m in constraints of the constraints of	85.78 alculation ee Table 5 ble 5), Wat ble 5), Wat alculated in Ap alculated in Ap alculated in	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12	78.99 only if c ):  May 106.74 L, equati 6.82	72.8  ylinder is  Jun  106.74  ion L9 0  5.76	72.02 s in the o Jul 106.74 r L9a), a 6.22	Aug 106.74 Iso see 8.09	75.08 or hot w Sep 106.74 Table 5	81.84 ater is fr  Oct 106.74	83.86 om com Nov 106.74	88.82 munity h		(66)
include (57)m in comparison of the comparison of	85.78 alculation ee Table 8 ble 5), Wat b Mar 4 106.74 tlated in Ap 2 12.05 alculated ir 6 183.87	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equali 160.34	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76	76.12 dwelling Aug 106.74 lso see 8.09 3a), also 137.82	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11	83.86 om com Nov 106.74	88.82 munity h		(66) (67)
include (57)m in comparison of the control of the c	85.78 alculation ee Table 5 ole 5), Wat o Mar 4 106.74 allated in Ap 2 12.05 alculated ir 6 183.87 ulated in A	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equali 160.34	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76	76.12 dwelling Aug 106.74 lso see 8.09 3a), also 137.82	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11	83.86 om com Nov 106.74	88.82 munity h		(66) (67)
include (57)m in comparison of the control of the c	85.78 alculation ee Table 5 ole 5), Wat o Mar 4 106.74 tlated in Ap 2 12.05 alculated ir 6 183.87 ulated in A 7 33.67	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47 ppendix 33.67	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equati 160.34 L, equat	Jun 106.74 ion L9 of 5.76 uation L 148.01 ion L15	72.02 s in the of  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a)	76.12 dwelling  Aug 106.74 lso see 8.09 3a), also 137.82 ), also se	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table	81.84 ater is fr  Oct 106.74  13.78 ole 5 153.11 5	83.86 om com Nov 106.74 16.08	88.82 munity h		(66) (67) (68)
include (57)m in comparison of the control of the c	85.78 alculation ee Table 5 ole 5), Wat o Mar 4 106.74 tlated in Ap 2 12.05 alculated ir 6 183.87 ulated in A 7 33.67	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47 ppendix 33.67 5a)	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equati 33.67	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01  ion L15 33.67	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67	Aug 106.74 Iso see 8.09 3a), also 137.82 ), also se 33.67	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11 5 33.67	83.86 om com Nov 106.74 16.08	88.82 munity h  Dec 106.74  17.15  178.58		(66) (67) (68) (69)
include (57)m in comparison of the following series of	85.78 alculation ee Table 6 ble 5), Wat b Mar 4 106.74 alated in Ap 2 12.05 alculated in A 6 183.87 ulated in A 7 33.67 ns (Table 6) 0	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47 ppendix 33.67 5a) 0	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equat 33.67	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01  ion L15 33.67	72.02 s in the of  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a)	76.12 dwelling  Aug 106.74 lso see 8.09 3a), also 137.82 ), also se	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table	81.84 ater is fr  Oct 106.74  13.78 ole 5 153.11 5	83.86 om com Nov 106.74 16.08	88.82 munity h		(66) (67) (68)
include (57)m in comparison of the comparison of	85.78 alculation ee Table 8 ble 5), Wat b Mar 4 106.74 tlated in Ap 2 12.05 alculated ir 6 183.87 ulated in A 7 33.67 ns (Table 8 0 tion (nega	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Appendix 173.47 ppendix 33.67 5a) 0 tive valu	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equati 33.67  0 es) (Tab	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01  ion L15 33.67  0  le 5)	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67	76.12 dwelling Aug 106.74 lso see 8.09 3a), also 137.82 ), also se 33.67	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11 5 33.67	83.86 om com Nov 106.74 16.08 166.24	88.82 munity h  Dec 106.74  17.15  178.58  33.67		(66) (67) (68) (69) (70)
include (57)m in comparison of the following spains (58)    Metabolic gains (Tallous Jan Ferman 106.74 106.	85.78 alculation ee Table 8 ble 5), Wat b Mar 4 106.74 alated in Ap 2 12.05 alculated ir 6 183.87 alated in Ap 33.67 ns (Table 9 -85.39	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47 ppendix 33.67 5a) 0	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equat 33.67	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01  ion L15 33.67	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67	Aug 106.74 Iso see 8.09 3a), also 137.82 ), also se 33.67	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11 5 33.67	83.86 om com Nov 106.74 16.08	88.82 munity h  Dec 106.74  17.15  178.58		(66) (67) (68) (69)
include (57)m in comparison of the following spains (58). Internal gains	85.78 alculation ee Table 5 ole 5), Wat o Mar 4 106.74 tlated in Ap 2 12.05 alculated ir 6 183.87 ulated in A 7 33.67 ns (Table 5) tion (nega 9 -85.39 (Table 5)	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47 ppendix 33.67 5a) 0 tive valu -85.39	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equat 33.67  0 es) (Tab -85.39	72.8 ylinder is  Jun 106.74 ion L9 of 5.76 uation L 148.01 ion L15 33.67  0 le 5) -85.39	72.02 s in the of  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67	76.12 dwelling  Aug 106.74 lso see 8.09 3a), also 137.82 ), also se 33.67	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67  0  -85.39	81.84 ater is fr  Oct 106.74  13.78 ole 5 153.11 5 33.67  0	83.86 om com Nov 106.74 16.08 166.24 33.67	88.82 munity h  Dec 106.74  17.15  178.58  33.67  0		(66) (67) (68) (69) (70)
include (57)m in comparison of the following spains (52) and the following spains (53) and the following spains (54) and the following spains (54) and the following spains (55) and the following spains (56) and the f	85.78  alculation  ee Table 8  ble 5), Wat  allow Mar  4 106.74  llated in Ap  2 12.05  alculated in Ap  6 183.87  ulated in Ap  7 33.67  ns (Table 8  0 tion (negative properties)  7 115.3	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Appendix 173.47 ppendix 33.67 5a) 0 tive valu	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equati 33.67  0 es) (Tab	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01  ion L15 33.67  0  le 5) -85.39	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67  0  -85.39	76.12 dwelling Aug 106.74 lso see 8.09 3a), also 137.82 ), also se 33.67  0  -85.39	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67  0  -85.39	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11 5 33.67  0  -85.39	83.86  Om com  Nov  106.74  16.08  166.24  33.67  0  -85.39	88.82 munity h  Dec 106.74  17.15  178.58  33.67  0  -85.39		(66) (67) (68) (69) (70)
include (57)m in comparison of the following spains (58)    Metabolic gains (Tall Jan Ferman	85.78  alculation  ee Table 6  ble 5), Wat  allated in A  106.74  allated in A  12 12.05  alculated in A  33.67  allated in A  33.67  allated in A  (Table 6)  0  tion (negans)  (Table 5)  7 115.3	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Appendix 33.67 5a) 0 tive valu -85.39	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equat 33.67  0 es) (Tab -85.39	72.8 ylinder is  Jun 106.74 fon L9 of 5.76 uation L 148.01 ion L15 33.67  0 le 5) -85.39  101.11 (66)	72.02 s in the of  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67  0  -85.39	76.12 dwelling Aug 106.74 lso see 8.09 3a), also 137.82 ), also se 33.67  0  -85.39	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67  0  -85.39	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11 5 33.67  0  -85.39  110  70)m + (7	83.86  om com  Nov  106.74  16.08  166.24  33.67  0  -85.39  116.48  1)m + (72)	88.82 munity h  Dec 106.74  17.15  178.58  33.67  0  -85.39  119.38		(66) (67) (68) (69) (70) (71)
include (57)m in comparison of the following spains (52) and the following spains (53) and the following spains (54) and the following spains (54) and the following spains (55) and the following spains (56) and the f	85.78  alculation  ee Table 6  ble 5), Wat  allated in A  106.74  allated in A  12 12.05  alculated in A  33.67  allated in A  33.67  allated in A  (Table 6)  0  tion (negans)  (Table 5)  7 115.3	79.03 of (65)m 5 and 5a tts Apr 106.74 opendix 9.12 n Append 173.47 ppendix 33.67 5a) 0 tive valu -85.39	78.99 only if c ):  May 106.74 L, equati 6.82 dix L, equ 160.34 L, equat 33.67  0 es) (Tab -85.39	72.8  ylinder is  Jun 106.74  ion L9 of 5.76  uation L 148.01  ion L15 33.67  0  le 5) -85.39	72.02 s in the o  Jul 106.74 r L9a), a 6.22 13 or L1 139.76 or L15a) 33.67  0  -85.39	76.12 dwelling Aug 106.74 lso see 8.09 3a), also 137.82 ), also se 33.67  0  -85.39	75.08 or hot w  Sep 106.74 Table 5 10.85 o see Tal 142.71 ee Table 33.67  0  -85.39	81.84 ater is fr  Oct 106.74  13.78 ble 5 153.11 5 33.67  0  -85.39	83.86  Om com  Nov  106.74  16.08  166.24  33.67  0  -85.39	88.82 munity h  Dec 106.74  17.15  178.58  33.67  0  -85.39		(66) (67) (68) (69) (70)

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

Orientat	tion:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.5	x	10.63	x	0.72	x	0.7	] =	5.57	(74)
North	0.9x	0.77	x	1.85	x	10.63	x	0.72	х	0.7	=	6.87	(74)
North	0.9x	0.77	x	1.5	x	20.32	x	0.72	х	0.7	=	10.65	(74)
North	0.9x	0.77	x	1.85	x	20.32	х	0.72	x	0.7	] =	13.13	(74)
North	0.9x	0.77	x	1.5	x	34.53	x	0.72	х	0.7	=	18.09	(74)
North	0.9x	0.77	X	1.85	x	34.53	X	0.72	х	0.7	=	22.31	(74)
North	0.9x	0.77	x	1.5	x	55.46	x	0.72	х	0.7	=	29.06	(74)
North	0.9x	0.77	x	1.85	x	55.46	X	0.72	x	0.7	=	35.84	(74)
North	0.9x	0.77	x	1.5	x	74.72	x	0.72	х	0.7	=	39.14	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.72	x	0.7	=	48.28	(74)
North	0.9x	0.77	x	1.5	x	79.99	x	0.72	x	0.7	=	41.9	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.72	x	0.7	=	51.68	(74)
North	0.9x	0.77	x	1.5	x	74.68	x	0.72	x	0.7	=	39.12	(74)
North	0.9x	0.77	x	1.85	x	74.68	x	0.72	x	0.7	=	48.25	(74)
North	0.9x	0.77	x	1.5	x	59.25	x	0.72	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.72	X	0.7	=	38.28	(74)
North	0.9x	0.77	x	1.5	x	41.52	x	0.72	x	0.7	=	21.75	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.72	x	0.7	=	26.83	(74)
North	0.9x	0.77	x	1.5	x	24.19	x	0.72	x	0.7	=	12.67	(74)
North	0.9x	0.77	x	1.85	x	24.19	x	0.72	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	1.5	x	13.12	x	0.72	x	0.7	=	6.87	(74)
North	0.9x	0.77	x	1.85	x	13.12	x	0.72	X	0.7	=	8.48	(74)
North	0.9x	0.77	x	1.5	x	8.86	x	0.72	X	0.7	=	4.64	(74)
North	0.9x	0.77	x	1.85	x	8.86	x	0.72	X	0.7	=	5.73	(74)
East	0.9x	1	x	2.2	x	19.64	X	0.72	X	0.7	=	15.09	(76)
East	0.9x	1	x	1.8	x	19.64	X	0.72	x	0.7	=	12.35	(76)
East	0.9x	3	X	1.8	x	19.64	X	0.72	x	0.7	=	37.04	(76)
East	0.9x	1	X	2.2	x	38.42	X	0.72	x	0.7	=	29.52	(76)
East	0.9x	1	x	1.8	x	38.42	X	0.72	X	0.7	=	24.15	(76)
East	0.9x	3	X	1.8	x	38.42	X	0.72	X	0.7	=	72.46	(76)
East	0.9x	1	X	2.2	x	63.27	X	0.72	X	0.7	=	48.62	(76)
East	0.9x	1	x	1.8	x	63.27	X	0.72	x	0.7	=	39.78	(76)
East	0.9x	3	X	1.8	x	63.27	X	0.72	x	0.7	=	119.34	(76)
East	0.9x	1	X	2.2	x	92.28	X	0.72	x	0.7	=	70.91	(76)
East	0.9x	1	x	1.8	x	92.28	X	0.72	X	0.7	=	58.02	(76)
East	0.9x	3	X	1.8	x	92.28	x	0.72	x	0.7	=	174.05	(76)
East	0.9x	1	X	2.2	x	113.09	x	0.72	x	0.7	=	86.9	(76)
East	0.9x	1	X	1.8	x	113.09	x	0.72	x	0.7	=	71.1	(76)
East	0.9x	3	X	1.8	×	113.09	X	0.72	X	0.7	] =	213.3	(76)

Foot	۰. ۲									ı		<b>-</b> 1				(70)
East	0.9x	1		X	2.2		X	115.77	=	X	0.72	×	0.7	=	88.96	(76)
East	0.9x	1	픸	X	1.8		X	115.77	7	X	0.72	X	0.7	=	72.78	(76)
East	0.9x	3		X	1.8		X	115.77	7	X	0.72	X	0.7	=	218.35	(76)
East	0.9x	1		X	2.2		X	110.22	2	X	0.72	X	0.7	_ =	84.69	(76)
East	0.9x	1		X	1.8		X	110.22	2	X	0.72	X	0.7	=	69.29	(76)
East	0.9x	3		X	1.8		X	110.22	2	X	0.72	X	0.7	=	207.88	(76)
East	0.9x	1		X	2.2		X	94.68		X	0.72	X	0.7	=	72.75	(76)
East	0.9x	1		X	1.8		X	94.68		X	0.72	X	0.7	=	59.52	(76)
East	0.9x	3		X	1.8		X	94.68		X	0.72	X	0.7	=	178.57	(76)
East	0.9x	1		X	2.2		X	73.59		X	0.72	X	0.7	=	56.55	(76)
East	0.9x	1		X	1.8		X	73.59		X	0.72	X	0.7	=	46.26	(76)
East	0.9x	3		X	1.8		x	73.59		X	0.72	X	0.7	=	138.79	(76)
East	0.9x	1		X	2.2		X	45.59		X	0.72	X	0.7	=	35.03	(76)
East	0.9x	1		X	1.8		x	45.59		X	0.72	X	0.7	=	28.66	(76)
East	0.9x	3		X	1.8		x	45.59		X	0.72	X	0.7	=	85.98	(76)
East	0.9x	1		X	2.2		x	24.49		X	0.72	x	0.7	=	18.82	(76)
East	0.9x	1		X	1.8		X	24.49		X	0.72	X	0.7	=	15.4	(76)
East	0.9x	3		X	1.8		x	24.49		X	0.72	X	0.7	=	46.19	(76)
East	0.9x	1		X	2.2		x	16.15		x	0.72	х	0.7		12.41	(76)
East	0.9x	1		X	1.8		x	16.15		x	0.72	x	0.7	=	10.15	(76)
East	0.9x	3		X	1.8		x	16.15		X	0.72	x	0.7	=	30.46	(76)
West	0.9x	0.54		X	1.58		x	19.64		x	0.72	x	0.7	=	7.6	(80)
West	0.9x	0.54		X	1.58		x	38.42		x	0.72	x	0.7	=	14.87	(80)
West	0.9x	0.54	司	X	1.58		x	63.27	ī	x	0.72	x	0.7	=	24.49	(80)
West	0.9x	0.54		X	1.58		x	92.28		x	0.72	x	0.7		35.71	(80)
West	0.9x	0.54		X	1.58		x	113.09	9	x	0.72	x	0.7	=	43.77	(80)
West	0.9x	0.54		X	1.58		x	115.77	7	x	0.72	x	0.7		44.8	(80)
West	0.9x	0.54		X	1.58		x	110.22	2	x	0.72	x	0.7	_ =	42.66	(80)
West	0.9x	0.54		X	1.58		x	94.68	ī	x	0.72	x	0.7		36.64	(80)
West	0.9x	0.54		X	1.58		X	73.59		X	0.72	x	0.7	<del>-</del>	28.48	(80)
West	0.9x	0.54		X	1.58		x	45.59		X	0.72	×	0.7	=	17.64	(80)
West	0.9x	0.54		X	1.58		x	24.49		X	0.72	x	0.7	=	9.48	(80)
West	0.9x	0.54		X	1.58		x	16.15	=	X	0.72	X	0.7	╡ -	6.25	(80)
	L									'						` ` ′
Solar a	ains in	watts, ca	lcula	ted	for each	mont	h		(	(83)m	= Sum(74)m .	(82)m				
(83)m=	84.52	164.79	272.6	$\overline{}$		502.49		18.49 49	1.9	416		195.62	105.23	69.65	]	(83)
Total g	ains – ir	nternal ar	nd sc	lar	(84)m =	(73)n	1 + (	83)m , wa	atts						•	
(84)m=	464.38	542.75	638.8	37	750.96	830.84	1 8	28.37 78	39.7	720.	04 631.52	527.54	459.04	439.77	]	(84)
7. Mea	an inter	nal temp	eratu	re (	heating	seasc	n)								•	
		•		•				area from	n Tab	le 9.	Th1 (°C)				21	(85)
-		_		•			_	ee Table		- 1	( - /					
	Jan	Feb	Ma	$\overline{}$	Apr	May	Ť		lul	Αι	ıg Sep	Oct	Nov	Dec	]	
L		<u> </u>			· · ·			<u>'</u>					•	•		

(86)m=	1	0.99	0.98	0.95	0.87	0.74	0.59	0.65	0.86	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	19.08	19.27	19.63	20.11	20.55	20.84	20.95	20.92	20.68	20.11	19.51	19.05		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)	-				
(88)m=	19.48	19.48	19.48	19.49	19.5	19.51	19.51	19.51	19.5	19.5	19.49	19.49		(88)
Utilisa	tion fac	tor for g	ains for ı	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.99	0.97	0.93	0.81	0.62	0.41	0.47	0.78	0.95	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ina T2 (f	ollow ste	ps 3 to	7 in Tabl	le 9c)				
(90)m=	17.78	17.98	18.33	18.81	19.21	19.44	19.5	19.49	19.33	18.82	18.22	17.76		(90)
L									1	fLA = Livin	g area ÷ (4	1) =	0.37	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	llina) = f	LA × T1	+ (1 – fL	A) x T2			'		
(92)m=	18.26	18.45	18.8	19.29	19.7	19.95	20.03	20.01	19.83	19.29	18.69	18.23		(92)
ء Apply	adjustn	nent to t	he mean	interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.26	18.45	18.8	19.29	19.7	19.95	20.03	20.01	19.83	19.29	18.69	18.23		(93)
8. Spa	ace hea	ting requ	uirement											
			ternal ter	•		ned at st	ep 11 of	Table 9l	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
tne uti		l	or gains of		i	l 1115	l. d	۸۰۰۰	Con	Oct	Nov	Doo		
] L Itiliea	Jan tion fac	Feb	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	0.97	0.92	0.82	0.66	0.48	0.54	0.8	0.95	0.99	0.99		(94)
L			, W = (94								0.00			, ,
(95)m=	460.75	535.14	619.26	693.23	684.4	542.83	376.83	388.63	505.7	502.04	452.82	436.94		(95)
Month	ly 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)
Heat I	oss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]				
(97)m=	1639.23	1588.07	1439.4	1203.43	924.92	613.62	392.94	413.84	658.89	1005.28	1345.97	1634.89		(97)
Space	heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	4 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	876.79	707.57	610.19	367.34	178.95	0	0	0	0	374.41	643.07	891.27		_
								Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	4649.58	(98)
Space	e heatin	g require	ement in	kWh/m²	<sup>2</sup> /year								70.88	(99)
9b. Ene	ergy rec	quiremer	nts – Cor	nmunity	heating	scheme	)							
			ace hea								unity sch	neme.		-
Fraction	n of spa	ace heat	from sec	condary	/supplen	nentary l	heating (	Table 1	1) '0' if n	one			0	(301)
Fraction	n of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
			y obtain he							up to four (	other heat	sources; tl	ne latter	
			s, geothern Communi			from powe	r stations.	See Appe	ndix C.			í		(303a)
											,		1	
		•	heat fro		•						02) x (303	a) =	1	(304a)
Factor	for cont	rol and	charging	method	(Table	4c(3)) fo	r commu	ınity hea	iting sys	tem			1.05	(305)
Distribu	ution los	ss factor	(Table 1	2c) for o	commun	ity heati	ng syste	m					1.05	(306)
Space	heating	g											kWh/year	_
Annual	space	heating	requirem	nent									4649.58	

				_
Space heat from Community boilers	(98) x (304a) x	(305) x (306) =	5126.17	(307a)
Efficiency of secondary/supplementary heating system	in % (from Table 4a or Apper	ndix E)	0	(308
Space heating requirement from secondary/supplement	tary system (98) x (301) x	100 ÷ (308) =	0	(309)
Water heating				_
Annual water heating requirement			1986.66	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x	(305) x (306) =	2190.29	(310a)
Electricity used for heat distribution	0.01 × [(307a)(30	7e) + (310a)(310e)] =	73.16	(313)
Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not e	enter 0) = (107) ÷ (314	) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f) mechanical ventilation - balanced, extract or positive in			0	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330	0b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)			294.6	(332)
				_
12b. CO2 Emissions – Community heating scheme				
12b. CO2 Emissions – Community heating scheme	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (no	kWh/year	kg CO2/kWh	kg CO2/year	(367a)
CO2 from other sources of space and water heating (no	kWh/year	kg CO2/kWh	kg CO2/year	](367a) ](367)
CO2 from other sources of space and water heating (no Efficiency of heat source 1 (%)  If there is	kWh/year of CHP) CHP using two fuels repeat (363) to	kg CO2/kWh	91 1736.65	
CO2 from other sources of space and water heating (no Efficiency of heat source 1 (%)  CO2 associated with heat source 1	kWh/year  ot CHP)  CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x	kg CO2/kWh  0 (366) for the second fue  0 =  0.52 =	91 1736.65 37.97	(367)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x	kg CO2/kWh  0 (366) for the second fue  0 =  0.52 =	91 1736.65 37.97 1774.63	(367)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution  Total CO2 associated with community systems	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x  (363)(366) + (368)(376)	kg CO2/kWh  0 (366) for the second fue  0 = 0.52 = 22) =	y1 91 1736.65 37.97 1774.63 0	(367) (372) (373)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution  Total CO2 associated with community systems  CO2 associated with space heating (secondary)	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x  (363)(366) + (368)(376)	kg CO2/kWh  0 (366) for the second fue  0 = 0.52 = 0.52 = 0.52	y1 91 1736.65 37.97 1774.63 0	(367) (372) (373) (374)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution  Total CO2 associated with community systems  CO2 associated with space heating (secondary)  CO2 associated with water from immersion heater or in	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x  (363)(366) + (368)(37  (309) x  stantaneous heater (312) x  (373) + (374) + (375) =	kg CO2/kWh  0 (366) for the second fue  0 = 0.52 = 0.52 = 0.52	91 1736.65 37.97 1774.63 0	(367) (372) (373) (374) (375)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution  Total CO2 associated with community systems  CO2 associated with space heating (secondary)  CO2 associated with water from immersion heater or in Total CO2 associated with space and water heating	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x  (363)(366) + (368)(37  (309) x  stantaneous heater (312) x  (373) + (374) + (375) =	kg CO2/kWh  0 (366) for the second fue  0 = 0.52 = 0.52  0 = 0.22 = 0.22	91 1736.65 37.97 1774.63 0 1774.63	(367) (372) (373) (374) (375) (376)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution  Total CO2 associated with community systems  CO2 associated with space heating (secondary)  CO2 associated with water from immersion heater or in Total CO2 associated with space and water heating  CO2 associated with electricity for pumps and fans with	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x  (363)(366) + (368)(37  (309) x  stantaneous heater (312) x  (373) + (374) + (375) =  nin dwelling (331)) x  (332))) x	kg CO2/kWh  0 (366) for the second fue  0 = 0.52 = 0.52 = 0.22 = 0.52 = 0.52	91 1736.65 37.97 1774.63 0 1774.63	(367) (372) (373) (374) (375) (376) (378)
CO2 from other sources of space and water heating (not Efficiency of heat source 1 (%)  CO2 associated with heat source 1  Electrical energy for heat distribution  Total CO2 associated with community systems  CO2 associated with space heating (secondary)  CO2 associated with water from immersion heater or in Total CO2 associated with space and water heating  CO2 associated with electricity for pumps and fans with CO2 associated with electricity for lighting	kWh/year  ot CHP) CHP using two fuels repeat (363) to  [(307b)+(310b)] x 100 ÷ (367b) x  [(313) x  (363)(366) + (368)(37  (309) x  stantaneous heater (312) x  (373) + (374) + (375) =  nin dwelling (331)) x  (332))) x	kg CO2/kWh  0 (366) for the second fue  0 = 0.52 = 0.52 = 0.22 = 0.52 = 0.52	91 1736.65 37.97 1774.63 0 1774.63 0 152.9	(367) (372) (373) (374) (375) (376) (378) (379)

			lloor D	) otoilo:						
Assessor Name: Software Name:	John Simpson Stroma FSAP 20		User D	Strom Softwa	are Vei				0006273 on: 1.0.4.7	
Address :	1.02, 25 Old Glouc			Address						
1. Overall dwelling dime	·	00101 01,	201120	11, 11011	107.11					
Ground floor					(1a) x		<b>ight(m)</b> 2.5	(2a) =	<b>Volume(m³</b> 221.25	(3a)
Total floor area TFA = (1	(1a)+(1b)+(1c)+(1d)+(1	e)+(1r	1)	88.5	(4)					_
Dwelling volume					(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	.(3n) =	221.25	(5)
2. Ventilation rate:				04h o #		40401				
Number of chimneys  Number of open flues  Number of intermittent fa	heating	secondar heating 0	+ [ ] + [	0 0	] = [ ] = [	0 0 2	x 2	40 = 20 = 10 =	0 0 20	(6a) (6b) (7a)
Number of passive vents	5				Ē	0	x -	10 =	0	(7b)
Number of flueless gas f	ires				F	0	X 4	40 =	0	(7c)
					_			Air ch	nanges per ho	our
Infiltration due to chimne	•					20		÷ (5) =	0.09	(8)
If a pressurisation test has I Number of storeys in t		lea, procee	d to (17),	otherwise (	continue tr	om (9) to	(16)		0	(9)
Additional infiltration	are aweiling (115)						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: Of the structural infiltration: Of th	oresent, use the value corre ings); if equal user 0.35	sponding to	the great	ter wall are	a (after	ruction			0	(11)
If no draught lobby, er	nter 0.05, else enter 0	•	,	,.					0	(13)
Percentage of window	s and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
Air permeability value,	•		•	•	•	etre of e	envelope	area	4	(17)
If based on air permeabi	•								0.29	(18)
Air permeability value applie Number of sides sheltere		as been dor	ne or a de	gree air pe	тпеаринту	is being u	sea		2	(19)
Shelter factor	o G			(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor			(21) = (18	) x (20) =				0.25	(21)
Infiltration rate modified	for monthly wind spee	d								
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Monthly average wind sp	peed from Table 7	•	•	•			•	•	•	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	]	
Wind Factor (22a)m = (2	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		

infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
0.31 0.31 0.3 0.27 0.27 0.23 0.23 0.23 0.25 0.27 0.28 0.29	
effective air change rate for the applicable case	<del></del>
anical ventilation:  tair heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	(23a
and with boot recovery efficiency in 9/ allowing for in use factor (from Table 4b)	(23b
	(230
lanced mechanical ventilation with heat recovery (MVHR) $(24a)$ m = $(22b)$ m + $(23b)$ × $[1 - (23c) \div 100]$	(24a
	(240
lanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)	(24b
	(24)
tole house extract ventilation or positive input ventilation from outside $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (22b)m + 0.5 \times (23b)$	
	(240
tural ventilation or whole house positive input ventilation from loft	•
$(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$	
0.55	(240
ve air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
0.55	(25)
osses and heat loss parameter:	
NT Gross Openings Net Area U-value A X U k-value	ΑΧk
area (m²) m² A ,m² W/m2K (W/K) kJ/m²·K	kJ/K
2.1 x 1.8 = 3.78	(26)
Type 1 $3.15$ $x^{1/[1/(1.6) + 0.04]} = 4.74$	(27)
Type 2 $0.78   x^{1/[1/(1.6) + 0.04]} = 1.17$	(27)
Type 3 $1.6   x^{1/[1/(1.6) + 0.04]} = 2.41$	(27)
Type 4 $1.6 \times 1/[1/(1.6) + 0.04] = 2.41$	(27)
Type 5 $2.25 \times 1/[1/(1.6) + 0.04] = 3.38$	(27)
e 1 85.4 x 0.15 = 12.81	(28)
e 2 3.1 x 0.15 = 0.465	(28)
De1 85.1 13.88 71.22 x 0.18 = 12.82	(29)
	(29)
	==
5 0 5 x 0.15 = 0.75	(30)
a of elements, m <sup>2</sup>	(31)
16.3 x 0 = 0	(32)
vs and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 ne areas on both sides of internal walls and partitions	
at loss, W/K = S (A x U) $(26)(30) + (32) = 53.58$	(33)
acity Cm = S(A x k) $((28)(30) + (32) + (32a)(32e) = 0$	(34)
	<b></b> ` ′
(TAID On TEA) in I Work	(35)
	(35)
mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250	(35)

if details of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total fabric he	at loss							(33) +	(36) =			68.79	(37)
Ventilation hea	at loss ca	alculated	l monthly	y .				· ,	= 0.33 × (	25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 40.12	39.98	39.84	39.2	39.08	38.51	38.51	38.41	38.73	39.08	39.32	39.58		(38)
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m= 108.91	108.77	108.63	107.99	107.86	107.3	107.3	107.2	107.52	107.86	108.11	108.36		
Heat loss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) <sub>1.</sub> (4)	12 /12=	107.98	(39)
(40)m= 1.23	1.23	1.23	1.22	1.22	1.21	1.21	1.21	1.21	1.22	1.22	1.22		
									Average =	Sum(40) <sub>1</sub> .	12 /12=	1.22	(40)
Number of day	/s in mor	nth (Tab	le 1a)										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ener	gy requi	rement:								kWh/ye	ear:	
												ı	
Assumed occu if TFA > 13.9			[1 ovn	( 0 0003	240 v (TE	-Λ 12 Ω'	\2\1 + O (	1012 v /	TEA 12		.6		(42)
if TFA £ 13.9		+ 1.76 X	[ı - exp	(-0.0003	49 X (11	-A -13.9	)2)] + 0.0	лото x (	IFA -13.	9)			
Annual average	•	ater usac	ge in litre	s per da	y Vd,av	erage =	(25 x N)	+ 36		96	.06		(43)
Reduce the annua	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.00		( - /
not more that 125	litres per p	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m= 105.67	101.82	97.98	94.14	90.3	86.45	86.45	90.3	94.14	97.98	101.82	105.67		
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	0Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1152.72	(44)
(45)m= 156.7	137.05	141.42	123.3	118.31	102.09	94.6	108.56	109.85	128.02	139.75	151.76		
									Total = Su	m(45) <sub>112</sub> =	=	1511.4	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,	) to (61)			'		
(46)m= 23.5	20.56	21.21	18.49	17.75	15.31	14.19	16.28	16.48	19.2	20.96	22.76		(46)
Water storage									_				
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	_			_			` '						
Otherwise if no		hot wate	er (this in	ıcludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage		olorod l	ooo foot	or io kno	(Ic\A/k	\/do\/\:							(40)
a) If manufact				JI IS KIIO	WII (KVVI	⊮uay).					0		(48)
Temperature f											0		(49)
Energy lost from		_	-		or io not		(48) x (49)	=			0		(50)
<ul><li>b) If manufact</li><li>Hot water store</li></ul>			-								0		(51)
If community h	-			- (v)	.,	-, ,					U		(01)
Volume factor	•		-								0		(52)
Temperature f			2b							<b>—</b>	0		(53)
Energy lost fro	m water	storage	, kWh/ve	ear			(47) x (51)	x (52) x (	53) =		0		(54)
Enter (50) or		_	,y.				. , (= -)	. / (	,		0		(55)
• •		-											

Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nual) fro	m Table	3							0		(58)
Primary circuit	t loss cal	culated t	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	lculated	for each	month (	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 15.27	13.8	15.27	14.78	15.27	14.78	15.27	15.27	14.78	15.27	14.78	15.27		(61)
Total heat req	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 171.97	150.85	156.7	138.08	133.58	116.87	109.87	123.83	124.63	143.3	154.53	167.03		(62)
Solar DHW input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add additiona	I lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (	G)	r	r	r	•	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter											
(64)m= 171.97	150.85	156.7	138.08	133.58	116.87	109.87	123.83	124.63	143.3	154.53	167.03		1
							Outp	out from wa	ater heatei	r (annual)₁	12	1691.24	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	1] + 0.8 x	( [(46)m	+ (57)m	+ (59)m	]	
(65)m= 55.92	49.02	50.84	44.69	43.16	37.64	35.27	39.91	40.22	46.39	50.16	F400		(65)
				.00		00.21	33.31	40.22	40.39	30.16	54.28		(00)
include (57)	m in cal	culation of	of (65)m		<u> </u>	<u> </u>	!	<u> </u>	<u> </u>	<u> </u>		eating	(00)
include (57) 5. Internal ga			. ,	only if c	<u> </u>	<u> </u>	!	<u> </u>	<u> </u>	<u> </u>		eating	(00)
, ,	ains (see	e Table 5	and 5a	only if c	<u> </u>	<u> </u>	!	<u> </u>	<u> </u>	<u> </u>		eating	(00)
5. Internal g	ains (see	e Table 5	and 5a	only if c	<u> </u>	<u> </u>	!	<u> </u>	<u> </u>	<u> </u>		eating	(00)
5. Internal g	ains (see	E Table 5	and 5a	only if c	ı :ylinder i:	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	(66)
5. Internal games Metabolic gair Jan	ains (see ns (Table Feb 130.23	E Table 5 2 5), Wat Mar 130.23	and 5a) ts Apr 130.23	only if constant of the consta	Jun 130.23	Jul 130.23	Aug 130.23	or hot w	ater is fr	om com	munity h	eating	
5. Internal games 5. Internal games 5. Internal games 5. Internal games 6. Internal	ains (see ns (Table Feb 130.23	E Table 5 2 5), Wat Mar 130.23	and 5a) ts Apr 130.23	only if constant of the consta	Jun 130.23	Jul 130.23	Aug 130.23	or hot w	ater is fr	om com	munity h	eating	
5. Internal games  Metabolic gain  Jan  (66)m= 130.23  Lighting gains	res (Table Feb 130.23 (calcula 19.64	2 Table 5 2 5), Wat Mar 130.23 ted in Ap	ts Apr 130.23 ppendix 12.09	May 130.23 L, equati	Jun 130.23 ion L9 o	Jul 130.23 r L9a), a	Aug 130.23 Iso see	Sep 130.23 Table 5	Oct 130.23	Nov	Dec	eating	(66)
5. Internal games  Metabolic gain  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11	res (Table Feb 130.23 (calcula 19.64	2 Table 5 2 5), Wat Mar 130.23 ted in Ap	ts Apr 130.23 ppendix 12.09	May 130.23 L, equati	Jun 130.23 ion L9 o	Jul 130.23 r L9a), a	Aug 130.23 Iso see	Sep 130.23 Table 5	Oct 130.23	Nov	Dec	eating	(66)
5. Internal gi Metabolic gair Jan (66)m= 130.23 Lighting gains (67)m= 22.11 Appliances ga	res (Table Feb 130.23 (calcula 19.64 tins (calcula 238.74	e Table 5 e 5), Wat Mar 130.23 ted in Ap 15.97 culated in 232.56	ts Apr 130.23 ppendix 12.09 Appendix 219.41	only if construction in the construction is constructed by the construction in the construction in the construction is constructed by the construction in the construction in the construction is constructed by the construction in the construction in the construction is constructed by the construction in the construction in the construction in the construction is constructed by the construction in the con	Jun 130.23 ion L9 o 7.63 uation L	Jul 130.23 r L9a), a 8.25 13 or L1	Aug 130.23 Iso see 10.72 3a), also	Sep 130.23 Table 5 14.39 see Ta	Oct 130.23 18.27 ble 5 193.65	Nov 130.23	Dec 130.23	eating	(66) (67)
5. Internal games  Metabolic gair  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances games  (68)m= 236.29	res (Table Feb 130.23 (calcula 19.64 tins (calcula 238.74	e Table 5 e 5), Wat Mar 130.23 ted in Ap 15.97 culated in 232.56	ts Apr 130.23 ppendix 12.09 Appendix 219.41	only if construction in the construction is constructed by the construction in the construction in the construction is constructed by the construction in the construction in the construction is constructed by the construction in the construction in the construction is constructed by the construction in the construction in the construction in the construction is constructed by the construction in the con	Jun 130.23 ion L9 o 7.63 uation L	Jul 130.23 r L9a), a 8.25 13 or L1	Aug 130.23 Iso see 10.72 3a), also	Sep 130.23 Table 5 14.39 see Ta	Oct 130.23 18.27 ble 5 193.65	Nov 130.23	Dec 130.23	eating	(66) (67)
5. Internal games  Metabolic gain  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances games  (68)m= 236.29  Cooking gains	res (Table Feb 130.23 (calcula 19.64 tins (calcula 238.74 s (calcula 36.02	Mar 130.23 ted in Ap 15.97 culated in 232.56 ated in A	ts Apr 130.23 ppendix 12.09 Append 219.41 ppendix 36.02	May 130.23 L, equati 9.04 dix L, equ 202.81 L, equat	Jun 130.23 ion L9 o 7.63 uation L 187.2 tion L15	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a)	Aug 130.23 Iso see 10.72 3a), also 174.32	Sep 130.23 Table 5 14.39 See Ta 180.5	Oct 130.23 18.27 ble 5 193.65 5	Nov 130.23 21.32	Dec 130.23 22.73	eating	(66) (67) (68)
Metabolic gair  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances ga  (68)m= 236.29  Cooking gains  (69)m= 36.02	res (Table Feb 130.23 (calcula 19.64 tins (calcula 238.74 s (calcula 36.02	Mar 130.23 ted in Ap 15.97 culated in 232.56 ated in A	ts Apr 130.23 ppendix 12.09 Append 219.41 ppendix 36.02	May 130.23 L, equati 9.04 dix L, equ 202.81 L, equat	Jun 130.23 ion L9 o 7.63 uation L 187.2 tion L15	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a)	Aug 130.23 Iso see 10.72 3a), also 174.32	Sep 130.23 Table 5 14.39 See Ta 180.5	Oct 130.23 18.27 ble 5 193.65 5	Nov 130.23 21.32	Dec 130.23 22.73	eating	(66) (67) (68)
5. Internal given by the second of the secon	res (Table Feb 130.23 (calcula 19.64 sins (calcula 36.02 ns gains 3	e Table 5 e 5), Wat Mar 130.23 ted in Ap 15.97 culated in 232.56 ated in Ap 36.02 (Table 5	and 5a ts Apr 130.23 ppendix 12.09 Appendix 219.41 ppendix 36.02 5a)	only if construction only if c	Jun 130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	Aug 130.23 Iso see 10.72 3a), also 174.32 ), also se 36.02	Sep 130.23 Table 5 14.39 see Ta 180.5 ee Table 36.02	Oct 130.23  18.27 ble 5 193.65 5 36.02	Nov 130.23 21.32 210.26	Dec 130.23 22.73 225.87 36.02	eating	(66) (67) (68) (69)
5. Internal given by the second of the secon	reportions (see all see  ted in Ap  130.23 ted in Ap  15.97 culated in  232.56 ated in Ap  36.02 (Table 5	ts Apr 130.23 ppendix 12.09 Appendix 219.41 ppendix 36.02 5a) 3 tive valu	only if construction only if c	Jun 130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	Aug 130.23 Iso see 10.72 3a), also 174.32 ), also se 36.02	Sep 130.23 Table 5 14.39 see Ta 180.5 ee Table 36.02	Oct 130.23  18.27 ble 5 193.65 5 36.02	Nov 130.23 21.32 210.26	Dec 130.23 22.73 225.87 36.02	eating	(66) (67) (68) (69)	
Metabolic gair  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances ga  (68)m= 236.29  Cooking gains  (69)m= 36.02  Pumps and fa  (70)m= 3  Losses e.g. ev	res (Table Feb 130.23 (calcula 19.64 sins (calcula 36.02 ns gains 3 raporatio -104.19	E Table 5 E 5), Wat Mar 130.23 ted in Ap 15.97 sulated in 232.56 ated in Ap 36.02 (Table 5 3 on (negation)	ts Apr 130.23 ppendix 12.09 Appendix 219.41 ppendix 36.02 5a) 3 tive valu	only if construction only if c	Jun 130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	Aug 130.23 Iso see 10.72 3a), also 174.32 , also se 36.02	Sep 130.23 Table 5 14.39 See Ta 180.5 ee Table 36.02	Oct 130.23  18.27 ble 5 193.65 5 36.02	Nov 130.23 21.32 210.26 36.02	Dec 130.23 22.73 225.87 36.02	eating	(66) (67) (68) (69)
Metabolic gair  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances ga  (68)m= 236.29  Cooking gains  (69)m= 36.02  Pumps and fa  (70)m= 3  Losses e.g. ev  (71)m= -104.19	res (Table Feb 130.23 (calcula 19.64 sins (calcula 36.02 ns gains 3 raporatio -104.19	E Table 5 E 5), Wat Mar 130.23 ted in Ap 15.97 sulated in 232.56 ated in Ap 36.02 (Table 5 3 on (negation)	ts Apr 130.23 ppendix 12.09 Appendix 219.41 ppendix 36.02 5a) 3 tive valu	only if construction only if c	Jun 130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	Aug 130.23 Iso see 10.72 3a), also 174.32 , also se 36.02	Sep 130.23 Table 5 14.39 See Ta 180.5 ee Table 36.02	Oct 130.23  18.27 ble 5 193.65 5 36.02	Nov 130.23 21.32 210.26 36.02	Dec 130.23 22.73 225.87 36.02	eating	(66) (67) (68) (69)
Metabolic gair  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances ga  (68)m= 236.29  Cooking gains  (69)m= 36.02  Pumps and fa  (70)m= 3  Losses e.g. ev  (71)m= -104.19  Water heating	res (Table Feb 130.23 (calcula 19.64 sins (calcula 36.02 ns gains 3 raporatio 72.94	e Table 5 e 5), Wat Mar 130.23 ted in Ap 15.97 culated in 232.56 ated in Ap 36.02 (Table 5 3 on (negation of the color of	and 5a ts Apr 130.23 opendix 12.09 Appendix 219.41 opendix 36.02 5a) 3 tive valu	only if constructions only its constructions only if constructions	Jun 130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02 3 ble 5) -104.19	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	Aug 130.23 Iso see 10.72 3a), also 174.32 3, also se 36.02	Sep 130.23 Table 5 14.39 See Ta 180.5 ee Table 36.02 3	Oct 130.23  18.27 ble 5 193.65 5 36.02  3 -104.19	Nov 130.23 21.32 210.26 36.02 3	Dec 130.23 22.73 225.87 36.02 3	eating	(66) (67) (68) (69) (70) (71)
Metabolic gair  Jan  (66)m= 130.23  Lighting gains  (67)m= 22.11  Appliances ga  (68)m= 236.29  Cooking gains  (69)m= 36.02  Pumps and fa  (70)m= 3  Losses e.g. ev  (71)m= -104.19  Water heating  (72)m= 75.16	res (Table Feb 130.23 (calcula 19.64 sins (calcula 36.02 ns gains 3 raporatio 72.94	e Table 5 e 5), Wat Mar 130.23 ted in Ap 15.97 culated in 232.56 ated in Ap 36.02 (Table 5 3 on (negation of the color of	and 5a ts Apr 130.23 opendix 12.09 Appendix 219.41 opendix 36.02 5a) 3 tive valu	only if constructions only its constructions only if constructions	Jun 130.23 ion L9 of 7.63 uation L 187.2 tion L15 36.02 3 ble 5) -104.19	Jul 130.23 r L9a), a 8.25 13 or L1 176.77 or L15a) 36.02	Aug 130.23 Iso see 10.72 3a), also 174.32 3, also se 36.02	Sep 130.23 Table 5 14.39 See Ta 180.5 ee Table 36.02 3	Oct 130.23  18.27 ble 5 193.65 5 36.02  3 -104.19	Nov 130.23 21.32 210.26 36.02 3	Dec 130.23 22.73 225.87 36.02 3	eating	(66) (67) (68) (69) (70) (71)

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

Orientation: A	ccess Factor able 6d	•	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	11.28	x	0.72	x	0.7	=	26.6	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	22.97	X	0.72	X	0.7	=	54.15	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	41.38	x	0.72	x	0.7	=	97.55	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	67.96	x	0.72	x	0.7	=	160.21	(75)
Northeast <sub>0.9x</sub>	0.77	x	2.25	x	91.35	X	0.72	X	0.7	=	215.36	(75)
Northeast 0.9x	0.77	x	2.25	x	97.38	x	0.72	x	0.7	=	229.59	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	91.1	x	0.72	x	0.7	=	214.78	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	X	72.63	X	0.72	X	0.7	=	171.22	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	X	50.42	x	0.72	X	0.7	=	118.87	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	X	28.07	X	0.72	X	0.7	=	66.17	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	x	14.2	X	0.72	X	0.7	=	33.47	(75)
Northeast <sub>0.9x</sub>	0.77	X	2.25	X	9.21	x	0.72	X	0.7	=	21.72	(75)
East 0.9x	1	X	3.15	X	19.64	X	0.72	X	0.7	=	21.61	(76)
East 0.9x	1	X	0.78	X	19.64	X	0.72	X	0.7	=	3.75	(76)
East 0.9x	1	X	3.15	X	38.42	x	0.72	X	0.7	=	42.27	(76)
East 0.9x	1	X	0.78	X	38.42	X	0.72	X	0.7	=	7.34	(76)
East 0.9x	1	X	3.15	x	63.27	X	0.72	X	0.7	=	69.61	(76)
East 0.9x	1	X	0.78	X	63.27	x	0.72	X	0.7	=	12.09	(76)
East 0.9x	1	X	3.15	X	92.28	X	0.72	X	0.7	=	101.53	(76)
East 0.9x	1	X	0.78	X	92.28	X	0.72	X	0.7	=	17.63	(76)
East 0.9x	1	X	3.15	X	113.09	x	0.72	X	0.7	=	124.43	(76)
East 0.9x	1	X	0.78	X	113.09	X	0.72	X	0.7	=	21.61	(76)
East 0.9x	1	X	3.15	X	115.77	X	0.72	X	0.7	=	127.37	(76)
East 0.9x	1	X	0.78	x	115.77	X	0.72	X	0.7	=	22.12	(76)
East 0.9x	1	X	3.15	X	110.22	x	0.72	X	0.7	=	121.26	(76)
East 0.9x	1	X	0.78	X	110.22	x	0.72	X	0.7	=	21.06	(76)
East 0.9x	1	X	3.15	X	94.68	x	0.72	X	0.7	=	104.16	(76)
East 0.9x	1	X	0.78	X	94.68	X	0.72	X	0.7	=	18.09	(76)
East 0.9x	1	X	3.15	X	73.59	X	0.72	X	0.7	=	80.96	(76)
East 0.9x	1	X	0.78	X	73.59	X	0.72	X	0.7	=	14.06	(76)
East 0.9x	1	X	3.15	X	45.59	X	0.72	X	0.7	=	50.16	(76)
East 0.9x	1	X	0.78	x	45.59	X	0.72	X	0.7	=	8.71	(76)
East 0.9x	1	X	3.15	X	24.49	X	0.72	X	0.7	=	26.94	(76)
East 0.9x	1	X	0.78	X	24.49	X	0.72	X	0.7	=	4.68	(76)
East 0.9x	1	X	3.15	x	16.15	X	0.72	X	0.7	=	17.77	(76)
East 0.9x	1	X	0.78	x	16.15	x	0.72	x	0.7	=	3.09	(76)
West 0.9x	0.77	X	1.6	x	19.64	x	0.72	x	0.7	=	10.98	(80)
West 0.9x	0.77	X	1.6	x	19.64	x	0.72	x	0.7	=	10.98	(80)
West 0.9x	0.77	X	1.6	x	38.42	х	0.72	х	0.7	=	21.47	(80)

West	0.9x	0.77		v	1.0	. 1	v		2.40	1 .		70	1 , 1	0.7	$\neg$	_ 1	04.47	(80)
West	Ļ	0.77		X	1.6		X		3.42	X		72	]	0.7	_	=	21.47	╡゛゛
West	0.9x 0.9x	0.77		X	1.6		X		3.27	X		72	] X   ] .,	0.7	_	=	35.36	(80)
West	0.9x	0.77		X	1.6		X		3.27	] X ] v		72	]	0.7	_	=	35.36	(80) (80)
West	0.9x	0.77		X	1.6		X		2.28	X		72	]	0.7	_	=	51.57	╡`′
West	0.9x	0.77		X	1.6		X		2.28	X		72	]	0.7	_	=	51.57	(80)
West	0.9x	0.77		X	1.6		X		3.09	] X ] v		72	]	0.7		=	63.2	(80) (80)
West	0.9x	0.77		X	1.6		X		3.09	X		72	]	0.7	_	=	63.2	╡゛゛
West	0.9x	0.77		X	1.6		X		5.77	] X ] v		72	]	0.7	<u></u>	=	64.7	(80)
West	0.9x	0.77		X	1.6		X		5.77	X		72	]	0.7		=	64.7	╡`′
West	<u> </u>	0.77		X	1.6		X		0.22	X l		72	]	0.7		=	61.59	](80)
West	0.9x	0.77		X	1.6		X		0.22	X		72	X	0.7	픰	=	61.59	<u> </u> (80)
West	0.9x	0.77		X	1.6		X		1.68	X		72	】	0.7	_	=	52.91	<u> </u> (80)
	0.9x	0.77		X	1.6		X		1.68	X I		72	] X   ]	0.7	_	=	52.91	<u> </u> (80)
West	0.9x	0.77	_	X	1.6		X		3.59	X		72	] X	0.7	ᆗ	=	41.12	<u> </u> (80)
West	0.9x	0.77	_	X	1.6		X		3.59	X		72	] X	0.7	_	=	41.12	<u> </u> (80)
West	0.9x	0.77		X	1.6		X		5.59	X		72	X	0.7	_	=	25.48	<u> </u> (80)
West	0.9x	0.77		X	1.6		X	45	5.59	X	0.	72	X	0.7	4	=	25.48	<u> </u> (80)
West	0.9x	0.77	_	X	1.6		X		1.49	X		72	] X   ]	0.7	_	=	13.69	<u> </u> (80)
West	0.9x	0.77		X	1.6	5	X	24	1.49	X	0.	72	X	0.7	_	=	13.69	<u> </u> (80)
West	0.9x	0.77		X	1.6	3	X	16	6.15	X	0.	72	X	0.7	_	=	9.03	(80)
West	0.9x	0.77		X	1.6	5	X	16	5.15	X	0.	72	X	0.7		=	9.03	(80)
ו		watts, ca			I			[		<u> </u>		(74)m			Ι		1	(00)
(83)m=	73.91	146.7	249.9		382.51	487.79		08.48	480.29	399	.29   29	96.14	175.99	92.46	60.0	03		(83)
Ĭ	472.55	nternal a	631.9	_	741.15	822.71	Ť	20.65	777.79	703	05 6	11.96	515.33	3 458.78	447.	25		(84)
(84)m=		<u> </u>			!			20.03	111.19	703	.05   6	11.90	313.33	456.76	447	.20		(04)
		nal temp		•														7
•		during h		•			_			ole 9	, Th1 ('	°C)					21	(85)
Utilisa		tor for ga		$\overline{}$			Ť				-			1			1	
	Jan	Feb	Ma	$\overline{}$	Apr	May	+	Jun	Jul	_		Sep	Oct	+	_	ес		(2.5)
(86)m=	1	1	0.99	<u> </u>	0.97	0.9		0.75	0.58	0.6	56	0.9	0.99	1	1			(86)
Mean		l temper	ature	in li		ea T1 (	follo	w step	s 3 to 7	in T	able 9	c)					ı	
(87)m=	19.59	19.73	20.0	1	20.38	20.72	2	20.92	20.98	20.	97 2	20.8	20.36	19.91	19.	56		(87)
Temp	erature	during h	eatin	g pe	eriods in	rest c	f dw	elling t	from Ta	able 9	9, Th2	(°C)						
(88)m=	19.9	19.9	19.9	9	19.9	19.9	1	19.91	19.91	19.	91 1	9.91	19.9	19.9	19.	9		(88)
Utilisa	ntion fac	tor for ga	ains f	or re	est of dv	velling	, h2	,m (se	e Table	9a)								
(89)m=	1	1	0.99	$\overline{}$	0.96	0.86	$\neg$	0.65	0.45	0.5	52 (	0.84	0.98	1	1			(89)
Mean	interna	l tempera	ature	in t	he rest	of dwe	llina	T2 (fo	llow ste	eps 3	to 7 in	Table	9c)		•		•	
(90)m=	18.02	18.23	18.6	$\overline{}$	19.17	19.63	Ť	19.86	19.9	19		9.73	19.14	18.48	17.9	98		(90)
* * *										<u> </u>			A = Liv	ing area ÷ (	4) =		0.4	(91)
																١	<u> </u>	_

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

(92)m= 18.65	18.83	19.18	19.66	20.07	20.29	20.34	20.33	20.16	19.63	19.05	18.61		(92)
Apply adjustr	nent to t	he mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate			l	
(93)m= 18.65	18.83	19.18	19.66	20.07	20.29	20.34	20.33	20.16	19.63	19.05	18.61		(93)
8. Space hea	ting requ	uirement											
Set Ti to the					ed at ste	ep 11 of	Table 9l	b, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation	<del></del>			ble 9a		·		1		1	1	l	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	1				г	г			1		I	
(94)m= 1	1	0.99	0.95	0.86	0.69	0.51	0.58	0.85	0.98	1	1		(94)
Useful gains,		<u> </u>	<u> </u>			1	1	1		1		I	
(95)m= 471.44	540.47	623.52	707.57	710.45	564.47	392.83	406.06	521.96	503.6	456.7	446.44		(95)
Monthly aver							1			,		ı	
(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					Lm , W =	=[(39)m :	x [(93)m	– (96)m	]			•	
(97)m= 1562.86	1515.52	1377.63	1161.77	902.66	610.13	400.98	421.08	651.82	973.94	1292.31	1561.99		(97)
Space heatin	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m		ı	
(98)m= 812.02	655.23	561.05	327.03	143.01	0	0	0	0	349.93	601.64	829.97		
							Tota	l per year	(kWh/yeaı	r) = Sum(9	8)15,912 =	4279.87	(98)
Space heatin	g require	ement in	kWh/m²	/year								48.36	(99)
9a. Energy red	nuiremer	nte – Indi	vidual b	eating s	veteme i	ncluding	micro-C	'HDI					
Space heating		ito iridi	vidual II	caming 5	y Storris r	ricidaling	THICLO C	<i>/</i>					
Fraction of sp	•	at from se	econdar	v/supple	mentarv	svstem						0	(201)
Fraction of sp					,	-	(202) = 1	- (201) =					(202)
•			-	. ,				, ,	(202)]			1	╡`
Fraction of to		•	-				(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of	main spa	ace heat	ing syste	em 1								92.8	(206)
Efficiency of	seconda	ry/supple	ementar	y heating	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heatin	L					<u>.                                    </u>					l .	,	
812.02	655.23	561.05	327.03	143.01	0	0	0	0	349.93	601.64	829.97		
(211)m = {[(98	)m x (20	)4)1	00 ÷ (20	)6)									(211)
875.02	706.07	604.58	352.4	154.1	0	0	0	0	377.08	648.32	894.36		( )
	<u> </u>						ITota	l I (kWh/yea	ar) =Sum(2		<u> </u>	4611.93	(211)
Space heatin	a fuel (c	ocondor	v) k\//b/	month						7 15, 10 12		1011.00	`′
$= \{[(98) \text{m x } (20)]$	•		• • •	monun									
(215)m = 0	0	00 - (20	0	0	0	0	0	0	0	0	0		
(	<u> </u>						_	l (kWh/yea	ar) =Sum(2	_	_	0	(215)
Motor booting	_								(	715,1012	2	0	(2:0)
Water heating Output from w		tor (calc	ulated al	hove)									
171.97	150.85	156.7	138.08	133.58	116.87	109.87	123.83	124.63	143.3	154.53	167.03		
Efficiency of w	l						L	L			L	87.3	(216)
(217)m= 89.35	89.32	89.24	89.04	88.57	87.3	87.3	87.3	87.3	89.06	89.28	89.37	07.0	(217)
` '	l			00.01	01.0	01.3	01.3	01.3	09.00	03.20	09.31		(211)
Fuel for water $(219)m = (64)$	•												
(219)m= $192.47$	168.88	175.59	155.07	150.81	133.87	125.86	141.84	142.76	160.9	173.09	186.89		
<u> </u>	1					I	Tota	I = Sum(2°	19a) <sub>119</sub> =	1		1908.03	(219)
								`	+112			1000.00	(210)

Annual totals		kWh/year	Г	kWh/year	7
Space heating fuel used, main system 1				4611.93	
Water heating fuel used				1908.03	
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a	a)(230g) =		75	(231)
Electricity for lighting				390.54	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	<b>Energy</b> kWh/year	Emission factors kg CO2/kWh	or	Emissions kg CO2/yea	ır
Space heating (main system 1)			or = [		ır ](261)
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh	-	kg CO2/yea	_
	kWh/year (211) x	kg CO2/kWh	= [	kg CO2/yea	(261)
Space heating (secondary)	kWh/year (211) x (215) x	0.216 0.519	= [	996.18	(261)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	0.216 0.519	= [	996.18 0 412.13	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	0.216 0.519 0.216	= [ = [ = [	996.18 0 412.13 1408.31	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year  (211) x  (215) x  (219) x  (261) + (262) + (263) + (264) =  (231) x  (232) x	0.216 0.519 0.216	= [ = [ = [	996.18  0  412.13  1408.31  38.93	(261) (263) (264) (265) (267)

El rating (section 14)

		Heer	Datailar						
Assessor Name:	John Simpson	User	Details: Stroma	Mum	bori		STDC	0006273	
Software Name:	John Simpson Stroma FSAP 2012		Softwa					on: 1.0.4.7	
		Property	Address:						
Address :	2.01, 25 Old Glouceste	·							
1. Overall dwelling dime	ensions:								
		Are	ea(m²)		Av. He	ight(m)	_	Volume(m	3)
Ground floor			80.37	1a) x		3	(2a) =	241.11	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+.	(1n)	80.37	4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	241.11	(5)
2. Ventilation rate:									
		ondary iting	other		total			m³ per hou	ır
Number of chimneys	0 +	0 +	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	   =	0	x	20 =	0	(6b)
Number of intermittent fa	ans			' F	3	x ·	10 =	30	(7a)
Number of passive vents	3			F	0	x	10 =	0	(7b)
Number of flueless gas f				F		x	40 =		(7c)
Number of flueless gas i	1163			L	0			0	(70)
							Air ch	nanges per h	our
Infiltration due to chimne	ys, flues and fans = (6a)+	(6b)+(7a)+(7b)+	(7c) =	Γ	30		÷ (5) =	0.12	(8)
If a pressurisation test has b	peen carried out or is intended, p	proceed to (17),	otherwise co	ontinue fr	rom (9) to				``
Number of storeys in t	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber fra		•		ruction			0	(11)
deducting areas of openi	resent, use the value correspor ings); if equal user 0.35	naing to the grea	iter waii area	(anter					
If suspended wooden	floor, enter 0.2 (unsealed	) or 0.1 (seal	ed), else e	enter 0				0	(12)
If no draught lobby, en	iter 0.05, else enter 0							0	(13)
Percentage of window	s and doors draught strip	ped						0	(14)
Window infiltration			0.25 - [0.2					0	(15)
Infiltration rate			(8) + (10) +	`	, , ,	, ,		0	(16)
• •	q50, expressed in cubic	•			etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) - (18)]$ es if a pressurisation test has be				is haina u	sad		0.37	(18)
Number of sides sheltere		on done or a de	gree un peri	noability	io boilig a	ocu		2	(19)
Shelter factor			(20) = 1 - [0	0.0 <b>75</b> x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.32	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7	]	
Wind Forter (00-) (0	2)								
Wind Factor $(22a)m = (2(22a)m = 1.27   1.25)$	<del>'                                    </del>	0.95 0.95	1 000	1	1.08	1 12	1.18	1	
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37		
Calculate effe		_	rate for t	he appli	cable ca	se					•		
If mechanical If exhaust air h			andiv N. (2	2h) _ (22	a) v Emy (	auation (	NEN otho	nuico (22h	\ _ (22a\			0	(23
If balanced with									) = (23a)			0	(23)
		•	-	_					2h\ /	00h) [	4 (00.0)	0	(23
a) If balance (24a)m= 0	o mech	anicai ve	ntilation 0	with ne	at recove		$\frac{HR}{0}$ (248	$\frac{1}{0} = \frac{2}{2}$	20)m + ( <i>i</i>	23b) <b>x</b> [	$\frac{1 - (230)}{0}$	1 ÷ 100]	(24
b) If balance											1 0	J	(2
(24b)m= 0	0		0	0	0	0	0 0	0	0	0	0	1	(24
c) If whole h												J	(=
•			then (24	-	-				5 × (23b	))			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)r			ole hous m = (22	•	•				0.5]				
(24d)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	]	(24
Effective air	change	rate - er	nter (24a	or (24l	o) or (24	c) or (24	d) in bo	· (25)				ı	
25)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	]	(25
2 Heat lease	o and he	act loop i	oromot	251								1	
3. Heat losse ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-val		A X U (W/I	<b>(</b> )	k-value kJ/m²-l		A X k kJ/K
Doors	aica	(111-)	11	_	2.1	x	1.4	.ix = [	2.94		KJ/III-•I	IX.	(26
Vindows Type	1 د				1.58	_	/[1/( 1.4 )+	;		╡			
Vindows Type						<del>_</del>	/[1/( 1.4 )+	l l	2.09	╡			(27
Windows Type					1.44	<del>_</del>	/[1/( 1.4 )+	l l	1.91	=			(27
Windows Type					1.44	<del>_</del>		l l	1.91	=			(27
					1.62	=	/[1/( 1.4 )+	l.	2.15	=			(27
Windows Type					1.62		/[1/( 1.4 )+	ı,	2.15	=			(27
Vindows Type					1.85		/[1/( 1.4 )+	l.	2.45	4			(27
Vindows Type 	e /				0.9	x1	/[1/( 1.4 )+	0.04] = [	1.19	닠 ,			(27
loor					14.1	X	0.2	=	2.82	ᆜ !		╛╘	(28
Walls Type1	53	<u> </u>	12.3	3	40.62	<u>x</u>	0.26	=	10.56	<u> </u>		_	(29
Walls Type2	18.	9	2.75		16.15	<u>x</u>	0.18	= [	2.91	[		_	(29
Walls Type3	15.	9	2.1		13.8	X	0.18	=	2.48				(29
Total area of e	elements	, m²			101.9	)							(31
Party wall					25.8	х	0	=	0				(32
for windows and to include the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragrapl	3.2	
abric heat los	ss, W/K	= S (A x	U)				(26)(30)	+ (32) =				41.77	(33
Heat capacity	Cm = S	(A x k )						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34
Thermal mass	parame	eter (TMF	c = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	: Medium		250	(35)
or design asses	sments wh	ere the de	tails of the	construct	ion are no	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		

can be u	ısed instea	ad of a dei	tailed calcu	ulation.										
					using Ap	pendix I	K						15.29	(36)
if details	of therma	ıl bridging	are not kn	own (36) =	= 0.15 x (3	1)								<u> </u>
	abric hea								(33) +	(36) =			57.06	(37)
Ventila			alculated	·	<u></u>				` ′		25)m x (5)	1	1	
(22)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)m=	46.33	46.08	45.83	44.66	44.44	43.42	43.42	43.23	43.81	44.44	44.88	45.35		(38)
	ansfer c			Γ	ı		ı	ı		= (37) + (37)	· · · · · ·	ı	1	
(39)m=	103.39	103.14	102.89	101.71	101.5	100.48	100.48	100.29	100.87	101.5	101.94	102.4	404.74	7(20)
Heat lo	ss para	meter (H	HLP), W/	/m²K						= (39)m ÷	Sum(39) <sub>1</sub> .	12 / 1 Z=	101.71	(39)
(40)m=	1.29	1.28	1.28	1.27	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27		_
Numbe	er of day	rs in mor	nth (Tabl	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.27	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
				-	-		-			-	-	-		
4. Wa	iter heat	ing ener	gy requi	irement:								kWh/ye	ear:	
Λeeum	ed occu	nancy 1	NI.									47	1	(42)
if TF		9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		47		(42)
Annua	l averag	e hot wa						(25 x N)				.86	]	(43)
		_			5% if the d ater use, l	_	_	to achieve	a water us	se target o	f		•	
notmore	. 1		-			_	•	<u> Λ</u>	Con	0-4	Nav	Daa	1	
Hot wate	Jan er usage ir	Feb n litres per	Mar day for ea	Apr ach month	May $Vd, m = fa$	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	102.14	98.43	94.72	91	87.29	83.57	83.57	87.29	91	94.72	98.43	102.14	]	
( ,			•							<u> </u>	m(44) <sub>112</sub> =	<u> </u>	1114.31	(44)
Energy (	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600	kWh/mon	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	151.48	132.48	136.71	119.19	114.36	98.69	91.45	104.94	106.19	123.76	135.09	146.7		
If in a take				-f /		( )		h / 40		Total = Su	m(45) <sub>112</sub> =		1461.03	(45)
								boxes (46		T			1	(40)
(46)m= Water	22.72 storage	19.87 loss:	20.51	17.88	17.15	14.8	13.72	15.74	15.93	18.56	20.26	22		(46)
	•		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0	]	(47)
If comr	munity h	eating a	nd no ta	ınk in dw	/elling, e	nter 110	) litres in	(47)					1	
			hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
	storage			(	:-	/1-\^/1	- /-1 \ .						1	
,					or is kno	wn (Kvvr	n/day):					0	]	(48)
•			m Table					(40) (40)				0	] 1	(49)
• • • • • • • • • • • • • • • • • • • •			storage eclared o	-	ear loss fact	or is not		(48) x (49)	) =			0		(50)
Hot wa	iter stora	age loss	factor fr	om Tabl	le 2 (kW							0	]	(51)
	•	-	ee section	on 4.3									1	
	e factor		ole 2a m Table	2h								0		(52) (53)
Chipe	natur <del>o</del> lo	actor IIO	rabic	20								U	I	(55)

Energy lost from w	_	e, kWh/y	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (54)	` '	for oooh	manth			((EC)m - (	EE) ~ (44)*	~		0		(55)
Water storage loss		1					55) × (41)r				1	(50)
(56)m= 0  If cylinder contains ded	0	0	0 (56) ==	0	0	0	7\m (56)	0	0	0	i 1.1	(56)
		1		T			1				IX FI	<b></b> \
(57)m= 0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit loss										0		(58)
Primary circuit loss			•	•	` '	, ,						
(modified by fac	1	1	i	i			<del></del>		<del></del>		1	(50)
(59)m= 0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calcula	ted for eacl	n month	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 15.27 13	.8 15.27	14.78	15.27	14.78	15.27	15.27	14.78	15.27	14.78	15.27		(61)
Total heat required	for water h	eating ca	alculated	I for eacl	h month	(62)m =	0.85 × (	45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 166.75 146	.28 151.98	133.97	129.64	113.47	106.72	120.21	120.97	139.03	149.87	161.97		(62)
Solar DHW input calcu	ated using App	oendix G o	r Appendix	H (negati	ve quantity	v) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additional line	s if FGHRS	and/or \	//WHRS	applies	, see Ap	pendix (	3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water	heater											
(64)m= 166.75 146	.28 151.98	133.97	129.64	113.47	106.72	120.21	120.97	139.03	149.87	161.97		
	•					Outp	out from wa	ater heate	r (annual) <sub>1</sub>	12	1640.87	(64)
Lloot mains from	. 4  4!	. I./ \ / \ / \ / \ / \	andb 0 01	- ′ [0 0-	(45)	(0.4)			,\	()	_	
Heat gains from w	ater neating	, KVVN/m	onth U.Z:	c8.0J c	× (45)m	+ (61)m	ו + 0.8 x	(46)m	+ (57)m	+ (59)m	]	
(65)m= $54.18$ 47		43.33	41.84	36.51	× (45)m	+ (61)m 38.71	1] + 0.8 x	44.97	+ (57)m 48.61	+ (59)m 52.6	]	(65)
	.5 49.27	43.33	41.84	36.51	34.22	38.71	39	44.97	48.61	52.6		(65)
(65)m= 54.18 47 include (57)m in	.5 49.27	43.33 of (65)m	41.84 only if c	36.51	34.22	38.71	39	44.97	48.61	52.6		(65)
include (57)m in 5. Internal gains	49.27 calculation (see Table	43.33 of (65)m 5 and 5a	41.84 only if c	36.51	34.22	38.71	39	44.97	48.61	52.6		(65)
include (57)m in  5. Internal gains  Metabolic gains (T	49.27 calculation (see Table	43.33 of (65)m 5 and 5a tts	41.84 only if c	36.51	34.22	38.71 dwelling	39 or hot w	44.97	48.61	52.6		(65)
include (57)m in  5. Internal gains  Metabolic gains (T	calculation (see Table able 5), Wa	43.33 of (65)m 5 and 5a	41.84 only if c	36.51 ylinder is	34.22 s in the c	38.71	39	44.97 ater is fr	48.61 om com	52.6 munity h		(65)
<ul> <li>(65)m= 54.18 47</li> <li>include (57)m in</li> <li>5. Internal gains</li> <li>Metabolic gains (T</li> <li>Jan F</li> <li>(66)m= 123.49 123</li> </ul>	calculation (see Table able 5), Wareb Mar 123.49	43.33 of (65)m 5 and 5a tts Apr 123.49	41.84 only if c ):  May 123.49	36.51 ylinder is Jun 123.49	34.22 s in the c	38.71 dwelling Aug 123.49	39 or hot w Sep 123.49	44.97 ater is fr	48.61 om com	52.6 munity h		
include (57)m in  5. Internal gains  Metabolic gains (T  Jan  (66)m= 123.49 123  Lighting gains (cal	calculation (see Table able 5), Wa b Mar 49 123.49 culated in A	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix	41.84 only if c ): May 123.49 L, equati	Jun 123.49	34.22 s in the o Jul 123.49 r L9a), a	38.71 dwelling  Aug 123.49 lso see	39 or hot w Sep 123.49 Table 5	44.97 ater is fr	48.61 om com	52.6 munity h		
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17	calculation (see Table sable 5), Wa eb Mar .49 123.49 culated in A	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92	41.84 only if c ):  May 123.49 L, equati 8.17	36.51 ylinder is Jun 123.49 ion L9 o	34.22 s in the o Jul 123.49 r L9a), a 7.45	38.71 dwelling  Aug 123.49 lso see 9.68	39 or hot w Sep 123.49 Table 5	44.97 ater is fr Oct 123.49	48.61 om com Nov 123.49	52.6 munity h		(66)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (	calculation (see Table able 5), Wa eb Mar 49 123.49 culated in A 74 14.43 calculated i	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq	Jun 123.49 ion L9 o 6.89 uation L	34.22 s in the o Jul 123.49 r L9a), a 7.45	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also	39 or hot w Sep 123.49 Table 5 13 o see Tal	44.97  ater is fr  Oct 123.49  16.5  ble 5	48.61 om com Nov 123.49	52.6 munity h		(66) (67)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal  (67)m= 19.98 17  Appliances gains (68)m= 220.21 22	calculation (see Table able 5), Wa eb Mar 49 123.49 culated in A 74 14.43 calculated i 2.5 216.74	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq 189.01	Jun 123.49 ion L9 of 6.89 uation L	34.22 s in the o Jul 123.49 r L9a), a 7.45 13 or L1: 164.74	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46	39 or hot w Sep 123.49 Table 5 13 o see Tal 168.22	44.97  ater is fr  Oct 123.49  16.5  ble 5  180.48	48.61 om com Nov 123.49	52.6 munity h		(66)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (cal	calculation (see Table sable 5), Wa eb Mar .49 123.49 culated in A 74 14.43 calculated i 2.5 216.74 culated in A	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq 189.01 L, equat	Jun 123.49 ion L9 o 6.89 uation L 174.46	34.22 s in the o Jul 123.49 r L9a), a 7.45 13 or L1 164.74 or L15a)	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se	39 or hot w Sep 123.49 Table 5 13 see Tal 168.22 ee Table	44.97  ater is fr  Oct  123.49  16.5  ole 5  180.48  5	48.61 om com Nov 123.49 19.26	Dec 123.49 20.53		(66) (67) (68)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (cal (69)m= 35.35 35	calculation (see Table able 5), Wa eb Mar .49 123.49 culated in A 74 14.43 calculated i 2.5 216.74 culated in A 35 35.35	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq 189.01	Jun 123.49 ion L9 of 6.89 uation L	34.22 s in the o Jul 123.49 r L9a), a 7.45 13 or L1: 164.74	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46	39 or hot w Sep 123.49 Table 5 13 o see Tal 168.22	44.97  ater is fr  Oct 123.49  16.5  ble 5  180.48	48.61 om com Nov 123.49	52.6 munity h		(66) (67)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal  (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (cal  (69)m= 35.35 35  Pumps and fans g	calculation (see Table able 5), Wa eb Mar 49 123.49 culated in A 74 14.43 calculated i 2.5 216.74 culated in A 35 35.35 ains (Table	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35 5a)	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq 189.01 L, equat	Jun 123.49 ion L9 of 6.89 uation L 174.46 ion L15 35.35	34.22 s in the of Jul 123.49 r L9a), a 7.45 13 or L1: 164.74 or L15a) 35.35	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se 35.35	39 or hot w Sep 123.49 Table 5 13 o see Tal 168.22 ee Table 35.35	44.97  ater is fr  Oct 123.49  16.5  ble 5  180.48  5  35.35	48.61 om com Nov 123.49 19.26	52.6 munity h  Dec 123.49 20.53 210.5		(66) (67) (68) (69)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (cal (69)m= 35.35 35  Pumps and fans g (70)m= 3	calculation (see Table able 5), Wa eb Mar (49 123.49 culated in A (414.43 calculated in A (5.5 216.74 culated in A (5.5 35.35 ains (Table 6) (5.5 3	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35 5a) 3	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eqi 189.01 L, equati 35.35	Jun 123.49 ion L9 o 6.89 uation L 174.46 ion L15 35.35	34.22 s in the o Jul 123.49 r L9a), a 7.45 13 or L1 164.74 or L15a)	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se	39 or hot w Sep 123.49 Table 5 13 see Tal 168.22 ee Table	44.97  ater is fr  Oct  123.49  16.5  ole 5  180.48  5	48.61 om com Nov 123.49 19.26	Dec 123.49 20.53		(66) (67) (68)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (ca (69)m= 35.35 35  Pumps and fans g (70)m= 3  Losses e.g. evapo	calculation (see Table able 5), Wa eb Mar .49 123.49 culated in A radiculated in A 2.5 216.74 culated in A 35 35.35 ains (Table a 3 ration (negaration)	43.33 of (65)m 5 and 5a tts	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq 189.01 L, equat 35.35	Jun 123.49 ion L9 o 6.89 uation L 174.46 ion L15 35.35	34.22 s in the of  Jul 123.49 r L9a), a 7.45 13 or L1: 164.74 or L15a) 35.35	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se 35.35	39 or hot w  Sep 123.49 Table 5 13 see Tal 168.22 ee Table 35.35	44.97  ater is fr  Oct 123.49  16.5  ble 5 180.48 5 35.35	48.61  om com  Nov  123.49  19.26  195.95  35.35	52.6 munity h  Dec 123.49  20.53  210.5		(66) (67) (68) (69) (70)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal  (67)m= 19.98 17  Appliances gains (cal  (68)m= 220.21 22  Cooking gains (cal  (69)m= 35.35 35  Pumps and fans g  (70)m= 3  Losses e.g. evapo  (71)m= -98.79 -98	calculation (see Table able 5), Wareb Mar 123.49 culated in A 14.43 culated in A 2.5 216.74 culated in A 35 35.35 ains (Table 3 3 attion (negative)	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35 5a) 3	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eqi 189.01 L, equati 35.35	Jun 123.49 ion L9 o 6.89 uation L 174.46 ion L15 35.35	34.22 s in the of Jul 123.49 r L9a), a 7.45 13 or L1: 164.74 or L15a) 35.35	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se 35.35	39 or hot w Sep 123.49 Table 5 13 o see Tal 168.22 ee Table 35.35	44.97  ater is fr  Oct 123.49  16.5  ble 5  180.48  5  35.35	48.61 om com Nov 123.49 19.26	52.6 munity h  Dec 123.49 20.53 210.5		(66) (67) (68) (69)
include (57)m in  5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains ( (68)m= 220.21 22  Cooking gains (cal (69)m= 35.35 35  Pumps and fans g (70)m= 3  Losses e.g. evapo (71)m= -98.79 -98  Water heating gain	calculation (see Table able 5), Wareb Mar (49 123.49) culated in Ar (14.43) calculated in Ar (2.5 216.74) culated in Ar (35 35.35) ains (Table 3 3 cation (negans) s (Table 5)	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35 5a) 3 ative valu -98.79	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eqi 189.01 L, equati 35.35  3 es) (Tab	Jun 123.49 ion L9 o 6.89 uation L 174.46 ion L15 35.35 3 lle 5)	34.22 s in the of Jul 123.49 r L9a), a 7.45 13 or L15 164.74 or L15a) 35.35	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se 35.35	39 or hot w  Sep 123.49 Table 5 13 o see Tal 168.22 ee Table 35.35  3 -98.79	44.97  ater is fr  Oct 123.49  16.5  ole 5 180.48 5 35.35  3	48.61 om com  Nov 123.49 19.26 195.95 35.35 3	52.6 munity h  Dec 123.49  20.53  210.5  35.35		(66) (67) (68) (69) (70)
include (57)m in 5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (ca (69)m= 35.35 35  Pumps and fans g  (70)m= 3  Losses e.g. evaporation (71)m= -98.79 -98  Water heating gain (72)m= 72.83 70	19.27   19.2	43.33 of (65)m 5 and 5a tts	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eq 189.01 L, equat 35.35	36.51  ylinder is  Jun 123.49  ion L9 of 6.89  uation L 174.46  ion L15 35.35  3  le 5) -98.79	34.22 s in the o  Jul 123.49 r L9a), a 7.45 13 or L1: 164.74 or L15a) 35.35  3  -98.79	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se 35.35  3  -98.79	39 or hot w  Sep 123.49 Table 5 13 see Tal 168.22 ee Table 35.35  3  -98.79	44.97  ater is fr  Oct 123.49  16.5 ble 5 180.48 5 35.35  3 -98.79	48.61  om com  Nov  123.49  19.26  195.95  35.35  3  -98.79	52.6 munity h  Dec 123.49  20.53  210.5  35.35  3  -98.79		(66) (67) (68) (69) (70)
include (57)m in 5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains ( (68)m= 220.21 22  Cooking gains (cal (69)m= 35.35 35  Pumps and fans g (70)m= 3  Losses e.g. evapor (71)m= -98.79 -98  Water heating gair (72)m= 72.83 70  Total internal gair	19.27   19.2	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35 5a) 3 ative valu -98.79	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eqi 189.01 L, equati 35.35  3 es) (Tab -98.79	Jun 123.49 ion L9 of 6.89 uation L 174.46 ion L15 35.35  3 ile 5) -98.79  50.71 (66)	34.22 s in the of Jul 123.49 r L9a), a 7.45 13 or L1: 164.74 or L15a) 35.35  3  -98.79  46 m + (67)m	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 o, also se 35.35  3  -98.79  52.03 o + (68)m -	39 or hot w  Sep 123.49 Table 5 13 o see Tal 168.22 ee Table 35.35  3  -98.79  54.17 + (69)m + (	44.97  ater is fr  Oct 123.49  16.5  ole 5  180.48  5  35.35  3  -98.79  60.44  70)m + (7	48.61  om com  Nov  123.49  19.26  195.95  35.35  3  -98.79  67.52  1)m + (72)	52.6 munity h  Dec 123.49  20.53  210.5  35.35  3  -98.79  70.69		(66) (67) (68) (69) (70) (71)
include (57)m in 5. Internal gains  Metabolic gains (T  Jan F  (66)m= 123.49 123  Lighting gains (cal (67)m= 19.98 17  Appliances gains (68)m= 220.21 22  Cooking gains (ca (69)m= 35.35 35  Pumps and fans g  (70)m= 3  Losses e.g. evaporation (71)m= -98.79 -98  Water heating gain (72)m= 72.83 70	19.27   19.2	43.33 of (65)m 5 and 5a tts Apr 123.49 ppendix 10.92 n Append 204.48 appendix 35.35 5a) 3 ative valu -98.79	41.84 only if c ):  May 123.49 L, equati 8.17 dix L, eqi 189.01 L, equati 35.35  3 es) (Tab	36.51  ylinder is  Jun 123.49  ion L9 of 6.89  uation L 174.46  ion L15 35.35  3  le 5) -98.79	34.22 s in the o  Jul 123.49 r L9a), a 7.45 13 or L1: 164.74 or L15a) 35.35  3  -98.79	38.71 dwelling  Aug 123.49 lso see 9.68 3a), also 162.46 , also se 35.35  3  -98.79	39 or hot w  Sep 123.49 Table 5 13 see Tal 168.22 ee Table 35.35  3  -98.79	44.97  ater is fr  Oct 123.49  16.5 ble 5 180.48 5 35.35  3 -98.79	48.61  om com  Nov  123.49  19.26  195.95  35.35  3  -98.79	52.6 munity h  Dec 123.49  20.53  210.5  35.35  3  -98.79		(66) (67) (68) (69) (70)

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

Orientati	on:	Access Factor Table 6d	,	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	X	1.44	x	10.63	x	0.72	x	0.7	=	10.7	(74)
North	0.9x	0.77	X	1.85	x	10.63	x	0.72	x	0.7	=	6.87	(74)
North	0.9x	0.77	X	1.44	x	20.32	x	0.72	x	0.7	=	20.44	(74)
North	0.9x	0.77	X	1.85	x	20.32	x	0.72	x	0.7	=	13.13	(74)
North	0.9x	0.77	X	1.44	x	34.53	x	0.72	x	0.7	=	34.73	(74)
North	0.9x	0.77	X	1.85	x	34.53	x	0.72	x	0.7	=	22.31	(74)
North	0.9x	0.77	X	1.44	x	55.46	x	0.72	x	0.7	=	55.79	(74)
North	0.9x	0.77	X	1.85	x	55.46	X	0.72	X	0.7	=	35.84	(74)
North	0.9x	0.77	X	1.44	x	74.72	x	0.72	x	0.7	=	75.16	(74)
North	0.9x	0.77	X	1.85	X	74.72	X	0.72	X	0.7	=	48.28	(74)
North	0.9x	0.77	X	1.44	x	79.99	X	0.72	X	0.7	=	80.46	(74)
North	0.9x	0.77	X	1.85	x	79.99	X	0.72	X	0.7	=	51.68	(74)
North	0.9x	0.77	X	1.44	X	74.68	X	0.72	X	0.7	=	75.12	(74)
North	0.9x	0.77	X	1.85	x	74.68	X	0.72	X	0.7	=	48.25	(74)
North	0.9x	0.77	X	1.44	x	59.25	X	0.72	x	0.7	=	59.6	(74)
North	0.9x	0.77	X	1.85	x	59.25	X	0.72	X	0.7	=	38.28	(74)
North	0.9x	0.77	X	1.44	x	41.52	X	0.72	X	0.7	=	41.76	(74)
North	0.9x	0.77	X	1.85	x	41.52	X	0.72	X	0.7	=	26.83	(74)
North	0.9x	0.77	X	1.44	x	24.19	X	0.72	X	0.7	=	24.33	(74)
North	0.9x	0.77	X	1.85	x	24.19	X	0.72	X	0.7	=	15.63	(74)
North	0.9x	0.77	X	1.44	x	13.12	X	0.72	X	0.7	=	13.2	(74)
North	0.9x	0.77	X	1.85	x	13.12	X	0.72	X	0.7	=	8.48	(74)
North	0.9x	0.77	X	1.44	x	8.86	x	0.72	x	0.7	=	8.92	(74)
North	0.9x	0.77	X	1.85	x	8.86	X	0.72	X	0.7	=	5.73	(74)
East	0.9x	1	X	1.44	x	19.64	x	0.72	x	0.7	] =	9.88	(76)
East	0.9x	1	X	1.62	X	19.64	X	0.72	X	0.7	=	11.11	(76)
East	0.9x	3	X	1.62	X	19.64	X	0.72	X	0.7	=	33.34	(76)
East	0.9x	1	X	1.44	x	38.42	X	0.72	X	0.7	=	19.32	(76)
East	0.9x	1	X	1.62	x	38.42	X	0.72	X	0.7	=	21.74	(76)
East	0.9x	3	X	1.62	x	38.42	X	0.72	X	0.7	=	65.22	(76)
East	0.9x	1	X	1.44	X	63.27	X	0.72	X	0.7	=	31.82	(76)
East	0.9x	1	X	1.62	X	63.27	X	0.72	X	0.7	=	35.8	(76)
East	0.9x	3	X	1.62	x	63.27	X	0.72	X	0.7	=	107.4	(76)
East	0.9x	1	X	1.44	x	92.28	X	0.72	X	0.7	=	46.41	(76)
East	0.9x	1	X	1.62	x	92.28	X	0.72	X	0.7	=	52.21	(76)
East	0.9x	3	X	1.62	x	92.28	X	0.72	X	0.7	=	156.64	(76)
East	0.9x	1	X	1.44	x	113.09	X	0.72	X	0.7	=	56.88	(76)
East	0.9x	1	X	1.62	x	113.09	X	0.72	X	0.7	=	63.99	(76)
East	0.9x	3	X	1.62	X	113.09	X	0.72	X	0.7	] =	191.97	(76)

East	۰. ۲		ı		1		1		1		ı		7(70)
	0.9x	1	X	1.44	X	115.77	X	0.72	X	0.7	=	58.23	(76)
East	0.9x	1	X	1.62	X	115.77	X	0.72	X	0.7	=	65.51	(76)
East	0.9x	3	X	1.62	X	115.77	X	0.72	X	0.7	=	196.52	(76)
East	0.9x	1	X	1.44	X	110.22	X	0.72	X	0.7	=	55.43	(76)
East -	0.9x	1	X	1.62	X	110.22	X	0.72	X	0.7	=	62.36	(76)
East	0.9x	3	X	1.62	X	110.22	X	0.72	X	0.7	=	187.09	(76)
East	0.9x	1	X	1.44	X	94.68	X	0.72	X	0.7	=	47.62	(76)
East	0.9x	1	X	1.62	X	94.68	X	0.72	X	0.7	=	53.57	(76)
East	0.9x	3	X	1.62	X	94.68	X	0.72	X	0.7	=	160.71	(76)
East	0.9x	1	X	1.44	X	73.59	X	0.72	X	0.7	=	37.01	(76)
East	0.9x	1	X	1.62	X	73.59	X	0.72	X	0.7	=	41.64	(76)
East	0.9x	3	X	1.62	X	73.59	X	0.72	X	0.7	=	124.91	(76)
East	0.9x	1	X	1.44	X	45.59	X	0.72	x	0.7	=	22.93	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.72	x	0.7	=	25.8	(76)
East	0.9x	3	x	1.62	x	45.59	x	0.72	x	0.7	=	77.39	(76)
East	0.9x	1	x	1.44	x	24.49	X	0.72	x	0.7	=	12.32	(76)
East	0.9x	1	X	1.62	x	24.49	X	0.72	x	0.7	=	13.86	(76)
East	0.9x	3	х	1.62	x	24.49	X	0.72	x	0.7	=	41.57	(76)
East	0.9x	1	x	1.44	x	16.15	x	0.72	x	0.7	=	8.12	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.72	x	0.7	=	9.14	(76)
East	0.9x	3	x	1.62	x	16.15	x	0.72	x	0.7	=	27.42	(76)
West	0.9x	0.54	x	1.58	x	19.64	x	0.72	x	0.7	j =	7.6	(80)
West	0.9x	0.77	x	0.9	x	19.64	X	0.72	x	0.7	j =	6.17	(80)
West	0.9x	0.54	x	1.58	x	38.42	X	0.72	x	0.7	j =	14.87	(80)
West	0.9x	0.77	x	0.9	x	38.42	x	0.72	x	0.7	=	12.08	(80)
West	0.9x	0.54	x	1.58	×	63.27	x	0.72	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	0.9	x	63.27	x	0.72	x	0.7	=	19.89	(80)
West	0.9x	0.54	x	1.58	x	92.28	x	0.72	x	0.7	=	35.71	(80)
West	0.9x	0.77	x	0.9	x	92.28	x	0.72	x	0.7	=	29.01	(80)
West	0.9x	0.54	x	1.58	x	113.09	x	0.72	x	0.7	=	43.77	(80)
West	0.9x	0.77	x	0.9	x	113.09	x	0.72	x	0.7	j =	35.55	(80)
West	0.9x	0.54	x	1.58	x	115.77	x	0.72	x	0.7	j =	44.8	(80)
West	0.9x	0.77	x	0.9	x	115.77	x	0.72	x	0.7	j =	36.39	(80)
West	0.9x	0.54	x	1.58	x	110.22	X	0.72	x	0.7	j =	42.66	(80)
West	0.9x	0.77	х	0.9	x	110.22	x	0.72	x	0.7	j =	34.65	(80)
West	0.9x	0.54	x	1.58	x	94.68	x	0.72	x	0.7	j =	36.64	(80)
West	0.9x	0.77	x	0.9	x	94.68	x	0.72	x	0.7	i =	29.76	(80)
West	0.9x	0.54	х	1.58	x	73.59	x	0.72	x	0.7	=	28.48	(80)
West	0.9x	0.77	x	0.9	×	73.59	x	0.72	x	0.7	=	23.13	(80)
West	0.9x	0.54	x	1.58	x	45.59	x	0.72	x	0.7	=	17.64	(80)
West	0.9x	0.77	X	0.9	×	45.59	x	0.72	x	0.7	=	14.33	(80)
			•		-		- '		•		-		_

West	0.9x	0.54	x	1.5	58	x	24	1.49	x [		0.72	x [	0.7	=	9.48	(80)
West	0.9x	0.77	x	0.9	9	x	24	1.49	x		0.72	x	0.7	=	7.7	(80)
West	0.9x	0.54	x	1.5	58	x	16	3.15	x		0.72	x	0.7	=	6.25	(80)
West	0.9x	0.77	×	0.9	9	x	16	6.15	x		0.72	x	0.7	=	5.08	(80)
	_					_										
Solar	gains in	watts, ca	alculated	for eacl	h month				(83)m	= Su	ım(74)m .	(82)m				
(83)m=	85.67	166.8	276.45	411.62	515.59	533	3.59	505.56	426.	18	323.77	198.05	106.59	70.65	]	(83)
Total g	ains – i	nternal a	nd solar	(84)m =	(73)m -	+ (8:	3)m ,	watts					•	•	•	
(84)m=	461.74	540.77	636.9	750.25	832.05	828	8.69	786.8	713.	4	622.2	518.51	452.36	435.42		(84)
7. Me	an inter	nal temp	erature	(heating	season	)										
			eating p	`			rea fr	om Tah	ole 9	Th1	1 (°C)				21	(85)
•		•	ains for l			_			, o o,		. ( •)				21	
Otilloc	Jan	Feb	Mar	Apr	May	È	lun	Jul	Au		Sep	Oct	Nov	Dec	]	
(86)m=	1	1	0.99	0.96	0.87	<del>                                     </del>	.71	0.54	0.61	<del>-  </del>	0.87	0.98	1	1		(86)
. ,			I						<u> </u>			0.00	<u>.                                    </u>			()
			ature in I							-				1	1	(07)
(87)m=	19.56	19.72	20.02	20.41	20.75	20	).93	20.98	20.9	7	20.82	20.37	19.89	19.53		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwe	elling f	from Ta	ble 9	, Th	12 (°C)				_	
(88)m=	19.85	19.85	19.86	19.87	19.87	19	.88	19.88	19.8	8	19.88	19.87	19.87	19.86		(88)
Utilisa	ation fac	tor for a	ains for r	est of d	wellina.	h2.n	n (see	e Table	9a)							
(89)m=	1	0.99	0.98	0.94	0.82		.61	0.41	0.48	3	0.8	0.97	1	1	]	(89)
Moan	intorna	l tompor	ature in t	ho rost	of dwalli	na T	T2 (fo	llow etc	ne 3	——1 to 7	in Tabl	0.00)			ı	
(90)m=	17.94	18.18	18.61	19.18	19.63	Ť	0.84	19.87	19.8		19.73	19.14	18.44	17.9	]	(90)
(00)					.0.00								l area ÷ (4	<u> </u>	0.39	(91)
													<b>3</b> (	,	0.55	(0.7
			ature (fo							$\overline{}$			1		1	(00)
(92)m=	18.57	18.78	19.15	19.66	20.06		).26	20.31	20.3		20.15	19.62	19	18.54		(92)
		r	ne mean		· ·	ī			r	-		•	1 40	40.54	1	(02)
(93)m=	18.57	18.78	19.15	19.66	20.06	20	).26	20.31	20.3	3	20.15	19.62	19	18.54		(93)
		ting requ					_4 _4 _	44 -£	T-61-	οĿ	41	4 T: /	70)		lata	
			ernal ten or gains ι			iea a	at ste	рттот	rabie	90	, so tha	t 11,m=(	76)m an	a re-caid	culate	
	Jan	Feb	Mar	Apr	May	Г.,	lun	Jul	Au	a	Sep	Oct	Nov	Dec	1	
Utilisa	L		ains, hm	•	may					9	ООР		1 1101		I	
(94)m=	1	0.99	0.98	0.94	0.83	0.	.65	0.47	0.53	3	0.82	0.97	0.99	1	]	(94)
Usefu	ıl gains,	hmGm ,	W = (94)	l)m x (84	4)m	!			I						l	
(95)m=	460.21	536.96	624.69	704.18	691.92	534	4.55	366.43	380.	3	507.93	501.99	449.47	434.32		(95)
Month	nly aver	age exte	rnal tem	perature	from Ta	able	8						•		l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14	4.6	16.6	16.4	1	14.1	10.6	7.1	4.2	]	(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm	, W =	[(39)m :	x [(93	)m-	- (96)m	]				
(97)m=	1474.86	1431.04	1301.92	1094.56	848.75	569	9.02	372.32	391.0	06	610.57	915.19	1213.55	1468.04	]	(97)
Space	e heatin	g require	ement for	r each n	nonth, k\	Nh/ı	month	า = 0.02	24 x [(	97)	m – (95	)m] x (4	1)m		•	
(98)m=	754.9	600.82	503.86	281.07	116.67		0	0	0		0	307.42	550.13	769.08		
									Т	otal	per year	(kWh/yea	r) = Sum(9	8) <sub>15,912</sub> =	3883.96	(98)
Space	e heatin	a reauire	ement in	kWh/m²	?/vear										48.33	(99)
- 1 5		J - 1		,	,											<b>」</b> ` ′

9a. Energy requiremen	ts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating:					J							_
Fraction of space hear	t from se	econdar	y/supple	mentary	system						0	(201)
Fraction of space hear	t from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of total heating	ng from i	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main spa	ce heat	ing syste	em 1								92.8	(206)
Efficiency of secondar	y/supple	ementar	y heating	g systen	າ, %						0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating require			·	1				007.40	T = 5 + 6	700.00	1	
754.9 600.82	503.86	281.07	116.67	0	0	0	0	307.42	550.13	769.08	]	
$(211)m = \{[(98)m \times (204)] \\ 813.46  647.44 \}$	4)] } x 1 542.95	00 ÷ (20 302.88	)6) 125.73	0	0	0	0	331.27	592.82	828.76	1	(211)
813.46   647.44	542.95	302.00	125.73					ar) =Sum(2			4185.3	(211)
Space heating fuel (se	condar	v) k\//h/	month				. (	,	- · · /15,1012	2	4100.0	(211)
$= \{[(98)m \times (201)]\} \times 10^{-10}$		• •	monun									
(215)m= 0 0	0	0	0	0	0	0	0	0	0	0		
			-	-	-	Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>		0	(215)
Water heating												
Output from water heat	er (calc 151.98	ulated a 133.97	bove) 129.64	113.47	106.72	120.21	120.97	139.03	149.87	161.97	1	
Efficiency of water heat		133.97	129.04	113.47	100.72	120.21	120.97	139.03	143.07	101.97	87.3	(216)
(217)m= 89.34 89.3	89.21	88.98	88.47	87.3	87.3	87.3	87.3	89.01	89.25	89.35	0.10	(217)
Fuel for water heating,	kWh/mo	onth	!		<u> </u>	ļ		<u>l</u>	!	!	J	
$(219)m = (64)m \times 100$			140.54	400.00	400.05	107.7	400.57	450.0	107.00	104.07	1	
(219)m= 186.65   163.81	170.37	150.57	146.54	129.98	122.25	137.7	138.57 I = Sum(2	156.2 19a) =	167.92	181.27	1851.82	(219)
Annual totals							. • • • • • • • • • • • • • • • • • • •		Wh/year	•	kWh/year	
Space heating fuel use	d, main	system	1					•••	, J Cu.		4185.3	
Water heating fuel used	d										1851.82	7
Electricity for pumps, fa	ans and	electric	keep-ho	t								
central heating pump:			'							30	1	(230c)
boiler with a fan-assist											<u>]</u> 1	
		<b>10</b> /1 /					-f (000-)	(000-)		45	<u> </u>	(230e)
Total electricity for the	above, k	kwn/yea	ır			sum	or (230a).	(230g) =			75	(231)
Electricity for lighting											352.78	(232)
12a. CO2 emissions -	- Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHF						
					ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main sy	/stem 1)	)		(21	1) x			0.2	16	=	904.03	(261)
	,			(21)	5) x					_	0	(263)
Space heating (second	ary)			(21)	<b>5</b> )			1 0.5	19 I	_	1 ()	
Space heating (secondary) (215) $\times$ 0.519 = Water heating (219) $\times$ 0.216 = 39												
Space heating (second Water heating Space and water heating				(219	9) x	+ (263) + (	(264) –			=	399.99	(264)

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93	(267)
Electricity for lighting	(232) x	0.519 =	183.09	(268)
Total CO2, kg/year		sum of (265)(271) =	1526.03	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.99	(273)
El rating (section 14)			84	(274)

		User Details:		
Access v Name	laha Cimpaga		enham. CTI	20000272
Assessor Name: Software Name:	John Simpson Stroma FSAP 2012	Stroma Nur Software V		RO006273 sion: 1.0.4.7
Contware Hame.	Ottoma i Orai 2012	Property Address: 202	CISIOII. VOI	31011. 1.0.1.7
Address :	2.02, 25 Old Glouceste	er St, LONDON, WC1N 3AF		
1. Overall dwelling dime	•			
		Area(m²)	Av. Height(m)	Volume(m³)
Ground floor		42.29 (1a) x	2.4 (2a)	= 101.5 (3a)
First floor		34.9 (1b) x	2.86 (2b)	= 99.81 (3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 77.19 (4)		
Dwelling volume		(3a)+(3	(3b)+(3c)+(3d)+(3e)+(3n) =	201.31 (5)
2. Ventilation rate:				
	main secon heating hea	ondary other ting	total	m³ per hour
Number of chimneys	0 +	0 + 0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 + 0 =	0 x 20 =	0 (6b)
Number of intermittent fa	ns		3 x 10 =	30 (7a)
Number of passive vents			0 x 10 =	0 (7b)
Number of flueless gas fi	res		0 x 40 =	0 (7c)
			Δir	changes per hour
Infiltration due to chimne	vs. flues and fans = $(6a)+(6a)+(6a)$	(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.15 (8)
•		proceed to (17), otherwise continue		0.15
Number of storeys in the	ne dwelling (ns)			0 (9)
Additional infiltration			[(9)-1]x0.1	= 0 (10)
Structural infiltration: 0	.25 for steel or timber fran	me or 0.35 for masonry cons	struction	0 (11)
if both types of wall are pa deducting areas of openia		ding to the greater wall area (after		
		or 0.1 (sealed), else enter (	)	0 (12)
If no draught lobby, en	ter 0.05, else enter 0			0 (13)
Percentage of windows	s and doors draught strip	ped		0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷	- 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	0 (16)
Air permeability value,	q50, expressed in cubic i	metres per hour per square	metre of envelope area	4 (17)
If based on air permeabil				0.35 (18)
		en done or a degree air permeabili	ty is being used	
	ed	(20) = 1 - [0.075 x	(19)] =	2 (19)
Number of sides sheltere				1 0.95 1(20)
Shelter factor	ing chalter factor			0.85 (20)
Shelter factor Infiltration rate incorporat		$(20) = 1 - [0.073 \times (20) = (18) \times (20) = (21) = (20) = ($		0.3 (21)
Shelter factor Infiltration rate incorporat Infiltration rate modified f	or monthly wind speed	(21) = (18) x (20)	=	0.3 (21)
Shelter factor Infiltration rate incorporat	or monthly wind speed  Mar Apr May		=	0.3 (21)

4.9

4.4

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

(22)m=

5.1

5

Wind Factor	(22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	
Adjusted infi	Itration rat	e (allowi	ing for sl	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
0.38		0.36	0.33	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35	]	
Calculate ef		-	rate for t	he appli	cable ca	ise						0	(23a)
If exhaust air			endix N, (2	23b) = (23a	a) × Fmv (	equation (	N5)) , othe	rwise (23b	) = (23a)			0	(23b)
If balanced v									, , ,			0	(23c)
a) If balan	ced mech	anical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2:	2b)m + (	23b) × [	1 – (23c)	) ÷ 100]	`` ′
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If balan	ced mech	anical ve	entilation	without	heat red	covery (I	MV) (24k	m = (22)	2b)m + (	23b)	•	_	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole	house ex	tract ver	ntilation o	or positiv	e input	ventilatio	on from	outside					
	)m < 0.5 >	<del>``</del>	· ` `	ŕ	<del>i                                     </del>	· `	Ť	<del>i                                      </del>	· ` `	<del>i                                      </del>	1	7	
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0	J	(24c)
d) If natura	al ventilation) m = 1, th								0.51				
(24d)m= 0.57	<del></del>	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	1	(24d)
Effective a	ir change	rate - er	1 nter (24a	) or (24b	o) or (24	c) or (24	ld) in bo	x (25)				1	
(25)m= 0.57	<del></del>	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	]	(25)
3. Heat loss	ses and he	eat loss i	naramet	or.		•						-	
ELEMENT		SS	Openin	ıgs	Net Ar		U-val W/m2		A X U		k-value		A X k kJ/K
	Gros area	SS	•	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-		A X k kJ/K
ELEMENT	area	SS	Openin	ıgs	ı, A	m² x	W/m2	2K =	(W/				kJ/K
<b>ELEMENT</b> Doors	area	SS	Openin	ıgs	A ,ı	m² x x1	W/m2	2K =   - 0.04] =	(W/ 3.78				kJ/K (26)
ELEMENT Doors Windows Ty	area pe 1 pe 2	SS	Openin	ıgs	A ,i	m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup>	W/m2 1.8 1/[1/( 1.6 )+	2K =   $-0.04$ ] =   $-0.04$ ] =	(W/ 3.78 2.93				kJ/K (26) (27) (27)
ELEMENT  Doors  Windows Ty  Windows Ty	area pe 1 pe 2 pe 3	SS	Openin	ıgs	A , r 2.1 1.95 3.28	m <sup>2</sup> x x1 x1 x1	W/m2 1.8 1/[1/( 1.6 )+	2K =   -0.04] =   -0.0	(W/ 3.78 2.93 4.93				kJ/K (26) (27)
Doors Windows Ty Windows Ty Windows Ty	area pe 1 pe 2 pe 3 pe 4	SS	Openin	ıgs	A , r 2.1 1.95 3.28 2.16	m <sup>2</sup>	W/m2 1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+	2K =   - 0.04] =   - 0.04] =   - 0.04] =   - 0.04] =	(W/ 3.78 2.93 4.93 3.25	K)			kJ/K (26) (27) (27) (27)
Doors Windows Ty Windows Ty Windows Ty Windows Ty	area pe 1 pe 2 pe 3 pe 4	SS	Openin	ıgs	A ,1 2.1 1.95 3.28 2.16 1.43	m <sup>2</sup>	W/m <sup>2</sup> 1.8 1/[1/( 1.6 )+ 1/[1/( 1.6 )+ 1/[1/( 1.6 )+ 1/[1/( 1.6 )+	2K =   - 0.04] =   - 0.04] =   - 0.04] =   - 0.04] =	(W/ 3.78 2.93 4.93 3.25 2.15	K)			kJ/K (26) (27) (27) (27) (27)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty	area pe 1 pe 2 pe 3 pe 4 pe 5	ss (m²)	Openin	gs 1 <sup>2</sup>	A ,1 2.1 1.95 3.28 2.16 1.43 8.93	m <sup>2</sup>	W/m <sup>2</sup> 1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+	2K =   -0.04] =   -0.0	(W/ 3.78 2.93 4.93 3.25 2.15	K)			kJ/K (26) (27) (27) (27) (27) (27)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Floor	area pe 1 pe 2 pe 3 pe 4 pe 5	ss (m²)	Openin m	gs 1 <sup>2</sup>	A ,1 2.1 1.95 3.28 2.16 1.43 8.93 2.4	m <sup>2</sup>	W/m2  1.8  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  0.15	2K = 0.04] = 0	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36	K)			kJ/K (26) (27) (27) (27) (27) (27) (28)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Floor Walls Type1	area  pe 1  pe 2  pe 3  pe 4  pe 5	ss (m²)	Openin m	gs 1 <sup>2</sup>	A ,1 2.1 1.95 3.28 2.16 1.43 8.93 2.4 65.50	m <sup>2</sup>	W/m2  1.8  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  0.15  0.18	2K = 0.04] = 0	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8	K)			kJ/K (26) (27) (27) (27) (27) (27) (28) (29)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2	area  pe 1  pe 2  pe 3  pe 4  pe 5	6 8	22.0 2.1	gs 1 <sup>2</sup>	A ,1 2.1 1.95 3.28 2.16 1.43 8.93 2.4 65.55	m <sup>2</sup>	W/m <sup>2</sup> 1.8  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  0.15  0.18	2K =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   =   =   =   =   =	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65	K)			kJ/K (26) (27) (27) (27) (27) (27) (28) (29)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Walls Type1 Walls Type2 Roof Type1	area  pe 1  pe 2  pe 3  pe 4  pe 5  87.  16.  9.9	6 8 9	22.0 2.1	gs 1 <sup>2</sup>	A ,1 2.1 1.95 3.28 2.16 1.43 8.93 2.4 65.53 14.7	m <sup>2</sup>	W/m <sup>2</sup> 1.8  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  0.15  0.18  0.15	2K =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   =   =   =   =   =   =   =   =   =	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65	K)			kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Walls Type1 Walls Type2 Roof Type1 Roof Type2	area  pe 1  pe 2  pe 3  pe 4  pe 5  87.  16.  9.9	6 8 9	22.0 2.1	gs 1 <sup>2</sup>	A ,1 2.1 1.95 3.28 2.16 1.43 8.93 2.4 65.55 14.7 9.9	m <sup>2</sup>	W/m <sup>2</sup> 1.8  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  0.15  0.18  0.15	2K =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   =   =   =   =   =   =   =   =   =	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of Party wall *for windows a	area  pe 1  pe 2  pe 3  pe 4  pe 5  87.  16.  9.9  35.  f elements	6 8 9 3 5, m <sup>2</sup>	22.0 2.1 0	indow U-va	A ,1  2.1  1.95  3.28  2.16  1.43  8.93  2.4  65.55  14.7  9.9  35.3  152  42.9	m <sup>2</sup>	W/m <sup>2</sup> 1.8  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  0.15  0.18  0.15  0.15	2K =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   -0.04  =   =   -0.04  =   =   =   =   =   =   =   =   =   =	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65 1.49 5.3	K)	kJ/m²-	K	kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30) (31)
Doors Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of Party wall	area  pe 1  pe 2  pe 3  pe 4  pe 5  87.  16.  9.9.  35.  f elements  and roof wind  reas on both	6 8 3 5, m <sup>2</sup> dows, use 6	22.0 2.1 0 0 effective winternal wal	indow U-va	A ,1  2.1  1.95  3.28  2.16  1.43  8.93  2.4  65.55  14.7  9.9  35.3  152  42.9	m <sup>2</sup>	W/m <sup>2</sup> 1.8  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  0.15  0.18  0.15  0.15	2K =   -0.04  =   -0.0	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65 1.49 5.3	K)	kJ/m²-	K	kJ/K (26) (27) (27) (27) (27) (28) (29) (30) (30) (31) (32)
ELEMENT  Doors  Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Windows Ty Floor  Walls Type1  Walls Type2  Roof Type1  Roof Type2  Total area of Party wall  * for windows a ** include the a	area  pe 1  pe 2  pe 3  pe 4  pe 5  87.  16.  9.9  35.  f elements  and roof wind reas on both oss, W/K	6 8 9 3 5, m <sup>2</sup> dows, use 6 9 sides of ir = S (A x	22.0 2.1 0 0 effective winternal wal	indow U-va	A ,1  2.1  1.95  3.28  2.16  1.43  8.93  2.4  65.55  14.7  9.9  35.3  152  42.9	m <sup>2</sup>	W/m <sup>2</sup> 1.8  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  0.15  0.18  0.15  0.15  0.17  0.17  0.17  0.18	2K =   -0.04  =   -0.0	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65 1.49 5.3	K)	kJ/m²-	K	kJ/K (26) (27) (27) (27) (27) (28) (29) (30) (30) (31) (32)
ELEMENT  Doors  Windows Ty  Windows Ty  Windows Ty  Windows Ty  Windows Ty  Floor  Walls Type1  Walls Type2  Roof Type1  Roof Type2  Total area of  Party wall  * for windows a  ** include the a  Fabric heat I	area  pe 1  pe 2  pe 3  pe 4  pe 5  87.  16.  9.9  35.  f elements  and roof wind reas on both loss, W/K  by Cm = Si	6 8 3 5, m <sup>2</sup> lows, use 6 sides of ir = S (A x (A x k)	22.0 2.1 0 0 effective winternal wall	indow U-valls and part	A ,1  2.1  1.95  3.28  2.16  1.43  8.93  2.4  65.53  14.7  9.9  35.3  152  42.9  alue calculatitions	m <sup>2</sup>	W/m <sup>2</sup> 1.8  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  1/[1/( 1.6 )+  0.15  0.18  0.15  0.15  0.17  0.17  0.17  0.18	2K  = 0.04] =   -0.04] =   -0.04] =   -0.04] =   -0.04] =   -0.04] =   =   =   =     =     =     (1/U-value)   + (32) = ((28).	(W/ 3.78 2.93 4.93 3.25 2.15 13.43 0.36 11.8 2.65 1.49 5.3	K)	kJ/m²-	K	(26) (27) (27) (27) (27) (27) (28) (29) (30) (30) (31) (32)

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

can be ເ	ısed instea	ad of a de	tailed calc	ulation.										
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix I	K						17.9	(36)
	_	,	,		= 0.15 x (3	•							-	` ′
Total fa	abric hea	at loss							(33) +	(36) =			76.45	(37)
Ventila	tion hea	it loss ca	alculated	monthly	y				(38)m	= 0.33 × (	(25)m x (5)		_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	37.97	37.78	37.6	36.75	36.59	35.85	35.85	35.72	36.14	36.59	36.92	37.25		(38)
Heat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (37)	38)m		-	
(39)m=	114.42	114.23	114.05	113.2	113.04	112.3	112.3	112.17	112.59	113.04	113.36	113.7	]	
Heat lo	ss para	meter (H	HLP), W	/m²K				•		Average = = (39)m ÷	Sum(39) <sub>1</sub> · (4)	12 /12=	113.2	(39)
(40)m=	1.48	1.48	1.48	1.47	1.46	1.45	1.45	1.45	1.46	1.46	1.47	1.47	]	
Numbe	er of day	rs in mor	nth (Tab	le 1a)	•	•	•	•		Average =	Sum(40) <sub>1</sub>	12 /12=	1.47	(40)
1101110	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
				l .	l .	l .						l	J	
4. Wa	iter heat	ina ener	rav reau	irement:								kWh/y	ear:	
												,,,,,	•	
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		41		(42)
		•	ater usaç	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		91	.38	1	(43)
		_				_	_	to achieve	a water us	se target o	f		J	
not more			· ·		ater use, l	ioi and co	•	1		<u> </u>	1		1	
Hot water	Jan Tusago ir	Feb	Mar	Apr	May Vd,m = fa	Jun	Jul Table 10 x	Aug	Sep	Oct	Nov	Dec		
			,										1	
(44)m=	100.51	96.86	93.2	89.55	85.89	82.24	82.24	85.89	89.55	93.2	96.86	100.51	4000 5	(44)
Energy o	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	m x nm x L	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1096.5	(44)
(45)m=	149.06	130.37	134.53	117.28	112.54	97.11	89.99	103.26	104.49	121.78	132.93	144.35		
										Total = Su	m(45) <sub>112</sub> =	-	1437.69	(45)
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46	) to (61)	•			1	
(46)m=	22.36	19.56	20.18	17.59	16.88	14.57	13.5	15.49	15.67	18.27	19.94	21.65		(46)
	storage e volum		includir	na anv sa	olar or M	/WHRS	storage	within sa	ame ves	امء		0	1	(47)
•		` ,		•	/elling, e		_		arric ves	301		0	J	(47)
	-	_			_			mbi boil	ers) ente	er '0' in (	47)			
	storage			(1)					, ,	(	,			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
Tempe	rature fa	actor fro	m Table	2b								0	]	(49)
• • • • • • • • • • • • • • • • • • • •			_	, kWh/ye				(48) x (49)	) =			0	]	(50)
•				-	loss fact								- 1	
		_	factor fr ee secti		le 2 (kW	n/litre/da	ay)					0	J	(51)
		from Tal		UII 4.3								0	1	(52)
			m Table	2b								0		(53)
•													ı	

Energy lost fro		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or	, , ,	,					((50) (	(55) (44)			0		(55)
Water storage	ioss cai	culated i		montn			., ,	(55) × (41)r	n <del></del>	<del></del>	1	1	>
(56)m= 0	0	0	0	0 (50)	0	0	0	0 (50)	0	0	0	Part II	(56)
If cylinder contain	s dedicate	a solar sto	rage, (57)i	m = (56)m	x [(50) – (	H11)] ÷ (5)	u), eise (5	7)m = (56)	m wnere (	HTT) IS TRO	m Append	ıx H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	3							0		(58)
Primary circuit				•	•	` '	` '						
(modified by	1	1					<del></del>	<del></del>		<del>-                                    </del>	i	I	(==)
(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= 15.27	13.8	15.27	14.78	15.27	14.78	15.27	15.27	14.78	15.27	14.78	15.27		(61)
Total heat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 164.33	144.16	149.8	132.07	127.81	111.89	105.26	118.54	119.28	137.05	147.71	159.63		(62)
Solar DHW 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 additiona	I lines if	FGHRS	and/or V	WWHRS	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= 164.33	144.16	149.8	132.07	127.81	111.89	105.26	118.54	119.28	137.05	147.71	159.63		
	•	•					Outp	out from wa	ater heate	r (annual) <sub>1</sub>	12	1617.53	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	]	
(65)m= 53.38	I	1											
(05)111= 35.36	46.8	48.55	42.69	41.24	35.98	33.74	38.15	38.44	44.31	47.89	51.82		(65)
include (57)	<u> </u>					<u> </u>	<u> </u>		44.31	47.89	51.82		(65)
include (57)	m in cald	culation o	of (65)m	only if c		<u> </u>	<u> </u>		44.31	47.89	51.82		(65)
include (57) 5. Internal g	m in cald	culation of Table 5	of (65)m and 5a	only if c		<u> </u>	<u> </u>		44.31	47.89	51.82		(65)
include (57)	m in cald	culation of Table 5	of (65)m and 5a	only if c		<u> </u>	dwelling	or hot w	44.31	47.89	51.82		(65)
include (57)  5. Internal g	m in cald ains (see ns (Table	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the d	<u> </u>		44.31 ater is fr	47.89 rom com	51.82 munity h		(65)
include (57)  5. Internal gradients  Metabolic gain  Jan  (66)m= 120.37	m in caldains (see	E Table 5 5), Wat Mar 120.37	of (65)m and 5a ts Apr 120.37	only if c ):  May 120.37	ylinder is Jun 120.37	Jul 120.37	Aug 120.37	Sep	44.31 ater is fr	47.89 om com	51.82 munity h		
include (57)  5. Internal given by the second of the secon	m in calc ains (see ns (Table Feb 120.37 (calcula	Example 5 to 2 to 3 to 3 to 3 to 3 to 3 to 3 to 3	of (65)m and 5a ts Apr 120.37	only if c  May  120.37  L, equati	Jun 120.37	Jul 120.37 r L9a), a	Aug 120.37	or hot w  Sep 120.37 Table 5	44.31 ater is fr Oct 120.37	47.89 om com	51.82 munity h		
include (57)  5. Internal gain  Metabolic gain  Jan  (66)m= 120.37  Lighting gains (67)m= 19.03	m in calcons (See Feb 120.37 (calcula 16.9	E Table 5 E 5), Wat Mar 120.37 ted in Ap	of (65)m and 5a ts Apr 120.37 ppendix 10.41	only if construction is the construction of th	Jun 120.37 ion L9 o	Jul 120.37 r L9a), a	Aug 120.37 Iso see	Sep 120.37 Table 5	44.31 ater is fr Oct 120.37	47.89 om com Nov 120.37	51.82 munity h		(66)
include (57)  5. Internal gradients  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances ga	m in calcular min	culation of Table 5  5), Wat Mar  120.37  ted in Ap  13.75  culated in	of (65)m and 5a ts Apr 120.37 opendix 10.41 Append	only if constructions in the construction of t	Jun 120.37 ion L9 o 6.57 uation L	Jul 120.37 r L9a), a 7.1 13 or L1	Aug 120.37 Iso see 9.22 3a), also	Sep 120.37 Table 5 12.38 Disee Tal	44.31  ater is fr  Oct 120.37  15.72  ble 5	47.89 rom com Nov 120.37	51.82 munity h		(66) (67)
include (57)  5. Internal given the second of the second o	m in calc	culation of Table 5 2 5), Wat Mar 120.37 ted in Ap 13.75 culated in 210.1	of (65)m and 5a ts Apr 120.37 opendix 10.41 Appendix 198.22	only if c  May  120.37  L, equati  7.78  dix L, eq  183.22	Jun 120.37 ion L9 o 6.57 uation L 169.12	Jul 120.37 r L9a), a 7.1 13 or L1:	Aug 120.37 Iso see 9.22 3a), also	Sep 120.37 Table 5 12.38 See Tal 163.07	44.31  ater is fr  Oct 120.37  15.72  ble 5 174.95	47.89 om com Nov 120.37	51.82 munity h		(66)
include (57)  5. Internal graph of the following spans (66)m= 120.37  Lighting gains (67)m= 19.03  Appliances gains (68)m= 213.47  Cooking gains	m in calcains (see Feb 120.37 (calcula 16.9 ins (calcula 215.68 (calcula	ted in Aputed in	of (65)m and 5a ts Apr 120.37 ppendix 10.41 Append 198.22 ppendix	only if constructions only if constructions only if constructions on the construction of the construction on the construction of the construction on the construction of the construction	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a)	Aug 120.37 Iso see 9.22 3a), also 157.48	Sep 120.37 Table 5 12.38 See Tal 163.07 ee Table	44.31  ater is fr  Oct 120.37  15.72  ble 5 174.95 5	47.89  Tom com  Nov  120.37  18.35	Dec 120.37		(66) (67) (68)
include (57)  5. Internal gradies  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances gains  (68)m= 213.47  Cooking gains  (69)m= 35.04	m in calcular man in calcular	ted in Ap 210.1 ated in Ap 35.04	of (65)m and 5a ts Apr 120.37 opendix 10.41 Append 198.22 opendix 35.04	only if c  May  120.37  L, equati  7.78  dix L, eq  183.22	Jun 120.37 ion L9 o 6.57 uation L 169.12	Jul 120.37 r L9a), a 7.1 13 or L1:	Aug 120.37 Iso see 9.22 3a), also	Sep 120.37 Table 5 12.38 See Tal 163.07	44.31  ater is fr  Oct 120.37  15.72  ble 5 174.95	47.89 rom com Nov 120.37	51.82 munity h		(66) (67)
include (57)  5. Internal given the second of the second o	m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ains (calcula 215.68 c (calcula 35.04 as gains	culation of Table 5 2 5), Wat Mar 120.37 ted in Ap 13.75 culated in 210.1 ated in Ap 35.04 (Table 5	of (65)m and 5a ts Apr 120.37 opendix 10.41 Appendix 198.22 opendix 35.04	only if construction only if c	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15 35.04	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	Aug 120.37 Iso see 9.22 3a), also 157.48 ), also se 35.04	Sep 120.37 Table 5 12.38 See Tal 163.07 ee Table 35.04	44.31  ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04	47.89  Tom com  Nov  120.37  18.35  189.95	Dec 120.37 19.56 204.05		(66) (67) (68) (69)
include (57)  5. Internal graph of the first section of the first sectio	m in calc ains (see ns (Table Feb 120.37 (calcula 16.9 ins (calc 215.68 s (calcula 35.04 ns gains 3	culation of Table 5 2 5), Wat Mar 120.37 ted in Ap 13.75 culated in 210.1 ated in Ap 35.04 (Table 5	of (65)m and 5a ts Apr 120.37 ppendix 10.41 Append 198.22 ppendix 35.04 5a) 3	only if construction only if c	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a)	Aug 120.37 Iso see 9.22 3a), also 157.48	Sep 120.37 Table 5 12.38 See Tal 163.07 ee Table	44.31  ater is fr  Oct 120.37  15.72  ble 5 174.95 5	47.89  Tom com  Nov  120.37  18.35	Dec 120.37		(66) (67) (68)
include (57)  5. Internal gradies  Metabolic gain  Jan  (66)m= 120.37  Lighting gains  (67)m= 19.03  Appliances gains  (68)m= 213.47  Cooking gains  (69)m= 35.04  Pumps and fain  (70)m= 3  Losses e.g. examples  Losses e.g. examples  Losses e.g. examples  Losses e.g. examples  Losses e.g. examples  Appliances gains  (69)m= 35.04	m in calcular services (Table Feb 120.37 (calcular 16.9 ins (calcular 35.04 ns gains 3 vaporatio	culation of Table 5 2 5), Wat Mar 120.37 ted in Ap 13.75 culated in 210.1 ated in Ap 35.04 (Table 5	of (65)m ts Apr 120.37 opendix 10.41 Appendix 198.22 opendix 35.04 5a) 3 tive valu	only if construction only if c	Jun 120.37 ion L9 o 6.57 uation L 169.12 ion L15 35.04  3 le 5)	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	Aug 120.37 Iso see 9.22 3a), also 157.48 ), also se 35.04	Sep 120.37 Table 5 12.38 See Tal 163.07 ee Table 35.04	44.31  ater is fr  Oct 120.37  15.72  ble 5 174.95 5 35.04	47.89  om com  Nov 120.37  18.35  189.95  35.04	Dec 120.37 19.56 204.05 35.04		(66) (67) (68) (69) (70)
include (57)  5. Internal given by the second secon	m in calcons (Table Feb 120.37 (calcula 16.9 ins (calcula 35.04 ns gains 3 vaporatio -96.3	culation of the Table 5  2 5), Wat Mar 120.37  ted in Ap 13.75  culated in 210.1  ated in Ap 35.04  (Table 5 3 on (negation of the period)	of (65)m and 5a ts Apr 120.37 ppendix 10.41 Append 198.22 ppendix 35.04 5a) 3	only if construction only if c	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	Aug 120.37 Iso see 9.22 3a), also 157.48 ), also se 35.04	Sep 120.37 Table 5 12.38 See Tal 163.07 ee Table 35.04	44.31  ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04	47.89  Tom com  Nov  120.37  18.35  189.95	Dec 120.37 19.56 204.05		(66) (67) (68) (69)
include (57)  5. Internal grains  (66)m= 120.37  Lighting gains (67)m= 19.03  Appliances ga (68)m= 213.47  Cooking gains (69)m= 35.04  Pumps and fa (70)m= 3  Losses e.g. ev (71)m= -96.3  Water heating	m in calcular section (calcular section) (calcular	culation of the Europe Solution of the Europe	of (65)m and 5a ts Apr 120.37 pendix 10.41 Append 198.22 pendix 35.04 5a) 3 tive valu -96.3	only if construction only if c	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04 3 le 5) -96.3	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04	Aug 120.37 Iso see 9.22 3a), also 157.48 ), also se 35.04	Sep 120.37 Table 5 12.38 Disee Table 163.07 Dee Table 35.04	44.31  ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3	18.35 189.95 35.04	Dec 120.37 19.56 204.05 35.04 3		(66) (67) (68) (69) (70) (71)
include (57)  5. Internal given by the second secon	m in calcular services (Table Feb 120.37 (calcular 16.9 ins (calcular 35.04 ns gains 3 vaporation 96.3 gains (Table 69.64	culation of the Table 5  2 5), Wat Mar 120.37  ted in Ap 13.75  culated in 210.1  ated in Ap 35.04  (Table 5 3 on (negation of the period) of the period of	of (65)m ts Apr 120.37 opendix 10.41 Appendix 198.22 opendix 35.04 5a) 3 tive valu	only if construction only if c	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	Jul 120.37 r L9a), a 7.1 13 or L1 159.7 or L15a) 35.04	Aug 120.37 Iso see 9.22 3a), also 157.48 3, also se 35.04	Sep 120.37 Table 5 12.38 2 see Tal 163.07 ee Table 35.04  3 -96.3	44.31  ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3	47.89  om com  Nov  120.37  18.35  189.95  35.04  3  -96.3	51.82 munity h  Dec 120.37  19.56  204.05  35.04  3  -96.3		(66) (67) (68) (69) (70)
include (57)  5. Internal graph of the first section of the first sectio	m in calc ains (see as (Table Feb 120.37 (calcula 16.9 ains (calcula 215.68 c (calcula 35.04 as gains 3 vaporatio -96.3 gains (T 69.64 gains =	culation of Earlie Solution of Earlie Earlie Solution of Earlie	of (65)m and 5a ts Apr 120.37 ppendix 10.41 Appendix 35.04 5a) 3 tive valu -96.3	only if construction only if c	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	Jul 120.37 r L9a), a 7.1 13 or L1: 159.7 or L15a) 35.04 3 -96.3	Aug 120.37 Iso see 9.22 3a), also 157.48 ), also se 35.04 3 -96.3	Sep 120.37 Table 5 12.38 See Tal 163.07 Table 35.04  3  -96.3	44.31  ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3  59.56  (70)m + (7	47.89  Tom com  Nov  120.37  18.35  189.95  35.04  3  -96.3  66.52  1)m + (72)	51.82 munity h  Dec 120.37  19.56  204.05  35.04  3  -96.3		(66) (67) (68) (69) (70) (71)
include (57)  5. Internal given by the second secon	m in calc ains (see ns (Table Feb 120.37 (calcula 16.9 ins (calcula 35.04 ns gains 3 /aporatic -96.3 gains (T 69.64 gains = 364.33	culation of the Table 5  2 5), Wat Mar 120.37  ted in Ap 13.75  culated in 210.1  ated in Ap 35.04  (Table 5 3 on (negation of the period) of the period of	of (65)m and 5a ts Apr 120.37 pendix 10.41 Append 198.22 pendix 35.04 5a) 3 tive valu -96.3	only if construction only if c	Jun 120.37 ion L9 of 6.57 uation L 169.12 ion L15 35.04  3 le 5) -96.3	Jul 120.37 r L9a), a 7.1 13 or L1 159.7 or L15a) 35.04	Aug 120.37 Iso see 9.22 3a), also 157.48 3, also se 35.04	Sep 120.37 Table 5 12.38 2 see Tal 163.07 ee Table 35.04  3 -96.3	44.31  ater is fr  Oct 120.37  15.72 ble 5 174.95 5 35.04  3  -96.3	47.89  om com  Nov  120.37  18.35  189.95  35.04  3  -96.3	51.82 munity h  Dec 120.37  19.56  204.05  35.04  3  -96.3		(66) (67) (68) (69) (70) (71)

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

Orientation: Acces Table		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	11.28	x	0.72	x	0.7	] =	25.54	(75)
Northeast 0.9x 0	.77 ×	2.16	x	22.97	x	0.72	x	0.7	=	51.98	(75)
Northeast 0.9x 0	.77 ×	2.16	x	41.38	x	0.72	x	0.7	=	93.65	(75)
Northeast 0.9x 0	.77 ×	2.16	x	67.96	x	0.72	x	0.7	=	153.8	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	91.35	x	0.72	x	0.7	=	206.74	(75)
Northeast 0.9x 0	.77 ×	2.16	x	97.38	x	0.72	x	0.7	=	220.41	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	91.1	x	0.72	x	0.7	=	206.19	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	72.63	x	0.72	X	0.7	=	164.38	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	50.42	x	0.72	x	0.7	=	114.12	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	28.07	x	0.72	X	0.7	=	63.52	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	X	14.2	X	0.72	X	0.7	=	32.13	(75)
Northeast <sub>0.9x</sub> 0	.77 ×	2.16	x	9.21	x	0.72	x	0.7	=	20.85	(75)
East 0.9x	1 ×	1.95	X	19.64	X	0.72	X	0.7	=	13.38	(76)
East 0.9x	1 ×	1.43	x	19.64	X	0.72	X	0.7	=	9.81	(76)
East 0.9x	1 ×	1.95	x	38.42	x	0.72	x	0.7	=	26.17	(76)
East 0.9x	1 ×	1.43	X	38.42	X	0.72	X	0.7	=	19.19	(76)
East 0.9x	1 ×	1.95	x	63.27	x	0.72	X	0.7	=	43.09	(76)
East 0.9x	1 x	1.43	x	63.27	x	0.72	x	0.7	=	31.6	(76)
East 0.9x	1 ×	1.95	x	92.28	x	0.72	X	0.7	=	62.85	(76)
East 0.9x	1 ×	1.43	x	92.28	x	0.72	x	0.7	=	46.09	(76)
East 0.9x	1 ×	1.95	x	113.09	x	0.72	x	0.7	=	77.03	(76)
East 0.9x	1 ×	1.43	X	113.09	X	0.72	X	0.7	=	56.49	(76)
East 0.9x	1 ×	1.95	x	115.77	x	0.72	X	0.7	=	78.85	(76)
East 0.9x	1 x	1.43	x	115.77	x	0.72	X	0.7	=	57.82	(76)
East 0.9x	1 ×	1.95	x	110.22	x	0.72	X	0.7	=	75.07	(76)
East 0.9x	1 x	1.43	x	110.22	X	0.72	x	0.7	=	55.05	(76)
East 0.9x	1 x	1.95	x	94.68	x	0.72	X	0.7	=	64.48	(76)
East 0.9x	1 ×	1.43	X	94.68	X	0.72	X	0.7	=	47.29	(76)
East 0.9x	1 ×	1.95	X	73.59	X	0.72	X	0.7	=	50.12	(76)
East 0.9x	1 x	1.43	x	73.59	x	0.72	X	0.7	=	36.75	(76)
East 0.9x	1 x	1.95	x	45.59	X	0.72	x	0.7	=	31.05	(76)
East 0.9x	1 ×	1.43	X	45.59	X	0.72	X	0.7	=	22.77	(76)
East 0.9x	1 x	1.95	x	24.49	x	0.72	X	0.7	=	16.68	(76)
East 0.9x	1 ×	1.43	X	24.49	X	0.72	X	0.7	=	12.23	(76)
East 0.9x	1 x	1.95	x	16.15	x	0.72	X	0.7	=	11	(76)
	1 ×	1.43	x	16.15	x	0.72	x	0.7	=	8.07	(76)
West 0.9x 0	.77 ×	3.28	x	19.64	x	0.72	x	0.7	=	22.5	(80)
	.77 ×	8.93	x	19.64	x	0.72	x	0.7	=	61.26	(80)
West 0.9x 0	.77 ×	3.28	x	38.42	x	0.72	x	0.7	=	44.02	(80)

West	ا م م								1			1 1		$\overline{}$	ı		7,000
	0.9x	0.77	,		93	X		8.42	X	0.7		X	0.7	_	=	119.83	(80)
West	0.9x	0.77	,		28	X	<b>—</b>	3.27	X	0.7	'2	X	0.7		=	72.49	(80)
West	0.9x	0.77	,	<u> </u>	93	X		3.27	X	0.7	72	X	0.7	_	=	197.35	(80)
West	0.9x	0.77	,	3.	28	X	9	2.28	X	0.7	72	X	0.7	_	=	105.72	(80)
West	0.9x	0.77		8.	93	X	9	2.28	X	0.7	72	X	0.7		=	287.82	(80)
West	0.9x	0.77	<u> </u>	3.	28	X	1	13.09	X	0.7	'2	X	0.7		=	129.56	(80)
West	0.9x	0.77	<b>)</b>	8.	93	X	1	13.09	X	0.7	<b>'</b> 2	X	0.7		=	352.74	(80)
West	0.9x	0.77	<u> </u>	3.	28	X	1	15.77	X	0.7	'2	X	0.7		=	132.63	(80)
West	0.9x	0.77	<b>)</b>	8.	93	X	1	15.77	X	0.7	<b>7</b> 2	X	0.7		=	361.09	(80)
West	0.9x	0.77	>	3.	28	X	1	10.22	X	0.7	72	X	0.7		=	126.27	(80)
West	0.9x	0.77	>	8.	93	X	1	10.22	X	0.7	'2	X	0.7		=	343.77	(80)
West	0.9x	0.77	<b>)</b>	3.	28	x	9	4.68	X	0.7	'2	x	0.7		=	108.46	(80)
West	0.9x	0.77	>	8.	93	x	9	4.68	x	0.7	'2	x	0.7		=	295.29	(80)
West	0.9x	0.77	<b>)</b>	3.	28	x	7	3.59	x	0.7	<b>'</b> 2	x	0.7		=	84.3	(80)
West	0.9x	0.77	<u> </u>	8.	93	x	7	3.59	x	0.7	'2	x	0.7		=	229.52	(80)
West	0.9x	0.77	<b>)</b>	3.	28	x	4	5.59	x	0.7	'2	x	0.7		=	52.23	(80)
West	0.9x	0.77	<b>)</b>	8.	93	x	4	5.59	x	0.7	'2	x	0.7		=	142.19	(80)
West	0.9x	0.77	<b>)</b>	3.	28	x	2	4.49	x	0.7	<b>'</b> 2	x	0.7		=	28.06	(80)
West	0.9x	0.77	,	8.	93	x	2	4.49	x	0.7	<b>'</b> 2	X	0.7		=	76.38	(80)
West	0.9x	0.77		3.	28	x	1	6.15	x	0.7	'2	X	0.7		=	18.5	(80)
West	0.9x	0.77	,	8.	93	x	1	6.15	X	0.7	'2	X	0.7	一	=	50.38	(80)
	L	-							ı			, ,	-		ı		<b>」</b> ` '
Solar o	ains in	watts, ca	lculate	d for eac	h mont	h			(83)m	n = Sum(7	74)m(	(82)m					
•	132.48	261.19	438.18	656.28	822.55	1	350.8	806.34	679			311.76	165.48	108	.8		(83)
Total g	ains – i	nternal a	nd sola	r (84)m	= (73)m	1 + (	83)m	, watts	<u> </u>		!			·			
(84)m=	498.84	625.52	789.4	986.31	1131.0	8 11	138.57	1080.6	96	0 80	5.77	624.1	502.41	464.	16		(84)
7 Me	an inter	nal temp	erature	(heating	n seaso	n)					•			•			
		during h		,			area f	from Tab	ole 9	. Th1 (°	C)					21	(85)
-		ctor for ga	•			_				, (	• ,						
<b>C</b> 1	Jan	Feb	Mar	Apr	May	Ť	Jun	Jul	Α	ug S	Sep	Oct	Nov	De	ес		
(86)m=	1	0.99	0.97	0.91	0.78	+	0.59	0.45	0.5		.79	0.97	0.99	1			(86)
Maan	intorno	l tompor	atura in	living or	T1 /	follo	···· oto	no 2 to 7	 7 in T		<u> </u>		·				
(87)m=	19.38	l tempera	19.98	20.46	20.8	_	20.95	20.99	20.		<del></del>	20.34	19.76	19.3	34		(87)
										Ļ	<u> </u>	20.04	13.70	15.0	J-T		(01)
		during h		1	T	$\overline{}$			_	<del></del>	<del></del>		1	1			(00)
(88)m=	19.7	19.7	19.7	19.71	19.71		19.72	19.72	19.	72   19	9.72	19.71	19.71	19.7	71		(88)
Utilisa	ation fac	tor for ga	ains for	rest of c	lwelling	, h2	,m (se	e Table	9a)								
(89)m=	1	0.99	0.97	0.88	0.71		0.49	0.32	0.3	38 0	).7	0.95	0.99	1			(89)
Mean	interna	l tempera	ature in	the rest	of dwe	lling	T2 (fo	ollow ste	eps 3	to 7 in	Table	9c)					
(90)m=	17.57	17.9	18.45	19.12	19.54	$\int_{1}^{2}$	19.69	19.72	19.	72 19	9.6	18.97	18.14	17.5	52		(90)
				-	-	•					fLA	A = Liv	ing area ÷ (	4) =		0.44	(91)
																	_

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

(92)m=	18.37	18.65	19.13	19.71	20.1	20.25	20.28	20.27	20.15	19.58	18.86	18.32		(92)
Apply	adjustn	nent to th	ne mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate	ļ			
(93)m=	18.37	18.65	19.13	19.71	20.1	20.25	20.28	20.27	20.15	19.58	18.86	18.32		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti	to the r	nean int	ernal ter	nperatui	e obtain	ed at ste	ep 11 of	Table 9l	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	r gains	using Ta	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm	:				_			_			
(94)m=	0.99	0.99	0.96	0.88	0.73	0.53	0.38	0.44	0.73	0.94	0.99	1		(94)
Usefu	l gains,	hmGm ,	W = (94)	1)m x (84	4)m									
(95)m=	496.08	617.04	758.28	869.99	825.49	608.8	408.56	425.72	591.12	589.51	496.93	462.23		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]				
(97)m=	1610.03	1570.93	1440.5	1223.68	949	634.37	413.16	434.48	681.02	1014.84	1332.93	1605.72		(97)
Space	heating	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	24 x [(97	)m – (95	)m] x (4 <sup>-</sup>	1)m	-		
(98)m=	828.78	641.02	507.57	254.66	91.89	0	0	0	0	316.45	601.92	850.76		
•						-		Tota	l per year	(kWh/year	) = Sum(9	8)15,912 =	4093.05	(98)
Space	e heating	a require	ement in	kWh/m²	/vear								53.03	(99)
•		· ·			•				\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\				00.00	
			ıts – Indi	viduai n	eating s	ystems II	ncluaing	micro-C	HP)					
•	e heatin	_	t from se	ocondan	//supple	mentary	evetom					I	0	(201)
	•					memary	-	(202) 4	(004)				0	= '
	•		t from m		• •			(202) = 1	, ,				1	(202)
Fracti	on of to	al heatir	ng from i	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heati	ng syste	em 1								92.8	(206)
Efficie	ency of s	econda	ry/supple	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	⊒ ar
Space			ement (c		_		oui	, rug	ГООР	001	1101	200	KVVII, y O	·ui
	828.78	641.02	507.57	254.66	91.89	0	0	0	0	316.45	601.92	850.76		
(044)					)C)				<u> </u>					(244)
(211)111	893.08	690.75	4)] } x 1 546.95	274.42	99.02	0	0	0	0	341	648.62	916.76		(211)
	095.00	090.73	340.93	214.42	33.02		U		l (kWh/yea				4440.00	(211)
_								1010	ii (KVVII) y CC	ar) =0arri(2	- ' '/15,1012		4410.62	(211)
•		•	econdar	, , .	month									
$= \{[(98)]$		0 (1)] } X 1	00 ÷ (20	0	0	0	0	0	0	0	0	0		
(215)111=	U	0	U	U	0	U	U	_	l (kWh/yea		_	_	_	7(045)
								TOla	ii (KVVII/yea	ar) =Surri(2	213) <sub>15,1012</sub>	.=	0	(215)
	heating													
Output			ter (calc			111 00	105.06	110.54	110.00	127.05	147.71	150.62		
Γ <i>ι</i> : -: -	164.33	144.16	149.8	132.07	127.81	111.89	105.26	118.54	119.28	137.05	147.71	159.63		7/040
ı		ater hea				_	_						87.3	(216)
(217)m=		89.33	89.22	88.93	88.33	87.3	87.3	87.3	87.3	89.03	89.3	89.4		(217)
		0.	kWh/mo											
(219)m=		m x 100 161.38	) ÷ (217) 167.9	m 148.5	144.7	128.17	120.57	135.78	136.63	153.94	165.42	178.56		
(219)111=	103.00	101.36	101.9	140.3	144./	120.17	120.37		136.63 Il = Sum(2°		100.42	170.00	4005 10	7(2(5)
								TOTA	– Juiii(2	ι σα) <sub>112</sub> =			1825.43	(219)

Annual totals		kWh/year	kWh/year
Space heating fuel used, main system 1			4410.62
Water heating fuel used			1825.43
Electricity for pumps, fans and electric keep-hot			
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230	0a)(230g) =	75 (231)
Electricity for lighting			336.09 (232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)			
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh	kg CO2/year
	kWh/year (211) x	kg CO2/kWh	kg CO2/year 952.69 (261)
Space heating (secondary)	kWh/year (211) x (215) x	kg CO2/kWh  0.216 =  0.519 =  0.216 =	kg CO2/year  952.69 (261)  0 (263)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	kg CO2/kWh  0.216 =  0.519 =  0.216 =	kg CO2/year  952.69 (261)  0 (263)  394.29 (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	kg CO2/kWh  0.216 =  0.519 =  0.216 =	kg CO2/year  952.69 (261)  0 (263)  394.29 (264)  1346.99 (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh  0.216 =  0.519 =  0.519 =	kg CO2/year  952.69 (261)  0 (263)  394.29 (264)  1346.99 (265)  38.93 (267)

El rating (section 14)

		User Details:		
Access Name:	John Cimpon		mhor. CTD	0006273
Assessor Name: Software Name:	John Simpson Stroma FSAP 2012	Stroma Nur Software Ve		on: 1.0.4.7
Contware Hame.	Otroma i Ora 2012	Property Address: 203	JISIOII. VOIGI	011. 1.0.1.7
Address :	2.03, 25 Old Gloucester	St, LONDON, WC1N 3AF		
1. Overall dwelling dime	•			
		Area(m²)	Av. Height(m)	Volume(m³)
Ground floor		39.4 (1a) x	2.4 (2a) =	94.56 (3a)
First floor		34.9 (1b) x	2.86 (2b) =	99.81 (3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	.(1n) 74.3 (4)		
Dwelling volume		(3a)+(3	(3c)+(3c)+(3d)+(3e)+(3n) =	194.37 (5)
2. Ventilation rate:				
	main secon heating heatir		total	m³ per hour
Number of chimneys	0 + 0	+ 0 =	0 x 40 =	0 (6a)
Number of open flues	0 + 0	+ 0 =	0 x 20 =	0 (6b)
Number of intermittent fa	ns		3 x 10 =	30 (7a)
Number of passive vents	i		0 x 10 =	0 (7b)
Number of flueless gas fi	res		0 x 40 =	0 (7c)
			Air c	hanges per hour
Infiltration due to chimne	ys, flues and fans = (6a)+(6b	b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.15 (8)
	peen carried out or is intended, pro			0.15
Number of storeys in the	he dwelling (ns)			0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
	.25 for steel or timber frame	,	truction	0 (11)
if both types of wall are pa deducting areas of openia	resent, use the value correspondir ngs); if equal user 0.35	ng to the greater wall area (after		
	floor, enter 0.2 (unsealed) o	or 0.1 (sealed), else enter 0	)	0 (12)
If no draught lobby, en	ter 0.05, else enter 0			0 (13)
Percentage of windows	s and doors draught strippe	ed		0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	0 (15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	0 (16)
•	q50, expressed in cubic me		metre of envelope area	4 (17)
·	lity value, then $(18) = [(17) \div 20]$			0.35 (18)
	es if a pressurisation test has been	n done or a degree air permeabilit	y is being used	
Number of sides sheltere Shelter factor	ea each	(20) = 1 - [0.075 x	(19)] =	2 (19)
Infiltration rate incorporat	ting shelter factor	$(21) = (18) \times (20) =$		0.85 (20)
Infiltration rate modified f	-	(=:) (:3) ~ (20) =		0.3 (21)
Jan Feb	Mar Apr May Ju	ın Jul Aug Sep	Oct Nov Dec	7
Monthly average wind sp		Jan   7 tag   Jep	1 001 1101 000	_
working average wind sp		<del></del>	<del> </del>	7

4.4

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

(22)m=

Wind Factor (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
A alicenta al institu		. /			ما د داد ما د		(04 =)	(00-)		!		•	
		<u> </u>	<del></del>			<del>i ´</del>	<del>`</del>	<del>ì ´</del>	0.32	0.34	0.35	]	
	jiusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m    1												
												0	(23a)
		0 11	, ,	, (	, (	' '	,, ,	`	) = (23a)			0	(23b)
		•	•	_									(23c)
· ·	1			<b>—</b>		<del>-                                    </del>	<del>-                                    </del>	ŕ	<del> </del>	<del>-                                    </del>	<del>' ' '</del>	÷ 100]	(5.4.)
			<u> </u>								0		(24a)
			1	i		<del></del>	<del>- ^ `                                  </del>	<del>i `</del>	<del>r ´       `</del>	<del></del>		1	(O.4h.)
									0	0	0		(240)
				-	-				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	ventilation	on or wh	ole hous	e positiv	e input	ventilatio	on from	oft		•		•	
if (22b)n	n = 1, th	en (24d)	m = (22l	o)m othe	rwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]	,	•	1	
(24d)m= 0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(24d)
	<u>_</u>		<del>`</del>	<del>^ `</del>	<del>_</del>	<del>´`</del>	<del></del>	<del>`</del>		1		1	
(25)m= 0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(25)
3. Heat losse	Adjusted infilitration rate (allowing for shelter and wind speed) = (21a) x (22a)m      0.38												
3. Heat losse <b>ELEMENT</b>	Gros	SS	Openin	gs						K)			
	Gros	SS	Openin	gs	A ,r	m²	W/m2	2K	(W/	K)			kJ/K
<b>ELEMENT</b> Doors	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K =	(W/	K)			kJ/K (26)
ELEMENT  Doors  Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.1 0.63	m² x x1	W/m2 1.8 /[1/( 1.6 )+	eK =   0.04] =	3.78 0.95	K)			kJ/K (26) (27)
ELEMENT  Doors  Windows Type  Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.1 0.63	m² x x1 x1	W/m2 1.8 /[1/( 1.6 )+ /[1/( 1.6 )+	eK =   0.04] =   0.04] =	3.78 0.95 4.93	K)			kJ/K (26) (27) (27)
ELEMENT  Doors  Windows Type  Windows Type  Windows Type	Gros area e 1 e 2 e 3	SS	Openin	gs	A ,r 2.1 0.63 3.28 0.78	m <sup>2</sup>	W/m2 1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+	0.04] = 0.04] = 0.04] =	(W// 3.78 0.95 4.93 1.17	K)			kJ/K (26) (27) (27) (27)
ELEMENT  Doors  Windows Type  Windows Type  Windows Type	Gros area e 1 e 2 e 3	SS	Openin	gs	A ,r 2.1 0.63 3.28 0.78 8.93	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+	0.04] = 0.04] = 0.04] = 0.04] =	(W// 3.78 0.95 4.93 1.17	K)			kJ/K (26) (27) (27) (27) (27)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor	Gros area e 1 e 2 e 3 e 4	ss (m²)	Openin m	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93 2.4	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+	0.04] = 0.04]	(W// 3.78 0.95 4.93 1.17 13.43 0.36	K)			kJ/K (26) (27) (27) (27) (27) (28)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor Walls Type1	Gros area 4 75.	ss (m²)	Openin m	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93 2.4 61.98	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+  0.15  0.18	0.04] = 0.04]	(W// 3.78 0.95 4.93 1.17 13.43 0.36	K)			(26) (27) (27) (27) (27) (28) (29)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2	Gros area  1 2 2 3 4 75.	6 <u></u>	13.6 2.1	gs <sup>2</sup>	A ,r 2.1 0.63 3.28 0.78 8.93 2.4 61.98	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+  0.15  0.18	0.04] = 0.04]	(W// 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58	K)			kJ/K (26) (27) (27) (27) (27) (28) (29)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Windows Type Walls Type1  Walls Type2  Roof Type1	Gros area  1 2 2 3 4 75.	6 <u>2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 </u>	13.6 2.1	gs <sup>2</sup>	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ 0.15  0.18  0.18	0.04] = 0.04]	(W// 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2	Gros area  e 1  e 2  e 3  e 4  75.  22  6.8  35.	6 2 3	13.6 2.1	gs <sup>2</sup>	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ 0.15  0.18  0.18	0.04] = 0.04]	(W// 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e	Gros area  e 1  e 2  e 3  e 4  75.  22  6.8  35.	6 2 3	13.6 2.1	gs <sup>2</sup>	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+  0.15  0.18  0.15  0.15	K	(W// 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58 1.02 5.3	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30) (31)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Windows Type Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall	Gros area  1	6 2 3 3, m <sup>2</sup>	13.6 2.1 0	gs 1 <sup>2</sup>	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.4  42.9	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ 0.15  0.18  0.18  0.15  0.15	K	(W/) 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58 1.02 5.3		kJ/m²-		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30) (31)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall * for windows and	Gros area  2 1 2 2 3 3 4 4  75.  6.8  35.  Elements	6 2 3 3 3, m <sup>2</sup>	13.6 2.1 0	gs p <sup>2</sup> 2 Indow U-ve	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.7  42.9  alue calculuration and a second	m <sup>2</sup>	W/m2  1.8 /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ /[1/( 1.6 )+ 0.15  0.18  0.18  0.15  0.15	K	(W/) 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58 1.02 5.3		kJ/m²-		kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (30) (30) (31)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall  * for windows and ** include the area	Gros area  e 1  e 2  e 3  e 4  75.  22  6.8  35.  elements	6 3 3 , m <sup>2</sup> ows, use e	13.6. 2.1 0 0 effective winternal wal	gs p <sup>2</sup> 2 Indow U-ve	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.7  42.9  alue calculuration and a second	m <sup>2</sup>	W/m2  1.8  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  0.15  0.18  0.15  0.15  0.15  0.7  0.7  0.7  0.7  0.7  0.7  0.7  0.	K	(W/) 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58 1.02 5.3		kJ/m²-	K	kJ/K (26) (27) (27) (27) (28) (29) (30) (30) (31) (32)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall  * for windows and ** include the area	Gros area  e 1  e 2  e 3  e 4  75.  22  6.8  35.  elements	6 3 3 5, m <sup>2</sup> ows, use e sides of ir = S (A x	13.6. 2.1 0 0 effective winternal wal	gs p <sup>2</sup> 2 Indow U-ve	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.7  42.9  alue calculuration and a second	m <sup>2</sup>	W/m2  1.8  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  0.15  0.18  0.15  0.15  0.15  0.7  0.7  0.7  0.7  0.7  0.7  0.7  0.	2K =   0.04  =	(W/) 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58 1.02 5.3	as given in	kJ/m²-	K	kJ/K (26) (27) (27) (27) (28) (29) (30) (30) (31) (32)
ELEMENT  Doors  Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Roof Type1 Roof Type2 Total area of e Party wall  * for windows and ** include the area Fabric heat los	Gros area  e 1  e 2  e 3  e 4  75.  22  6.8  35.  elements  d roof wind as on both as on both cas, W/K:  Cm = Si	6 2 3 3 3, m <sup>2</sup> ows, use e sides of ir = S (A x (A x k)	13.6. 2.1 0 0 effective winternal wall	gs 1 <sup>2</sup> 2 Indow U-va Is and pan	A ,r  2.1  0.63  3.28  0.78  8.93  2.4  61.98  19.9  6.8  35.3  142.4  42.9  alue calculations	m <sup>2</sup>	W/m2  1.8  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  /[1/( 1.6 )+  0.15  0.18  0.15  0.15  0.15  0.7  0.7  0.7  0.7  0.7  0.7  0.7  0.	2K = 0.04] = 0	(W// 3.78 0.95 4.93 1.17 13.43 0.36 11.16 3.58 1.02 5.3 0	as given in [2] + (32a).	kJ/m²-	3.2	kJ/K (26) (27) (27) (27) (28) (29) (30) (30) (31) (32)

		1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-											
can be used instead Thermal bridge				ıcina Δn	nandiv l	<b>K</b>						44.70	7(26)
if details of therma	,	,			•							14.76	(36)
Total fabric he		aro not ni	om (00) -	- 0.70 % (0	• /			(33) +	(36) =			60.44	(37)
Ventilation hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × (	25)m x (5)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 36.8	36.62	36.44	35.59	35.43	34.7	34.7	34.56	34.98	35.43	35.75	36.09		(38)
Heat transfer of	coefficier	nt, W/K				•		(39)m	= (37) + (37)	38)m		•	
(39)m= 97.24	97.06	96.88	96.03	95.87	95.13	95.13	95	95.42	95.87	96.19	96.53		
Heat loss para	meter (H	HLP), W/	m²K						Average = = (39)m ÷		12 /12=	96.03	(39)
(40)m= 1.31	1.31	1.3	1.29	1.29	1.28	1.28	1.28	1.28	1.29	1.29	1.3		
Number of day	s in mor	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.29	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
	_	_	-			-			-	-	-		
4. Water heat	ting ener	rgy requi	irement:								kWh/ye	ear:	
Assumed occu	inancy I	N									25	1	(42)
if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.	.9)	35		(42)
Annual averag	e hot wa										).91		(43)
Reduce the annua not more that 125	_				_	_	to achieve	a water us	se target o	f		•	
	Feb	Mar				Jul	L	Son	Oct	Nov	Dec		
Jan Hot water usage ii			Apr ach month	May Vd,m = fa	Jun		Aug (43)	Sep	Oct	INOV	Dec		
(44)m= 98.91	95.31	91.71	88.12	84.52	80.92	80.92	84.52	88.12	91.71	95.31	98.91		
( )									Total = Su		 =	1078.96	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 146.67	128.28	132.37	115.41	110.74	95.56	88.55	101.61	102.82	119.83	130.8	142.05		
If instantaneous w	otor hooti	na ot noint	of upo (no	hot woto	· otorogol	ontor O in	havas (16		Total = Su	m(45) <sub>112</sub> =	=	1414.69	(45)
			·		, , , , , , , , , , , , , , , , , , ,		, ,	, ,	47.07	40.00	04.04	I	(46)
(46)m= 22 Water storage	19.24 loss:	19.86	17.31	16.61	14.33	13.28	15.24	15.42	17.97	19.62	21.31		(46)
Storage volum		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage		ا لم معمام م	ft-	میام ایم	/1.\^/L	- /-l -> -\ .						1	(10)
a) If manufact				or is kno	wn (Kvvr	i/day):					0		(48)
Temperature for							(40) × (40)				0		(49)
Energy lost fro b) If manufact		_	-		or is not		(48) x (49)	=			0		(50)
Hot water stora			-								0		(51)
If community h	-		on 4.3									· I	
Volume factor Temperature factor			2h							-	0		(52)
romperature i	uoioi 110	iii Table	20								0		(53)

Energy lost from	_	e, kWh/y	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (54)	` ,						,			0		(55)
Water storage los	s calculated	for each	month			((56)m = (	(55) × (41)ı	m 				
(56)m= 0	0 0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains de	licated solar st	orage, (57)	m = (56)m	x [(50) – (	[H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 0	0 0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit los	s (annual) fr	om Table	∋ 3							0		(58)
Primary circuit los			•	,	` '	` '						
(modified by fac	tor from Tab	ole H5 if t	here is s	solar wat	ter heati	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 calcul	ated for eacl	h month	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m= 15.27 1	3.8 15.27	14.78	15.27	14.78	15.27	15.27	14.78	15.27	14.78	15.27		(61)
Total heat require	d 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= 161.95 14	2.08 147.65	130.19	126.01	110.34	103.82	116.88	117.6	135.1	145.59	157.32		(62)
Solar DHW input calcu	lated using Ap	pendix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	l	
(add additional lin	es if FGHRS	and/or \	//WHRS	applies	, see Ap	pendix (	<b>3</b> )					
(63)m= 0	0 0	0	0	0	0	0	0	0	0	0		(63)
Output from water	heater		•				!		!		ı	
	2.08 147.65	130.19	126.01	110.34	103.82	116.88	117.6	135.1	145.59	157.32		
	l	1	1		1	Outp	out from wa	ater heate	r (annual)₁	12	1594.53	(64)
Heat gains from v	ater heating	ı kWh/m	onth 0 2!	5 ′ [0 85	× (45)m	+ (61)m	n1 + 0 8 x	([(46)m	+ (57)m	+ (59)m	1	_
riout game mom t	ator moathing	,,										
(65)m= 52.59 4	6.1 47.83	42.07			33.26	37.6	37.88	43.66	47.19	51.05		(65)
` '	ļ .		40.64	35.47	33.26	37.6	37.88	43.66	47.19	51.05		(65)
include (57)m ir	calculation	of (65)m	40.64 only if c	35.47	33.26	37.6	37.88	43.66	47.19	51.05		(65)
include (57)m in 5. Internal gains	calculation (see Table	of (65)m 5 and 5a	40.64 only if c	35.47	33.26	37.6	37.88	43.66	47.19	51.05		(65)
include (57)m in  5. Internal gains  Metabolic gains (	calculation (see Table able 5), Wa	of (65)m 5 and 5a tts	40.64 only if c	35.47 ylinder i	33.26 s in the o	37.6 dwelling	37.88 or hot w	43.66 ater is fr	47.19	51.05 munity h		(65)
include (57)m in  5. Internal gains  Metabolic gains (  Jan	calculation (see Table Table 5), Wareb Mar	of (65)m 5 and 5a tts Apr	40.64 only if c	35.47 ylinder i	33.26 s in the o	37.6 dwelling	37.88 or hot w	43.66 ater is fr	47.19 rom com	51.05 munity h		
include (57)m in  5. Internal gains  Metabolic gains (  Jan   1  (66)m= 117.29   11	calculation (see Table Table 5), Wareb Mar 7.29 117.29	of (65)m 5 and 5a tts Apr 117.29	40.64 only if colors:  May 117.29	35.47 ylinder i Jun 117.29	33.26 s in the (	37.6 dwelling Aug 117.29	37.88 or hot w Sep 117.29	43.66 ater is fr	47.19	51.05 munity h		(65)
include (57)m in  5. Internal gains  Metabolic gains (  Jan   117.29   11  Lighting gains (ca	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A	of (65)m 5 and 5a tts Apr 117.29 ppendix	40.64 only if c ): May 117.29 L, equati	Jun 117.29	33.26 s in the o Jul 117.29 r L9a), a	37.6 dwelling Aug 117.29 lso see	37.88 or hot w Sep 117.29	43.66 ater is fr Oct 117.29	47.19 rom com Nov 117.29	51.05 munity h		(66)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan 1  (66)m= 117.29 11  Lighting gains (ca (67)m= 18.81 1	calculation (see Table fable 5), Wa feb Mar 7.29 117.29 culated in A 5.7 13.58	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28	40.64 only if c ):  May 117.29 L, equati 7.69	35.47 ylinder is Jun 117.29 ion L9 o	33.26 s in the o Jul 117.29 r L9a), a	37.6 dwelling Aug 117.29 lso see 9.12	37.88 or hot w Sep 117.29 Table 5	43.66 ater is fr  Oct 117.29	47.19 rom com	51.05 munity h		
include (57)m in  5. Internal gains  Metabolic gains (  Jan   117.29   11  Lighting gains (ca	calculation (see Table fable 5), Wa feb Mar 7.29 117.29 culated in A 5.7 13.58	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28	40.64 only if c ):  May 117.29 L, equati 7.69	35.47 ylinder is Jun 117.29 ion L9 o	33.26 s in the o Jul 117.29 r L9a), a	37.6 dwelling Aug 117.29 lso see 9.12	37.88 or hot w Sep 117.29 Table 5	43.66 ater is fr  Oct 117.29	47.19 rom com Nov 117.29	51.05 munity h		(66)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan  (66)m= 117.29 11  Lighting gains (ca  (67)m= 18.81 1  Appliances gains	calculation (see Table fable 5), Wa feb Mar 7.29 117.29 culated in A 5.7 13.58	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Append	40.64 only if c ):  May 117.29 L, equati 7.69	35.47 ylinder is Jun 117.29 ion L9 o	33.26 s in the o Jul 117.29 r L9a), a	37.6 dwelling Aug 117.29 lso see 9.12	37.88 or hot w Sep 117.29 Table 5	43.66 ater is fr  Oct 117.29	47.19 rom com Nov 117.29	51.05 munity h		(66)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan  (66)m= 117.29 11  Lighting gains (ca  (67)m= 18.81 1  Appliances gains	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 6.7 13.58 calculated i 6.27 203.85	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Appendix 192.32	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eq	Jun 117.29 ion L9 o 6.49 uation L	33.26 s in the o Jul 117.29 r L9a), a 7.01 13 or L1 154.95	37.6 dwelling Aug 117.29 lso see 9.12 3a), also 152.8	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tai 158.22	43.66  ater is fr  Oct 117.29  15.53 ble 5 169.75	47.19 rom com Nov 117.29	51.05 munity h		(66) (67)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan  (66)m= 117.29 11  Lighting gains (ca  (67)m= 18.81 1  Appliances gains  (68)m= 207.12 20  Cooking gains (ca	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 6.7 13.58 calculated i 6.27 203.85	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Appendix 192.32	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eq	Jun 117.29 ion L9 o 6.49 uation L	33.26 s in the o Jul 117.29 r L9a), a 7.01 13 or L1 154.95	37.6 dwelling Aug 117.29 lso see 9.12 3a), also 152.8	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tai 158.22	43.66  ater is fr  Oct 117.29  15.53 ble 5 169.75	47.19 rom com Nov 117.29	51.05 munity h		(66) (67)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan  (66)m= 117.29 11  Lighting gains (ca  (67)m= 18.81 1  Appliances gains  (68)m= 207.12 20  Cooking gains (ca	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 3.7 13.58 calculated i 9.27 203.85 lculated in A 7.3 34.73	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Append 192.32 Appendix 34.73	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, equati 177.77 L, equat	Jun 117.29 ion L9 o 6.49 uation L 164.09	33.26 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 , also se	37.88 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table	43.66  ater is fr  Oct  117.29  15.53  ble 5  169.75  5	47.19 rom com Nov 117.29 18.13	51.05 munity h  Dec 117.29  19.33		(66) (67) (68)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan  (66)m= 117.29 11  Lighting gains (ca  (67)m= 18.81 1  Appliances gains  (68)m= 207.12 20  Cooking gains (ca  (69)m= 34.73 3	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 3.7 13.58 calculated i 9.27 203.85 lculated in A 7.3 34.73	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Append 192.32 Appendix 34.73	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, equati 177.77 L, equat	Jun 117.29 ion L9 o 6.49 uation L 164.09	33.26 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 , also se	37.88 or hot w Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table	43.66  ater is fr  Oct  117.29  15.53  ble 5  169.75  5	47.19 rom com Nov 117.29 18.13	51.05 munity h  Dec 117.29  19.33		(66) (67) (68)
include (57)m in  5. Internal gains  Metabolic gains (  Jan   1  (66)m= 117.29   11  Lighting gains (ca  (67)m= 18.81   1  Appliances gains  (68)m= 207.12   20  Cooking gains (ca  (69)m= 34.73   3  Pumps and fans (	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 3.7 13.58 Calculated i 9.27 203.85 Iculated in A 7.73 34.73 ains (Table 3 3	of (65)m 5 and 5a  tts	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eqi 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	33.26 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a; 34.73	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	43.66  ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73	47.19 rom com Nov 117.29 18.13 34.73	51.05 munity h  Dec 117.29 19.33 197.98		(66) (67) (68) (69)
include (57)m in  5. Internal gains  Metabolic gains (  Jan   10  (66)m= 117.29   11  Lighting gains (ca  (67)m= 18.81   1  Appliances gains  (68)m= 207.12   20  Cooking gains (ca  (69)m= 34.73   3  Pumps and fans ( (70)m= 3   10  Losses e.g. evapore	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 3.7 13.58 Calculated i 9.27 203.85 Iculated in A 7.73 34.73 ains (Table 3 3	of (65)m 5 and 5a  tts	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eqi 177.77 L, equat 34.73	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	33.26 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a; 34.73	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	43.66  ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73	47.19 rom com Nov 117.29 18.13 34.73	51.05 munity h  Dec 117.29 19.33 197.98		(66) (67) (68) (69)
include (57)m in  5. Internal gains  Metabolic gains (  Jan    (66)m= 117.29   11  Lighting gains (ca  (67)m= 18.81   1  Appliances gains  (68)m= 207.12   20  Cooking gains (ca  (69)m= 34.73   3  Pumps and fans (  (70)m= 3    Losses e.g. evapor  (71)m= -93.83   -9	calculation (see Table fable 5), Wa feb Mar 7.29 117.29 culated in A 6.7 13.58 calculated i 6.27 203.85 lculated in A 7.73 34.73 ains (Table 3 3 ration (nega 3.83 -93.83	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Appendix 192.32 Appendix 34.73 5a) 3 ative value	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eq 177.77 L, equat 34.73  as) (Tab	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	33.26 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a 34.73	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	43.66 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73	47.19  om com  Nov  117.29  18.13  34.73	51.05 munity h  Dec 117.29  19.33  197.98		(66) (67) (68) (69) (70)
include (57)m in  5. Internal gains  Metabolic gains (  Jan   117.29   11  Lighting gains (ca   18.81   1  Appliances gains (68)m=   207.12   20  Cooking gains (ca   (69)m=   34.73   3  Pumps and fans (70)m=   3  Losses e.g. evapor (71)m=   -93.83   -9  Water heating gains	calculation (see Table fable 5), Wa feb Mar 7.29 117.29 culated in A 6.7 13.58 calculated i 6.27 203.85 lculated in A 7.73 34.73 ains (Table 3 3 ration (nega 3.83 -93.83	of (65)m 5 and 5a tts Apr 117.29 ppendix 10.28 n Appendix 192.32 Appendix 34.73 5a) 3 ative value	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eq 177.77 L, equat 34.73  as) (Tab	Jun 117.29 ion L9 o 6.49 uation L 164.09 ion L15 34.73	33.26 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a 34.73	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73	43.66 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73	47.19  om com  Nov  117.29  18.13  34.73	51.05 munity h  Dec 117.29  19.33  197.98		(66) (67) (68) (69) (70)
include (57)m in  5. Internal gains  Metabolic gains (  Jan   1  (66)m= 117.29   11  Lighting gains (can (67)m= 18.81   1  Appliances gains (68)m= 207.12   20  Cooking gains (can (69)m= 34.73   3  Pumps and fans (70)m= 3  Losses e.g. evapor (71)m= -93.83   -9  Water heating gain (72)m= 70.68   66	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 6.7 13.58 fcalculated in A 7.3 34.73 ains (Table 3 3 ration (negation of the second of	of (65)m 5 and 5a  tts	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eqi 177.77 L, equati 34.73  as) (Tab	35.47  ylinder is  Jun 117.29  ion L9 o 6.49  uation L 164.09  ion L15 34.73  3  le 5) -93.83	33.26 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a 34.73  3  -93.83	37.6 dwelling Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73  3  -93.83	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Ta 158.22 ee Table 34.73  3  -93.83	43.66 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73 3 -93.83	47.19  om com  Nov  117.29  18.13  34.73  3  -93.83	51.05 munity h  Dec 117.29  19.33  197.98  34.73  3  -93.83		(66) (67) (68) (69) (70) (71)
include (57)m in  5. Internal gains  Metabolic gains (7  Jan  (66)m= 117.29 11  Lighting gains (ca  (67)m= 18.81 1  Appliances gains  (68)m= 207.12 20  Cooking gains (ca  (69)m= 34.73 3  Pumps and fans (70)m= 3  Losses e.g. evapor  (71)m= -93.83 -9  Water heating gain  (72)m= 70.68 66  Total internal gains	calculation (see Table fable 5), Wa feb Mar 7.29 117.29 culated in A 6.7 13.58 (calculated i 6.27 203.85 Iculated in A 7.73 34.73 ains (Table 3 3 ration (nega 3.83 -93.83 ns (Table 5) 3.6 64.29 ns =	of (65)m  5 and 5a  tts  Apr  117.29  ppendix  10.28  192.32  Appendix  34.73  5a)  3  ative valu  -93.83	40.64 only if co ):  May 117.29 L, equati 7.69 dix L, equ 177.77 L, equat 34.73  as) (Tab -93.83	Jun 117.29 ion L9 o 6.49 uation L 164.09 tion L15 34.73 3 lle 5) -93.83	33.26 s in the of  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a) 34.73  3  -93.83  44.71	37.6 dwelling  Aug 117.29 lso see 9.12 3a), also 152.8 34.73  3  -93.83  50.54 1+ (68)m-	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Tal 158.22 ee Table 34.73  3  -93.83  52.62 + (69)m + (	43.66 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73  3  -93.83  58.69  (70)m + (7	47.19  om com  Nov  117.29  18.13  34.73  3  -93.83  65.54  1)m + (72)	51.05 munity h  Dec 117.29  19.33  197.98  34.73  3  -93.83		(66) (67) (68) (69) (70) (71)
include (57)m in  5. Internal gains  Metabolic gains (  Jan    (66)m= 117.29   11  Lighting gains (ca (67)m= 18.81   1  Appliances gains (68)m= 207.12   20  Cooking gains (ca (69)m= 34.73   34  Pumps and fans g (70)m= 3  Losses e.g. evapor (71)m= -93.83   -9  Water heating gai (72)m= 70.68   66  Total internal gains	calculation (see Table Table 5), Wa Teb Mar 7.29 117.29 culated in A 6.7 13.58 fcalculated in A 7.3 34.73 ains (Table 3 3 ration (negation of the second of	of (65)m 5 and 5a  tts	40.64 only if c ):  May 117.29 L, equati 7.69 dix L, eqi 177.77 L, equati 34.73  as) (Tab	35.47  ylinder is  Jun 117.29  ion L9 o 6.49  uation L 164.09  ion L15 34.73  3  le 5) -93.83	33.26 s in the o  Jul 117.29 r L9a), a 7.01 13 or L1 154.95 or L15a 34.73  3  -93.83	37.6 dwelling Aug 117.29 lso see 9.12 3a), also 152.8 ), also se 34.73  3  -93.83	37.88 or hot w  Sep 117.29 Table 5 12.23 o see Ta 158.22 ee Table 34.73  3  -93.83	43.66 ater is fr  Oct 117.29  15.53 ble 5 169.75 5 34.73 3 -93.83	47.19  om com  Nov  117.29  18.13  34.73  3  -93.83	51.05 munity h  Dec 117.29  19.33  197.98  34.73  3  -93.83		(66) (67) (68) (69) (70) (71)

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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)	
East 0.9	x 1	X	0.63	x	19.64	x	0.72	x	0.7	=	4.32	(76)
East 0.9	x 1	X	0.78	x	19.64	х	0.72	х	0.7	] =	5.35	(76)
East 0.9	x 1	X	0.63	x	38.42	х	0.72	x	0.7	] =	8.45	(76)
East 0.9	x 1	X	0.78	x	38.42	x	0.72	x	0.7	=	10.47	(76)
East 0.9	x 1	X	0.63	x	63.27	х	0.72	x	0.7	] =	13.92	(76)
East 0.9	x 1	X	0.78	x	63.27	х	0.72	x	0.7	] =	17.24	(76)
East 0.9	x 1	X	0.63	x	92.28	x	0.72	x	0.7	=	20.31	(76)
East 0.9	x 1	X	0.78	x	92.28	X	0.72	X	0.7	=	25.14	(76)
East 0.9	x 1	X	0.63	х	113.09	x	0.72	x	0.7	=	24.89	(76)
East 0.9	x 1	X	0.78	х	113.09	X	0.72	X	0.7	=	30.81	(76)
East 0.9	x 1	X	0.63	x	115.77	X	0.72	X	0.7	=	25.47	(76)
East 0.9	x 1	X	0.78	x	115.77	x	0.72	x	0.7	=	31.54	(76)
East 0.9	x 1	X	0.63	x	110.22	X	0.72	x	0.7	=	24.25	(76)
East 0.9	x 1	X	0.78	x	110.22	x	0.72	x	0.7	=	30.03	(76)
East 0.9	x 1	X	0.63	x	94.68	x	0.72	x	0.7	=	20.83	(76)
East 0.9	x 1	X	0.78	x	94.68	X	0.72	X	0.7	=	25.79	(76)
East 0.9	x 1	X	0.63	x	73.59	x	0.72	x	0.7	=	16.19	(76)
East 0.9	x 1	X	0.78	x	73.59	x	0.72	x	0.7	=	20.05	(76)
East 0.9	x 1	X	0.63	x	45.59	x	0.72	X	0.7	=	10.03	(76)
East 0.9	x 1	X	0.78	x	45.59	x	0.72	x	0.7	=	12.42	(76)
East 0.9	x 1	X	0.63	x	24.49	x	0.72	x	0.7	=	5.39	(76)
East 0.9	x 1	X	0.78	x	24.49	x	0.72	X	0.7	=	6.67	(76)
East 0.9	x 1	X	0.63	x	16.15	x	0.72	x	0.7	=	3.55	(76)
East 0.9	x 1	X	0.78	x	16.15	x	0.72	x	0.7	=	4.4	(76)
West 0.9	x 0.77	X	3.28	x	19.64	x	0.72	x	0.7	=	22.5	(80)
West 0.9	x 0.77	X	8.93	X	19.64	X	0.72	X	0.7	=	61.26	(80)
West 0.9	x 0.77	X	3.28	x	38.42	x	0.72	x	0.7	=	44.02	(80)
West 0.9	× 0.77	X	8.93	X	38.42	X	0.72	X	0.7	=	119.83	(80)
West 0.9	× 0.77	X	3.28	X	63.27	X	0.72	X	0.7	=	72.49	(80)
West 0.9	× 0.77	X	8.93	X	63.27	X	0.72	X	0.7	=	197.35	(80)
West 0.9	× 0.77	X	3.28	X	92.28	X	0.72	X	0.7	=	105.72	(80)
West 0.9	× 0.77	X	8.93	X	92.28	X	0.72	X	0.7	=	287.82	(80)
West 0.9	× 0.77	X	3.28	X	113.09	x	0.72	X	0.7	=	129.56	(80)
West 0.9	× 0.77	X	8.93	X	113.09	x	0.72	X	0.7	=	352.74	(80)
West 0.9	x 0.77	X	3.28	x	115.77	x	0.72	x	0.7	] =	132.63	(80)
West 0.9	x 0.77	X	8.93	x	115.77	x	0.72	x	0.7	] =	361.09	(80)
West 0.9	x 0.77	X	3.28	x	110.22	x	0.72	X	0.7	<b>=</b>	126.27	(80)
West 0.9	x 0.77	X	8.93	x	110.22	x	0.72	x	0.7	] =	343.77	(80)
West 0.9	x 0.77	X	3.28	x	94.68	x	0.72	x	0.7	] =	108.46	(80)

	_					_										
West	0.9x	0.77	X	8.8	93	X	9	4.68	X		0.72	X	0.7	=	295.29	(80)
West	0.9x	0.77	X	3.2	28	X	7	3.59	X		0.72	x	0.7		84.3	(80)
West	0.9x	0.77	X	8.9	93	x [	7	3.59	X		0.72	x	0.7	=	229.52	(80)
West	0.9x	0.77	Х	3.2	28	x [	4	5.59	X		0.72	x	0.7	=	52.23	(80)
West	0.9x	0.77	X	8.8	93	x	4	5.59	X		0.72	x	0.7	=	142.19	(80)
West	0.9x	0.77	X	3.2	28	x	2	4.49	X		0.72	x	0.7	_	28.06	(80)
West	0.9x	0.77	X	8.8	93	x [	2	4.49	x		0.72	x	0.7		76.38	(80)
West	0.9x	0.77	X	3.2	28	x [	1	6.15	X		0.72	x	0.7	=	18.5	(80)
West	0.9x	0.77	X	8.8	93	x	1	6.15	X		0.72	x	0.7		50.38	(80)
Solar	gains in	watts, ca	alculated	for eac	h month				(83)m	ı = Sı	um(74)m .	(82)m			_	
(83)m=	93.43	182.77	301	438.98	537.99	55	50.73	524.32	450	.38	350.07	216.87	116.5	76.83		(83)
Total g	ains – ir	nternal a	ind sola	r (84)m =	= (73)m ·	+ (8	33)m	, watts							_	
(84)m=	451.22	538.53	643.91	761.21	839.25	83	31.76	792.17	724	.03	634.32	522.03	445.65	423.94	<u> </u>	(84)
7. Me	an inter	nal temp	erature	(heating	season	)										
Temp	erature	during h	eating p	eriods ir	n the livi	ng a	area f	from Tab	ole 9,	, Th′	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(se	е Та	ble 9a)								
	Jan	Feb	Mar	Apr	May	,	Jun	Jul	A	ug	Sep	Oct	Nov	Dec	:	
(86)m=	1	0.99	0.98	0.95	0.84	0	0.68	0.51	0.5	58	0.84	0.97	1	1	7	(86)
Mean	internal	temper	ature in	living ar	ea T1 (fo	ollov	w ste	ns 3 to 7	in T	able	9c)		•	•		
(87)m=	19.56	19.74	20.05	20.45	20.78		0.94	20.99	20.		20.84	20.4	19.9	19.53	7	(87)
Tomp	oroturo	durina h	ooting r	eriods ir	root of	طس	مااام	from To	hla (	 > Th	2 (°C)		1	<u> </u>		
(88)m=	19.83	19.84	19.84	19.85	19.85		9.86	19.86	19.		19.85	19.85	19.85	19.84	٦	(88)
					l					<u> </u>			1 .0.00	10.0.		()
				rest of d		_	<u> </u>		r –	1	0.70		1 000		¬	(00)
(89)m=	1	0.99	0.98	0.92	0.79		).58	0.39	0.4		0.76	0.96	0.99	1		(89)
Mean				the rest	1	<del>-</del>			·			e 9c)	,		¬	
(90)m=	17.93	18.19	18.65	19.22	19.64	19	9.82	19.85	19.	85	19.73	19.15	18.43	17.88		(90)
											f	LA = Livi	ng area ÷ (4	4) =	0.46	(91)
Mean	internal	temper	ature (fo	or the wh	ole dwe	lling	g) = fl	_A × T1	+ (1	– fL	A) × T2					
(92)m=	18.67	18.9	19.29	19.79	20.16	20	0.33	20.37	20.	37	20.24	19.73	19.11	18.64		(92)
Apply	adjustn	nent to t	ne mear	interna	temper	atu	re fro	m Table	4e,	whe	re appro	priate	-		_	
(93)m=	18.67	18.9	19.29	19.79	20.16	20	0.33	20.37	20.	37	20.24	19.73	19.11	18.64		(93)
8. Sp	ace hea	ting requ	uiremen	t												
				•		ned	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m=	(76)m an	d re-ca	lculate	
the ut		Feb	Mar	using Ta	1	Г	lun	Jul	Ι		Con	Oct	Nov	Dos	П	
l Itilie	Jan ation fac			Apr	May	<u> </u>	Jun	Jui	A	ug	Sep	Oct	Nov	Dec		
(94)m=	1	0.99	0.97	0.92	0.81	0	).62	0.45	0.5	51	0.79	0.96	0.99	1	7	(94)
				4)m x (8				00			00	0.00	1 0.00			, ,
(95)m=	449.41	533.66	627.76	702.93	677	51	16.01	353.77	367	7.8	499.53	501.16	442.13	422.65		(95)
	hly avera	age exte	rnal tem	nperature	e from Ta	<u> </u>			<u> </u>				1			
(96)m=	4.3	4.9	6.5	8.9	11.7	_	4.6	16.6	16.	.4	14.1	10.6	7.1	4.2	7	(96)
Heat	loss rate	for mea	an interr	nal tempe	erature,	Lm	, W =	=[(39)m :	x [(9	3)m-	- (96)m	]			_	
(97)m=	1397.8	1358.77	1239.14	r	r	_	15.59	358.91	376	<del>'</del> T	585.9	874.85	1154.86	1393.5	5	(97)
				•									-	•		

Space heating	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)	)m – (95	)m] x (4	1)m			
(98)m= 705.6	554.47	454.87	246.61	99.65	0	0	0	0	278.02	513.17	722.32		
<u> </u>							Tota	l per year	(kWh/yeaı	) = Sum(9	8) <sub>15,912</sub> =	3574.71	(98)
Space heating	g require	ement in	kWh/m²	²/year								48.11	(99)
9a. Energy req	uiremer	nts – Indi	vidual h	eating s	ystems i	ncluding	micro-C	HP)					_
Space heatin	_										ı		_
Fraction of spa					mentary	system						0	(201)
Fraction of spa	ace hea	it from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total	al heatii	ng from	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of m	nain spa	ace heat	ing syste	em 1								92.8	(206)
Efficiency of s	econda	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 heating	g require	ement (c	alculate	d above	)	1	i		ī	î	r		
705.6	554.47	454.87	246.61	99.65	0	0	0	0	278.02	513.17	722.32		
$(211)m = \{[(98)]$	m x (20	4)] } x 1	00 ÷ (20	)6)	,	,			1			•	(211)
760.34	597.49	490.16	265.75	107.38	0	0	0	0	299.59	552.98	778.36		_
							Tota	I (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	F	3852.06	(211)
Space heating	` `		, , .	month									
$= \{[(98)m \times (20)] $ $(215)m = 0$	1)] } X 1 0	00 ÷ (20	8)	0	0	0	0	0	0	0	0		
(213)111= 0	0	0	0				_		ar) =Sum(2			0	(215)
Water heating								(		715,1012		0	(2.0)
Output from wa		ter (calc	ulated a	bove)									
	142.08	147.65	130.19	126.01	110.34	103.82	116.88	117.6	135.1	145.59	157.32		
Efficiency of wa	ater hea	ter										87.3	(216)
(217)m= 89.32	89.28	89.17	88.92	88.39	87.3	87.3	87.3	87.3	88.97	89.24	89.34		(217)
Fuel for water h	•												
(219)m = (64)r (219)m = 181.31	n x 100 159.14	) ÷ (217) 165.57	m 146.41	142.57	126.39	118.93	133.89	134.71	151.86	163.15	176.09		
(2.0)		.00.0.			120.00	1.0.00		I = Sum(2				1800.01	(219)
Annual totals										Wh/year	•	kWh/yea	
Space heating	fuel use	ed, main	system	1						, , ,		3852.06	
Water heating f	fuel use	d										1800.01	Ī
Electricity for po	umps, fa	ans and	electric	keep-ho	t								_
central heating	g pump:										30		(230c)
boiler with a fa											45		(230e)
Total electricity			(Wh/vea	r			sum	of (230a).	(230g) =			75	(231)
		above, r	www.yea	u			34.11	, ( <b></b> 00a).	(_009/			75	╡
Electricity for lig												332.11	(232)
12a. CO2 emi	ssions -	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHP						

**Energy** 

kWh/year

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**Emissions** 

kg CO2/year

**Emission factor** 

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	832.04	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	388.8	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1220.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	172.37	(268)
Total CO2, kg/year	sum	of (265)(271) =		1432.14	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =		19.28	(273)
El rating (section 14)				84	(274)

		l loon [	Dotoile:						
Accessor Name	John Simpson	User L	Details:	Mum	bor.		STDC	0006273	
Assessor Name: Software Name:	John Simpson Stroma FSAP 2012		Stroma Softwa					on: 1.0.4.7	
Contware Hame.	01101110 1 07 11 2012	Property	Address:		31011.		VOIGIC	311. 1.0. 1.1	
Address :	3.01, 25 Old Gloucester	· · ·							
1. Overall dwelling dime	ensions:								
		Are	a(m²)		Av. He	ight(m)	_	Volume(m	<sup>3</sup> )
Ground floor			80.6	(1a) x	2	2.83	(2a) =	228.1	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	.(1n)	80.6	(4)					
Dwelling volume				(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	(3n) =	228.1	(5)
2. Ventilation rate:									
	main secon heating heati		other		total			m³ per hou	ır
Number of chimneys	0 + 0	<del></del>	0	] = [	0	X ·	40 =	0	(6a)
Number of open flues	0 + 0	+	0	Ī = Ē	0	x	20 =	0	(6b)
Number of intermittent fa	ans			' <u> </u>	3	x -	10 =	30	(7a)
Number of passive vents	S			F	0	x	10 =	0	(7b)
Number of flueless gas f				<u> </u>	0		40 =	0	(7c)
rtamber of naciood gas i					0				(10)
							Air ch	hanges per h	our
Infiltration due to chimne	eys, flues and fans = (6a)+(6b	o)+(7a)+(7b)+	(7c) =	Γ	30		÷ (5) =	0.13	(8)
	been carried out or is intended, pro	oceed to (17),	otherwise c	ontinue fr	om (9) to	(16)			<u>-</u>
Number of storeys in t	he dwelling (ns)							0	(9)
Additional infiltration	0.05 (an ataul an Cal an faran	0 05 (-				[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber frame present, use the value corresponding				uction			0	(11)
deducting areas of openi		ig to the grea	tor wan area	(uno					
If suspended wooden	floor, enter 0.2 (unsealed) o	or 0.1 (seal	ed), else e	enter 0				0	(12)
If no draught lobby, er								0	(13)
•	s and doors draught strippe	ed	0.05 10.0	(4.4)	0.01			0	(14)
Window infiltration			0.25 - [0.2 (8) + (10) +			. (45)		0	(15)
Infiltration rate	aEO avaraged in aubic m	otroo par b	, , , ,	` ' ' `	, , ,		oroo.	0	(16)
•	q50, expressed in cubic molity value, then $(18) = [(17) \div 2]$	•	•		etre or e	envelope	area	5	(17)
·	es if a pressurisation test has been				is being u	sed		0.38	(18)
Number of sides sheltered			,	•	J			2	(19)
Shelter factor			(20) = 1 - [0	0.075 x (1	<b>19)] =</b>			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.32	(21)
Infiltration rate modified	for monthly wind speed							-	
Jan Feb	Mar Apr May Ju	ın Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7						_	_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	]	
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m = 1.27 1.25	1.23 1.1 1.08 0.9	5 0.95	0.92	1	1.08	1.12	1.18	1	
				-			L•	J	

Adjusted infiltra	ation rate (allo	wing for sh	nelter an	nd wind spe	ed) = (21a)	x (22a)m					
0.41	0.41 0.4	0.36	0.35	1 1	0.31 0.3	0.32	0.35	0.36	0.38	]	
<i>Calcul<mark>ate effec</mark></i> If mechanica	_	e rate for t	he appli	cable case		-					
	eat pump using A	nnendix N (2	(23a) = (23a	a) × Fmv (egu:	ation (N5)) otl	nerwise (23h	n) = (23a)			0	(23
	heat recovery: e		, ,	,	, ,, .	`	) - ( <b>20</b> 0)			0	(23
	d mechanical	•	ŭ		`	,	2h)m + ('	23h) <b>√</b> [¹	1 <b>–</b> (23c)		(23
(24a)m= 0	0 0	0	0	0	0 0	$\frac{4a}{1}$	0	0	0	]	(24
	d mechanical	ventilation	<u> </u>	heat recov	erv (MV) (24	1 4b)m = (2:	2b)m + (2	L 23b)	<u> </u>	J	
(24b)m= 0	0 0	0	0	0	0 0	0	0	0	0	]	(24
,	ouse extract v n < 0.5 × (23b		•	•			5 x (23b	)		1	
(24c)m = 0	0 0	0	0	0	0 0	0	0	0	0	1	(24
	ventilation or v	whole hous	L nositi	ve input ver	I	loft	<u> </u>		<u> </u>	J	·
	n = 1, then (24)						0.5]				
(24d)m= 0.59	0.58 0.58	0.56	0.56	0.55	0.55 0.54	0.55	0.56	0.57	0.57	]	(24
Effective air	change rate -	enter (24a	) or (24l	o) or (24c) o	or (24d) in b	ox (25)				_	
(25)m= 0.59	0.58 0.58	0.56	0.56	0.55	0.55 0.54	0.55	0.56	0.57	0.57		(25
3. Heat losses	s and heat los	s paramet	er:								
ELEMENT	Gross area (m²)	Openin m	gs	Net Area A ,m²	U-va W/m		A X U (W/ł	<b>&lt;</b> )	k-value kJ/m²-l		A X k kJ/K
Doors				2.1	X 1.4	1 =	2.94				(26
Nindows Type	: 1			1.58	x1/[1/( 1.4	)+ 0.04] =	2.09				(27
Vindows Type	2			1.3	X1/[1/( 1.4	)+ 0.04] =	1.72				(27
Nindows Type	3			1.02	X1/[1/( 1.4	)+ 0.04] =	1.35				(27
Windows Type	: 4			1.39	X1/[1/( 1.4	)+ 0.04] =	1.84				(27
Nindows Type	5			1.02	X1/[1/( 1.4	)+ 0.04] =	1.35	=			(27
Nindows Type	6			1.85	X1/[1/( 1.4	)+ 0.04] =	2.45	=			(27
Windows Type	· 7			0.9	X1/[1/( 1.4	)+ 0.04] =	1.19				(27
Walls Type1	58.5	9.74		48.76	_ x	6 =	12.68	<u> </u>		$\neg$ $\vdash$	(29
Walls Type2	15.1	2.75		12.35	X 0.1	8 =	2.22	<b>=</b>		i i	(29
Walls Type3	12.7	2.1	一	10.6	X 0.1	8 =	1.91	<b>=</b>		i i	(29
Poof Typo1	52.8	0		52.8	X 0.1	3 =	6.86	<b>=</b>		<b>i</b> i	(30
Rooi Type i			=	27.8	x 0.1	5 =	4.17	<b>=</b>		<b>=</b> =	(30
	27.8	0									
Roof Type2	27.8 lements, m <sup>2</sup>	0			i —						(31
Roof Type2 Fotal area of el		0		166.9	] ]		n				
Roof Type2  Fotal area of elearty wall  For windows and	lements, m²	e effective wi		166.9  24.1  alue calculated	× 0		0 ue)+0.04] a	s given in	paragraph	n 3.2	
Roof Type2  Fotal area of elearty wall  For windows and  The include the area	lements, m <sup>2</sup> roof windows, us	e effective wi		166.9  24.1  alue calculated	d using formula			s given in	paragraph	1 3.2	(32
Roof Type1 Roof Type2 Total area of el Party wall * for windows and ** include the area Fabric heat los Heat capacity (	roof windows, us as on both sides of as, W/K = S (A	e effective wi of internal wall		166.9  24.1  alue calculated	d using formula	30) + (32) =					(31)

can be u	ısed instea	ad of a de	tailed calci	ulation.										
					using Ap	pendix I	<						25.04	(36)
	_	,	•		= 0.15 x (3	•								<b></b> ` ′
Total fa	abric hea	at loss							(33) +	(36) =			72.38	(37)
Ventila	tion hea	it loss ca	alculated	monthly	у				(38)m	= 0.33 × (	25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	44.07	43.82	43.58	42.43	42.21	41.21	41.21	41.02	41.59	42.21	42.65	43.1		(38)
Heat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m=	116.45	116.2	115.95	114.8	114.59	113.58	113.58	113.4	113.97	114.59	115.02	115.48		_
Heat Ic	ss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> (4)	12 /12=	114.8	(39)
(40)m=	1.44	1.44	1.44	1.42	1.42	1.41	1.41	1.41	1.41	1.42	1.43	1.43		
Numbe	er of day	s in mor	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.42	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
,	-			-		-	-	-		-	-	-	-	
4. Wa	iter heat	ing ener	gy requi	irement:								kWh/y	ear:	
٨٥٥٠١٣	ad again	nanav I	NI.										1	(40)
if TF	ed occu A > 13.9 A £ 13.9	0, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	ΓFA -13.		.47	J	(42)
Annua	l averag	e hot wa			es per da							2.96	]	(43)
		_			5% if the d ater use, l	_	-	to achieve	a water us	se target o	f		4	
not more									0	0.1	N		1	
Hot wate	Jan er usage ir	Feb	Mar day for ea	Apr ach month	May $Vd, m = fa$	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	102.26	98.54	94.82	91.1	87.38	83.66	83.66	87.38	91.1	94.82	98.54	102.26	1	
(44)111=	102.20	30.34	34.02	91.1	07.50	03.00	03.00	07.50			m(44) <sub>112</sub> =	l	1115.53	(44)
Energy o	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600						` ′
(45)m=	151.64	132.63	136.86	119.32	114.49	98.8	91.55	105.05	106.31	123.89	135.24	146.86	]	
					!		!			Total = Su	m(45) <sub>112</sub> =	=	1462.64	(45)
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46	) to (61)	•			1	
(46)m=	22.75	19.89	20.53	17.9	17.17	14.82	13.73	15.76	15.95	18.58	20.29	22.03		(46)
	storage e volum		includin	na anv sa	olar or W	/WHRS	storana	within s	ame ves	امء		0	1	(47)
•		,		•	velling, e		_		arric voo	001		U		(47)
	-	_			ncludes i			. ,	ers) ente	er '0' in (	47)			
Water	storage	loss:		`					,	,	•			
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
Tempe	rature fa	actor fro	m Table	2b								0	]	(49)
			storage	-				(48) x (49)	) =			0	]	(50)
•				-	loss fact le 2 (kW							0	1	(E4)
		_	ee secti		IC Z (KVV	11/1111 <b>6</b> /Uc	чу <i>)</i>					0	J	(51)
	e factor	-		-								0	]	(52)
Tempe	rature fa	actor fro	m Table	2b								0	]	(53)
													=	

Energy lost from water storage, kWh/year Enter (50) or (54) in (55)	(47) x (51) x (52) x (53)	<u> </u>	)		(54) (55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$		<u>′</u>		(00)
(56)m= 0 0 0 0 0 0	0 0	0 0	0		(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷	(50), else (57)m = (56)m v	where (H11) is froi	m Appendi	хH	
(57)m= 0 0 0 0 0 0	0 0	0 0	0		(57)
Primary circuit loss (annual) from Table 3		(	)		(58)
Primary circuit loss calculated for each month (59)m = (58) ÷	` '				
(modified by factor from Table H5 if there is solar water hea	<del></del>	<del> </del>			(59)
(59)m= 0 0 0 0 0 0		0 0	0		(39)
Combi loss calculated for each month (61)m = (60) $\div$ 365 x (4	<del>`                                    </del>				(04)
(61)m= 15.27   13.8   15.27   14.78   15.27   14.78   15.27		15.27   14.78	15.27	(50)	(61)
Total heat required for water heating calculated for each mon	<del>- i - i - i -</del>	<del>`````</del>	<u>`</u>	(59)m + (61)m	(60)
(62)m= 166.92 146.42 152.14 134.1 129.76 113.58 106.8		39.17   150.02	162.13		(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quan (add additional lines if FGHRS and/or WWHRS applies, see A		ontribution to wate	r neating)		
(63)m= 0 0 0 0 0 0 0 0		0 0	0		(63)
Output from water heater					,
(64)m= 166.92 146.42 152.14 134.1 129.76 113.58 106.8	2 120.33 121.09 13	39.17 150.02	162.13		
	Output from water			1642.48	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)				1	ı
TICAL VAILIS HOTH WALCH HEALIHU. NYVI/HIOHIH U.ZJ HU.OJ X (43)	111 + (01)1111 + 0.0 X 1(4	401111 + (37 1111	+ (39)11	1	
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26	<del></del>	45.01 48.66	52.65	1	(65)
	38.75 39.04 4	45.01 48.66	52.65		(65)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26	38.75 39.04 4	45.01 48.66	52.65		(65)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):	38.75 39.04 4	45.01 48.66	52.65		(65)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the	38.75 39.04 4 e dwelling or hot water	45.01 48.66	52.65		(65)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts	38.75 39.04 4 e dwelling or hot water  Aug Sep	45.01 48.66 er is from com	52.65 munity h		(65)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12	45.01 48.66 er is from comi	52.65 munity h		
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 123.71 123.71 123.71 123.71 123.71 123.71	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5	45.01 48.66 er is from comi	52.65 munity h		
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 12	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1	45.01         48.66           er is from comment         Oct           Nov         23.71           17.15         20.02	52.65 munity h		(66)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 123.71 123.71 123.71 123.71 123.71 123.71 123.71 Lighting gains (calculated in Appendix L, equation L9 or L9a), (67)m= 20.76 18.44 15 11.35 8.49 7.17 7.74	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1	45.01         48.66           er is from comment         Oct           Nov         23.71           17.15         20.02	52.65 munity h		(66)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 123.71 123.71 123.71 123.71 123.71 123.71 123.71 123.71 123.71 123.71 Appliances gains (calculated in Appendix L, equation L9 or L9a), (67)m= 20.76 18.44 15 11.35 8.49 7.17 7.74 Appliances gains (calculated in Appendix L, equation L13 or L9a).	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1 13a), also see Table 162.81 168.58 18	Oct         Nov           23.71         123.71           17.15         20.02           25	52.65 munity h  Dec 123.71		(66) (67)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 12	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1 13a), also see Table 162.81 168.58 18 a), also see Table 5	Oct         Nov           23.71         123.71           17.15         20.02           25	52.65 munity h  Dec 123.71		(66) (67)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final content of the	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1 13a), also see Table 162.81 168.58 18 a), also see Table 5	Oct         Nov           23.71         123.71           17.15         20.02           25         80.87         196.38	52.65 munity h  Dec 123.71  21.34		(66) (67) (68)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the 5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 12	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1 13a), also see Table 162.81 168.58 18 a), also see Table 5	Oct         Nov           23.71         123.71           17.15         20.02           25         80.87         196.38	52.65 munity h  Dec 123.71  21.34		(66) (67) (68)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final content of the	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1 1.13a), also see Table 162.81 168.58 18 a), also see Table 5 35.37 35.37 3	Oct         Nov           23.71         123.71           17.15         20.02           8 5         80.87         196.38           35.37         35.37	52.65 munity h  Dec 123.71  21.34  210.95		(66) (67) (68) (69)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final content of the	Aug   Sep   1   123.71   123	Oct         Nov           23.71         123.71           17.15         20.02           8 5         80.87         196.38           35.37         35.37	52.65 munity h  Dec 123.71  21.34  210.95		(66) (67) (68) (69)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final content of the first of the	Aug   Sep   1   123.71   123	Oct Nov 23.71 123.71 17.15 20.02 9 5 80.87 196.38 35.37 35.37 3	52.65 munity h  Dec 123.71  21.34  210.95  35.37		(66) (67) (68) (69) (70)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final pains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 1	Aug   Sep   1   123.71   123	Oct Nov 23.71 123.71 17.15 20.02 9 5 80.87 196.38 35.37 35.37 3	52.65 munity h  Dec 123.71  21.34  210.95  35.37		(66) (67) (68) (69) (70)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final pains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul (66)m= 123.71 1	Aug   Sep   1   123.71   123	Oct         Nov           23.71         123.71           17.15         20.02           8 5         80.87         196.38           35.37         35.37           3         3           98.97         -98.97           60.5         67.59	52.65 munity h  Dec 123.71  21.34  210.95  35.37  3  -98.97		(66) (67) (68) (69) (70)
(65)m= 54.24 47.55 49.32 43.37 41.89 36.54 34.26 include (57)m in calculation of (65)m only if cylinder is in the final pains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul	38.75 39.04 4 e dwelling or hot water  Aug Sep 1 123.71 123.71 12 also see Table 5 10.06 13.51 1 13a), also see Table 162.81 168.58 18 a), also see Table 5 35.37 35.37 3  3 3  7 -98.97 -98.97 -9 52.08 54.23 6 0m + (68)m + (69)m + (70)	Oct         Nov           23.71         123.71           17.15         20.02           8 5         80.87         196.38           35.37         35.37           3         3           98.97         -98.97           60.5         67.59	52.65 munity h  Dec 123.71  21.34  210.95  35.37  3  -98.97		(66) (67) (68) (69) (70)

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

Orientat	tion:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.3	x	10.63	x	0.72	x	0.7	] =	4.83	(74)
North	0.9x	0.77	x	1.85	x	10.63	x	0.72	х	0.7	=	6.87	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.72	х	0.7	=	9.23	(74)
North	0.9x	0.77	x	1.85	x	20.32	х	0.72	x	0.7	] =	13.13	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.72	х	0.7	=	15.68	(74)
North	0.9x	0.77	x	1.85	x	34.53	x	0.72	х	0.7	=	22.31	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.72	х	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.85	x	55.46	X	0.72	x	0.7	=	35.84	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.72	х	0.7	=	33.92	(74)
North	0.9x	0.77	x	1.85	x	74.72	x	0.72	x	0.7	=	48.28	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.72	x	0.7	=	36.32	(74)
North	0.9x	0.77	x	1.85	x	79.99	x	0.72	x	0.7	=	51.68	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.72	x	0.7	=	33.91	(74)
North	0.9x	0.77	x	1.85	x	74.68	x	0.72	x	0.7	=	48.25	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.72	x	0.7	=	26.9	(74)
North	0.9x	0.77	x	1.85	x	59.25	x	0.72	X	0.7	=	38.28	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.72	x	0.7	=	18.85	(74)
North	0.9x	0.77	x	1.85	x	41.52	x	0.72	x	0.7	=	26.83	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.72	x	0.7	=	10.98	(74)
North	0.9x	0.77	x	1.85	x	24.19	x	0.72	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.72	x	0.7	=	5.96	(74)
North	0.9x	0.77	x	1.85	x	13.12	x	0.72	X	0.7	=	8.48	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.72	X	0.7	=	4.02	(74)
North	0.9x	0.77	x	1.85	x	8.86	x	0.72	X	0.7	=	5.73	(74)
East	0.9x	2	x	1.02	x	19.64	X	0.72	X	0.7	=	13.99	(76)
East	0.9x	2	x	1.39	x	19.64	X	0.72	x	0.7	=	19.07	(76)
East	0.9x	2	X	1.02	X	19.64	X	0.72	x	0.7	=	13.99	(76)
East	0.9x	2	x	1.02	x	38.42	x	0.72	X	0.7	=	27.38	(76)
East	0.9x	2	x	1.39	X	38.42	x	0.72	X	0.7	=	37.31	(76)
East	0.9x	2	X	1.02	X	38.42	X	0.72	X	0.7	=	27.38	(76)
East	0.9x	2	X	1.02	X	63.27	X	0.72	X	0.7	=	45.08	(76)
East	0.9x	2	x	1.39	x	63.27	X	0.72	x	0.7	=	61.44	(76)
East	0.9x	2	X	1.02	X	63.27	X	0.72	x	0.7	=	45.08	(76)
East	0.9x	2	X	1.02	X	92.28	X	0.72	x	0.7	=	65.75	(76)
East	0.9x	2	x	1.39	X	92.28	X	0.72	X	0.7	=	89.6	(76)
East	0.9x	2	X	1.02	x	92.28	x	0.72	x	0.7	=	65.75	(76)
East	0.9x	2	X	1.02	x	113.09	x	0.72	x	0.7	=	80.58	(76)
East	0.9x	2	X	1.39	x	113.09	x	0.72	x	0.7	=	109.81	(76)
East	0.9x	2	X	1.02	x	113.09	X	0.72	X	0.7	] =	80.58	(76)

Foot	۰. ۲		1		1		1		1		1		7(70)
East	0.9x	2	X	1.02	X	115.77	X	0.72	X	0.7	=	82.49	(76)
East	0.9x	2	X	1.39	X	115.77	X	0.72	X	0.7	=	112.41	(76)
East	0.9x	2	X	1.02	X	115.77	X	0.72	X	0.7	=	82.49	(76)
East	0.9x	2	X	1.02	X	110.22	X	0.72	X	0.7	=	78.53	(76)
East -	0.9x	2	X	1.39	X	110.22	X	0.72	X	0.7	=	107.02	(76)
East	0.9x	2	X	1.02	X	110.22	X	0.72	X	0.7	=	78.53	(76)
East	0.9x	2	X	1.02	X	94.68	X	0.72	X	0.7	=	67.46	(76)
East	0.9x	2	X	1.39	X	94.68	X	0.72	X	0.7	=	91.93	(76)
East	0.9x	2	X	1.02	X	94.68	X	0.72	X	0.7	=	67.46	(76)
East	0.9x	2	X	1.02	X	73.59	X	0.72	X	0.7	=	52.43	(76)
East	0.9x	2	X	1.39	X	73.59	X	0.72	X	0.7	=	71.45	(76)
East	0.9x	2	x	1.02	X	73.59	X	0.72	X	0.7	=	52.43	(76)
East	0.9x	2	x	1.02	x	45.59	x	0.72	x	0.7	=	32.48	(76)
East	0.9x	2	x	1.39	x	45.59	X	0.72	x	0.7	=	44.27	(76)
East	0.9x	2	X	1.02	x	45.59	x	0.72	x	0.7	=	32.48	(76)
East	0.9x	2	x	1.02	x	24.49	X	0.72	x	0.7	=	17.45	(76)
East	0.9x	2	x	1.39	x	24.49	X	0.72	x	0.7	=	23.78	(76)
East	0.9x	2	x	1.02	x	24.49	X	0.72	x	0.7	=	17.45	(76)
East	0.9x	2	x	1.02	x	16.15	x	0.72	x	0.7	=	11.51	(76)
East	0.9x	2	x	1.39	x	16.15	x	0.72	x	0.7	=	15.68	(76)
East	0.9x	2	x	1.02	x	16.15	x	0.72	x	0.7	=	11.51	(76)
West	0.9x	0.54	x	1.58	x	19.64	x	0.72	x	0.7	j =	7.6	(80)
West	0.9x	0.77	x	0.9	x	19.64	x	0.72	x	0.7	=	6.17	(80)
West	0.9x	0.54	x	1.58	x	38.42	x	0.72	x	0.7	=	14.87	(80)
West	0.9x	0.77	x	0.9	x	38.42	x	0.72	x	0.7	=	12.08	(80)
West	0.9x	0.54	x	1.58	x	63.27	X	0.72	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	0.9	x	63.27	X	0.72	x	0.7	=	19.89	(80)
West	0.9x	0.54	x	1.58	x	92.28	X	0.72	x	0.7	=	35.71	(80)
West	0.9x	0.77	x	0.9	x	92.28	X	0.72	x	0.7	=	29.01	(80)
West	0.9x	0.54	x	1.58	x	113.09	x	0.72	x	0.7	=	43.77	(80)
West	0.9x	0.77	x	0.9	x	113.09	x	0.72	x	0.7	=	35.55	(80)
West	0.9x	0.54	x	1.58	x	115.77	x	0.72	x	0.7	=	44.8	(80)
West	0.9x	0.77	x	0.9	x	115.77	x	0.72	x	0.7	=	36.39	(80)
West	0.9x	0.54	x	1.58	x	110.22	x	0.72	x	0.7	=	42.66	(80)
West	0.9x	0.77	x	0.9	x	110.22	X	0.72	x	0.7	j =	34.65	(80)
West	0.9x	0.54	х	1.58	x	94.68	x	0.72	x	0.7	j =	36.64	(80)
West	0.9x	0.77	x	0.9	x	94.68	x	0.72	x	0.7	j =	29.76	(80)
West	0.9x	0.54	x	1.58	x	73.59	x	0.72	x	0.7	j =	28.48	(80)
West	0.9x	0.77	x	0.9	x	73.59	x	0.72	x	0.7	j =	23.13	(80)
West	0.9x	0.54	x	1.58	x	45.59	x	0.72	x	0.7	j   =	17.64	(80)
West	0.9x	0.77	x	0.9	x	45.59	x	0.72	X	0.7	=	14.33	(80)

West	0.9x	0.54			50	X		24.49	x		0.70	7 x	0.7	,	٦ =	0.40	(80)
West	0.9x	0.54			.9	^ X		24.49	] ^     x		0.72	$\frac{1}{x}$	0.7		] - ] <u>=</u>	9.48	(80)
West	0.9x	0.77		<u> </u>	58	x		6.15	) ^   x		0.72	$\exists \hat{x}$	0.7		」 - 	6.25	(80)
West	0.9x	0.77			.9	x	_	6.15	) ^   x		0.72	<b>┤</b>	0.7		」	5.08	(80)
	0.57	0.77			.9	^	'	0.13			0.72	^	0.7		J <sup>-</sup>	3.06	(00)
Solar d	ains in	watts, ca	alculate	d for ea	ch month	1			(83)m	ı = Sı	um(74)m	(82)m					
(83)m=	72.53	141.36	233.97	346.85	432.49	1	46.58	423.55	358		273.61	167.8		3 5	9.78		(83)
Total g	ains – i	nternal a	nd sola	r (84)m	= (73)m	+ (	83)m	, watts						_		ı	
(84)m=	450	516.65	595.59	686.47	749.81	7	42.46	705.55	646	6.5	573.04	489.4	5 437.3	8 42	25.95		(84)
7. Mea	an inter	nal temp	erature	(heatin	g seasor	า)											
		during h					area t	from Tab	ole 9,	, Th	1 (°C)					21	(85)
Utilisa	tion fac	tor for g	ains for	living a	ea, h1,n	n (s	ee Ta	ıble 9a)									
	Jan	Feb	Mar	Apr	May	Ť	Jun	Jul	A	ug	Sep	Oc	t No	/	Dec		
(86)m=	1	1	0.99	0.97	0.92		0.8	0.65	0.7	'2	0.91	0.99	1		1		(86)
Mean	interna	l temper	ature in	living a	rea T1 (f	ollo	ow ste	ps 3 to 7	in T	able	9c)			•		•	
(87)m=	19.35	19.5	19.79	20.2	20.58	_	20.85	20.96	20.	-	20.71	20.2	19.71	1	9.32		(87)
Temp	erature	during h	eating	neriods	n rest of	 f dw	velling	from Ta	hle 9	Th	n2 (°C)		<u> </u>	•		ı	
(88)m=	19.73	19.73	19.73	19.74	19.75	$\overline{}$	19.76	19.76	19.	-	19.75	19.7	19.74	1	9.74		(88)
L	tion for	tor for a	ning for	root of	hualling	<u> </u>	m /oc	L Table	00)	!						l	
(89)m=	1	tor for ga	0.99	0.96	0.88	T	0.7	0.49	9 <i>a)</i>	i6 T	0.85	0.98	1	Т	1		(89)
L					ļ	 		<u> </u>	<u> </u>						•		()
Г	interna 17.55	l temper	ature in	the res	19.32	Ť	1 12 (fd 19.65	ollow ste	ps 3		' in Table	e 9c) 18.82	2 18.09	1 1	7.52		(90)
(90)m=	17.55	17.77	10.2	10.0	19.32		19.03	19.74	19.	/3			ving area -			0.39	(91)
													ring area	. ( .)		0.39	(01)
г		l temper		1	1	_	<u> </u>	i	<del>`</del>		<del></del>	40.0	10.70			1	(02)
(92)m=	18.24	18.44	18.82	19.34	19.81		20.12	20.21	20.		19.97	19.36		2   1	8.22		(92)
(93)m=	18.24	nent to th	18.82	19.34	19.81	$\overline{}$	20.12	20.21	4e,		19.97	19.36		) 1	8.22		(93)
		iting requ			10.01	<u></u>	20.12	20.21			10.07	10.00	10.72	<u> </u>	0.22		(3-5)
		mean int			ıre obtai	nec	d at ste	ep 11 of	Tabl	e 9b	o, so that	t Ti,m	=(76)m a	and re	e-calo	culate	
		factor fo						<u>'</u>			<u> </u>					-	
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oc	t No	/	Dec		
г	tion fac	tor for g		1	_	_			ı					-		1	(0.4)
(94)m=	1	0.99	0.99	0.96	0.89		0.74	0.56	0.6	52	0.87	0.98	0.99		1		(94)
(95)m=	1 gains, 448.52	hmGm , 513.45	VV = (9 586.82	657.46	663.96	T ,	546.9	392.31	402	05	496.99	477.3	8 434.8	1 1	24.84	]	(95)
L		age exte						392.31	402	.03	490.99	477.3	0 434.0	2 44	24.04		(55)
(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)
L		e for mea		1	1			<u> </u>									, ,
		1573.43		1198.44		_	26.82	410.12	430		668.79	1003.	79 1336.0	7 16	18.42		(97)
Space	heatin	g require	ement f	or each	month, k	Wr	n/mont	th = 0.02	24 x [	(97)	m – (95)	)m] x	(41)m	!			
(98)m=	874.28	712.31	625.96	389.51	197.55		0	0	0		0	391.6	4 648.9	1 88	38.02		
•										Total	per year (	(kWh/y	ear) = Sum	1(98)1	5,912 =	4728.19	(98)
Space	heatin	g require	ement i	n kWh/m	²/year											58.66	(99)
																<u> </u>	

9a. Energy requirements – Individual hea	ating systems i	ncluding	micro-C	HP)					
Space heating:	aang byotomo i	погаапту							
Fraction of space heat from secondary/	supplementary	system						0	(201)
Fraction of space heat from main system	m(s)		(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from main syste	em 1		(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system	n 1							92.8	(206)
Efficiency of secondary/supplementary	heating system	າ, %						0	(208)
Jan Feb Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated	<del>'i</del>					040.04	000.00		
	197.55 0	0	0	0	391.64	648.91	888.02		
$(211)$ m = {[(98)m x (204)] } x 100 ÷ (206)	<del>'</del>		0	0	400.00	C00 0C	050.00	1	(211)
942.12   767.57   674.53   419.73   3	212.88 0	0	0 Tota	0 L(kWh/yea	422.03 ar) =Sum(3	699.26	956.92	5095.03	(211)
Space heating fuel (secondary), kWh/m	onth		Tota	i (kwii, you	ar) =0am(2	- ' '/15,1012	2	5095.03	(211)
$= \{[(98) \text{m x } (201)] \} \times 100 \div (208)$	IOTILIT								
(215)m= 0 0 0 0	0 0	0	0	0	0	0	0		
		•	Tota	I (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>		0	(215)
Water heating									_
Output from water heater (calculated about 166.92   146.42   152.14   134.1	ove) 129.76   113.58	106.82	120.33	121.09	139.17	150.02	162.13		
Efficiency of water heater	129.70   113.30	100.02	120.33	121.09	139.17	130.02	102.13	87.3	(216)
	88.79 87.3	87.3	87.3	87.3	89.13	89.32	89.4	07.5	(217)
Fuel for water heating, kWh/month									
(219)m = (64)m x 100 ÷ (217)m		ı				ı	1	I	
(219)m= 186.73   163.85   170.36   150.43	146.14 130.1	122.36	137.83	138.71	156.14	167.96	181.35		<b>¬</b> ,,
Annual totals			Tota	I = Sum(2 <sup>-</sup>		Mhhhaar		1851.96	(219)
Space heating fuel used, main system 1					K	Wh/year		<b>kWh/yea</b> 5095.03	
Water heating fuel used								1851.96	╡
Electricity for pumps, fans and electric ke	een-hot						ļ	1001.00	
, , ,	oop not						- 00	1	(2200
central heating pump:							30		(230c
boiler with a fan-assisted flue							45		(230e
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting								366.7	(232)
Electricity generated by PVs								-2409.59	(233)
12a. CO2 emissions – Individual heatin	g systems inclu	uding mi	cro-CHP						
		ergy /h/year			<b>Emiss</b> kg CO:	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(21	1) x			0.2	16	=	1100.53	(261)
Space heating (secondary)	(215	5) x			0.5		=	0	(263)
Water heating	•	9) x					=		$\int_{(264)}^{(264)}$
vvacor ricating	(21)	-,			0.2	10		400.02	(204)

Space and water heating	(261) + (262) + (263) + (264)	) =	1500.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	190.32	(268)
Energy saving/generation technologies Item 1		0.519 =	-1250.58	(269)
Total CO2, kg/year		sum of (265)(271) =	479.21	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	5.95	(273)
EI rating (section 14)			95	(274)

# 15 Appendix D – New Extension BRUKL

The following BER BRUKL is taken from the SBEM 5.3 software for the new build extension to the commercial space in accordance with current local policy. This is following inclusion of the energy efficiency measures, but before inclusion of the photovoltaic systems proposed.

# BRUKL Output Document



Compliance with England Building Regulations Part L 2013

**Project name** 

### 25 Old Gloucester Street

As designed

Date: Tue Jun 06 13:53:23 2017

### Administrative information

**Building Details** 

Address: 25 Old Gloucester Street, LONDON, WC1N 3AF

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

**Owner Details** 

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 01206 266 755

Address: The Colchester Centre Hawkins Road,

Colchester, CO2 8JX

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

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	14.2	
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	14.2	
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	12.5	
Are emissions from the building less than or equal to the target?	BER =< TER	
Are as built details the same as used in the BER calculations?	Separate submission	

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

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

#### **Building fabric**

Element	U <sub>a-Limit</sub>	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	- 0 Basement - Stairs_W_4
Floor	0.25	0.16	1	0 Ground - Stairs_F_13
Roof	0.25	0.14	0.14	0.1 Mezzanine - Stairs_R_4
Windows***, roof windows, and rooflights	2.2	1	1	0.1 Mezzanine - Admin Office_G_5
Personnel doors	2.2	1.4	1.4	0 Ground - Stairs_D_6
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	2	2	"No external high usage entrance doors"

Ua-Limit = Limiting area-weighted average U-values [W/(m²K)]

U<sub>B-Calc</sub> = Calculated area-weighted average U-values [W/(m<sup>2</sup>K)]

U<sub>i-Calc</sub> = Calculated maximum individual element U-values [W/(m<sup>2</sup>K)]

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	5	

<sup>\*</sup> There might be more than one surface where the maximum U-value occurs.

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

<sup>\*\*\*</sup> Display windows and similar glazing are excluded from the U-value check.

### **Building services**

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

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

### 1- Gas boiler

ficiency
)

### 1- DHW sup. by gas boiler

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.027
Standard value	N/A	N/A

### Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
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
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name  ID of system type		SFP [W/(I/s)]								up m	
		В	C	D	) E	F	G	н	1	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
- 0 Basement - Cold-Dry Store	-	4.	+	-	4	-	÷	-	-	o <u>+</u> 0	N/A
- 0 Basement - Kitchen	7	E I	-	-	Ų,	-		Ų.	1	6-	N/A
- 0 Basement - Stairs	-	2.1	-			-	,91	-	-		N/A
- 0 Basement - Refuse Store	-	-	-	- 1	-	-	9.	-	4		N/A
0.1 Mezzanine - Stairs	-	- 1	-	2.1		-	*	8	-		N/A
0.1 Mezzanine - Admin Office	-	- 1.2		-3	-	-			-	-	N/A
0 Ground - Meeting Room	4	9.7		-	Jan 1		4	-	3	3	N/A
0 Ground - Stairs	9	e	3	-	9	-2	+		-		N/A
0 Ground - Acc. WC	0.3	4	2	-	-	-	2	2	-		N/A

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
- 0 Basement - Cold-Dry Store	100	-	6	12
- 0 Basement - Kitchen	-	100	G-	231

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
- 0 Basement - Stairs	4	100		52
- 0 Basement - Refuse Store	100	2	2	14
0.1 Mezzanine - Stairs	· ·	100	÷ -	41
0.1 Mezzanine - Admin Office	100		£0	215
0 Ground - Meeting Room	100	4	-	228
0 Ground - Stairs	-	100	4	53
0 Ground - Acc. WC	-	100	9	50

# 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?
0.1 Mezzanine - Admin Office	NO (-4%)	NO
0 Ground - Meeting Room	N/A	N/A

# 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?	YES				
Are any such measures included in the proposed design?	YES				

# Technical Data Sheet (Actual vs. Notional Building)

### **Building Global Parameters**

	Actual	Notional
Area [m²]	205.6	205.6
External area [m²]	198	198
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	5
Average conductance [W/K]	45.71	68.89
Average U-value [W/m²K]	0.23	0.35
Alpha value* [%]	21.73	20.65

<sup>\*</sup> Percentage of the building's average heat transfer coefficient which is due to thermal bridging

### **Building Use**

### % Area Building Type

A1/A2 Retail/Financial and Professional services

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

B1 Offices and Workshop businesses

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

### 100 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	19.36	21.29
Cooling	0	0
Auxiliary	4.84	2.71
Lighting	8.48	15.15
Hot water	6.43	2.67
Equipment*	22.51	22.51
TOTAL**	39.1	41.82

<sup>\*</sup> Energy used by equipment does not count towards the total for calculating emissions.

### Energy Production by Technology [kWh/m²]

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

### Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	114.56	126.5
Primary energy* [kWh/m²]	72.32	82.69
Total emissions [kg/m²]	12.5	14.2

<sup>\*</sup> Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

<sup>\*\*</sup> Total is net of any electrical energy displaced by CHP generators, if applicable.

	HVAC Sys	stems Per	formanc	е							
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 SEER	
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity											
	Actual	59.7	54.8	19.4	0	4.8	0.86	0	0.96	0	
	Notional	62.8	63.7	21.3	0	2.7	0.82	0			

### Key to terms

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

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

Cool SSEER 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 <sub>i-Typ</sub>	Ui-Min	Surface where the minimum value occurs*
Wall	0.23	0.18	- 0 Basement - Stairs_W_4
Floor	0.2	0.07	- 0 Basement - Stairs_S_3
Roof	0.15	0.14	0.1 Mezzanine - Stairs_R_4
Windows, roof windows, and rooflights	1.5	1	0.1 Mezzanine - Admin Office_G_5
Personnel doors	1.5	1.4	0 Ground - Stairs_D_6
Vehicle access & similar large doors	1.5	4	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
Ui-Typ = Typical individual element U-values (W/(m²)	()]	1	U <sub>I-Min</sub> = Minimum individual element U-values [W/(m²K)]

<sup>\*</sup> 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	5	

# 16 Appendix E – Existing Building BRUKL

The following BRUKLs are taken from the SBEM 5.3 software for the existing commercial building in accordance with current local policy. This is following inclusion of the energy efficiency measures, but before inclusion of the photovoltaic systems proposed.

The TER BRUKL calculation has been created for the existing commercial building in accordance with the compliance requirements of Part L2B.

# BRUKL Output Document



Compliance with England Building Regulations Part L 2013

**Project name** 

### 25 Old Gloucester Street

As designed

Date: Tue Jun 06 14:02:12 2017

### Administrative information

**Building Details** 

Address: 25 Old Gloucester Street, LONDON, WC1N 3AF

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 01206 266 755

Address: The Colchester Centre Hawkins Road,

Colchester, CO2 8JX

### 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 <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	24.7
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	24.7
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	38.8
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

#### **Building fabric**

Element	U <sub>a-Limit</sub>	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	1.57	1.6	- 0 Basement - Utility_W_5
Floor	0.25	0.33	1	- 0 Basement - Utility_F_4
Roof	0.25	2.8	2.8	- 0 Basement - Dining Area_R_11
Windows***, roof windows, and rooflights	2.2	4.7	4.96	- 0 Basement - Toilets_G_10
Personnel doors	2.2	1.4	1.4	- 0 Basement - Utility_D_6
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	2	-	"No external high usage entrance doors"

Ua-Limit = Limiting area-weighted average U-values [W/(m²K)]

U<sub>a-Calc</sub> = Calculated area-weighted average U-values [W/(m<sup>2</sup>K)]

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

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

Air Permeability	Worst acceptable standard	This building	
m³/(h.m²) at 50 Pa	10	25	

<sup>\*</sup> There might be more than one surface where the maximum U-value occurs.

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

<sup>\*\*\*</sup> Display windows and similar glazing are excluded from the U-value check.

### **Building services**

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

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

### 1- Gas boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HF	Refficiency
This system	0.96	-	-	-	-	
Standard value	0.91*	N/A	N/A	N/A	N/A	A
Automatic moni	itoring & targeting w	ith alarms for out-of	-range values for th	is HVAC system	n	NO

### 1- DHW sup. by gas boiler

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.002
Standard value	N/A	N/A

### Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
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
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name		SFP [W/(I/s)]					cc .				
ID of system type	A	В	C	D	E	F	G	H	1	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
- 0 Basement - Utility	-	4.4	4	4	4	-	+	-	2	4	N/A
- 0 Basement - Dining Store	7	U III	-	-	Ų,	-		4	~	8-3	N/A
- 0 Basement - Store	ъ.		-			-	,91	ь	-		N/A
- 0 Basement - Circulation		-	-		-	-	9.	-	-		N/A
- 0 Basement - Toilets	0.3	6.7	-	-		-	*	8	3-	-	N/A
- 0 Basement - Cleaners Store	0.3	- 1.2		<u>-</u>	-	-		-	-	-	N/A
- 0 Basement - Stairs 1	4	9.75		-	Jan 1		4	-	-	3	N/A
- 0 Basement - Dining Area	-	8	4	-		-	4	e	-		N/A
0 Ground - Office	4	-	-	-	-	-	4	-	4	-	N/A
0 Ground - Entrance Lobby	+	-	4	¥3-1	-	4	÷	4	-	-	N/A
0 Ground - Main Hall	4	-	-	3-1	100	-	4	E	9	200	N/A

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
- 0 Basement - Utility	100	- 1	5	14

General lighting and display lighting	Lumine	ous effic	acy [lm/W]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
- 0 Basement - Dining Store	100	4	- T	29
- 0 Basement - Store	100	2	2	13
- 0 Basement - Circulation	e.	100	-	28
- 0 Basement - Toilets		100	40	86
- 0 Basement - Cleaners Store	100	-	-	6
- 0 Basement - Stairs 1	-	100	4	33
- 0 Basement - Dining Area	-	100	-	266
0 Ground - Office	100		30	97
0 Ground - Entrance Lobby		100	9.11	57
0 Ground - Main Hall	-	100		626

# 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?
- 0 Basement - Dining Area	NO (-87.3%)	NO
0 Ground - Office	YES (+29.6%)	NO
0 Ground - Main Hall	NO (-16.5%)	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?	YES
Are any such measures included in the proposed design?	YES

# Technical Data Sheet (Actual vs. Notional Building)

### **Building Global Parameters**

	Actual	Notional
Area [m²]	388.9	388.9
External area [m²]	559.2	559.2
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	854.44	269.87
Average U-value [W/m²K]	1.53	0.48
Alpha value* [%]	5.42	25.74

<sup>\*</sup> Percentage of the building's average heat transfer coefficient which is due to thermal bridging

### **Building Use**

### % Area Building Type

A1/A2 Retail/Financial and Professional services

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

B1 Offices and Workshop businesses

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

#### 100 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	103.1	32.25
Cooling	0	0
Auxiliary	1.89	1.03
Lighting	4.65	7.37
Hot water	61.01	62.19
Equipment*	17.11	17.11
TOTAL**	170.64	102.84

<sup>\*</sup> Energy used by equipment does not count towards the total for calculating emissions.

### Energy Production by Technology [kWh/m²]

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

### Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	378.18	155.11
Primary energy* [kWh/m²]	220.27	140.37
Total emissions [kg/m²]	38.8	24.7

<sup>\*</sup> Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

<sup>\*\*</sup> Total is net of any electrical energy displaced by CHP generators, if applicable.

	HVAC Sys	stems Pe	rformanc	е						
Sy	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[S	T] Central h	eating using	g water: rad	iators, [HS	LTHW boi	ler, [HFT] N	latural Gas	s, [CFT] Ele	ctricity	
	Actual	318.1	60.1	103.1	0	1.9	0.86	0	0.96	0
	Notional	95.1	60	32.3	0	1	0.82	0		

### Key to terms

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

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

 ST
 = System type

 HS
 = Heat source

 HFT
 = Heating fuel type

 CFT
 = Cooling fuel type

# **Key Features**

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

### **Building fabric**

Element	U <sub>i-Typ</sub>	U <sub>i-Min</sub>	Surface where the minimum value occurs*
Wall	0.23	0.35	- 0 Basement - Dining Store_W_4
Floor	0.2	0.01	- 0 Basement - Store_S_3
Roof	0.15	2.8	- 0 Basement - Dining Area_R_11
Windows, roof windows, and rooflights	1.5	1	0 Ground - Main Hall_G_4
Personnel doors	1.5	1.4	- 0 Basement - Utility_D_6
Vehicle access & similar large doors	1.5	200	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
Uktus = Typical individual element Ukvalues (W//m²)	CVI		Lium = Minimum individual element Li-values (W/(m²K))

U<sub>I-Typ</sub> = Typical individual element U-values [W/(m<sup>2</sup>K)]

<sup>\*</sup> 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	25	

U<sub>I-Min</sub> = Minimum individual element U-values [W/(m<sup>2</sup>K)]

# BRUKL Output Document



Compliance with England Building Regulations Part L 2013

**Project name** 

### 25 Old Gloucester Street

As designed

Date: Tue Jun 06 14:30:31 2017

### Administrative information

**Building Details** 

Address: 25 Old Gloucester Street, LONDON, WC1N 3AF

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

**Owner Details** 

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 01206 266 755

Address: The Colchester Centre Hawkins Road,

Colchester, CO2 8JX

### 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 <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	24.7	
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	24.7	
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	46.9	
Are emissions from the building less than or equal to the target?	BER > TER	
Are as built details the same as used in the BER calculations?	Separate submission	

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

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

#### **Building fabric**

Element	U <sub>a-Limit</sub>	Ua-Calc	Ui-Calc	Surface where the maximum value occurs*
Wall**	0.35	1.57	1.6	- 0 Basement - Utility_W_5
Floor	0.25	0.33	1	- 0 Basement - Utility_F_4
Roof	0.25	2.8	2.8	- 0 Basement - Dining Area_R_11
Windows***, roof windows, and rooflights	2.2	4.7	4.96	- 0 Basement - Toilets_G_10
Personnel doors	2.2	1.4	1.4	- 0 Basement - Utility_D_6
Vehicle access & similar large doors	1.5	-	_	"No external vehicle access doors"
High usage entrance doors	3.5	2	-	"No external high usage entrance doors"

Ua-Limit = Limiting area-weighted average U-values [W/(m2K)]

U<sub>a-Calc</sub> = Calculated area-weighted average U-values [W/(m²K)]

U<sub>i-Calc</sub> = Calculated maximum individual element U-values [W/(m²K)]

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

Air Permeability	Worst acceptable standard	This building	
m³/(h.m²) at 50 Pa	10	25	

<sup>\*</sup> There might be more than one surface where the maximum U-value occurs.

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

<sup>\*\*\*</sup> Display windows and similar glazing are excluded from the U-value check.

### **Building services**

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

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

### 1- Gas boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency	
This system	0.84	-		-	-	
Standard value	0.91*	N/A	N/A	N/A	N/A	
Automatic mon	itoring & targeting w	ith alarms for out-of	f-range values for th	is HVAC syster	m NO	
* Standard shown is	itoring & targeting w for gas single boiler system r any individual boiler in a n	ns <=2 MW output. For sing	gle boiler systems >2 MW o			

### 1- DHW sup. by gas boiler

Water heating efficiency		Storage loss factor [kWh/litre per da				
This building	Hot water provided by HVAC system	0.002				
Standard value	N/A	N/A				

### Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
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
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name		SFP [W/(I/s)]							IID 65		
ID of system type	Α	В	C	D	E	F	G	Н	1	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
- 0 Basement - Utility	-	4.4	4	4	4	2	+	-	2	4	N/A
- 0 Basement - Dining Store	7	U III	-	-	Ų,	-		4	~	8-3	N/A
- 0 Basement - Store			-			-	9.	ь	-		N/A
- 0 Basement - Circulation		-	-	8.1	-	-	9. 1	-	-		N/A
- 0 Basement - Toilets	0.3	6.7	-	- 1		-	*	8	-		N/A
- 0 Basement - Cleaners Store	0.3	- 1 - 1	•	, <b>-</b> 3	-	- I		-	-		N/A
- 0 Basement - Stairs 1	-	9.70	÷ =	-	<b>5</b>	-	-	-	-	3	N/A
- 0 Basement - Dining Area	-	8	4	-	e	-	+	Θ.			N/A
0 Ground - Office	4	-	-	-	2	-	4	-	4	-	N/A
0 Ground - Entrance Lobby	-	-	4	-5	-	4	+	-	-	-	N/A
0 Ground - Main Hall	4	-	-	3-1	100	-	4 .	E	9	200	N/A

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
- 0 Basement - Utility	60	4.	4	23

General lighting and display lighting	Lumine	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
- 0 Basement - Dining Store	60	4	2	47
- 0 Basement - Store	60	2	÷	21
- 0 Basement - Circulation		60	£11	47
- 0 Basement - Toilets		60	400	143
- 0 Basement - Cleaners Store	60	6	.0	10
- 0 Basement - Stairs 1	-	60	4	55
- 0 Basement - Dining Area	-	60	4	443
0 Ground - Office	60	le .	3	162
0 Ground - Entrance Lobby		60	9.11	94
0 Ground - Main Hall	-	60	÷	1043

# 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?
- 0 Basement - Dining Area	NO (-87.3%)	NO
0 Ground - Office	YES (+29.6%)	NO
0 Ground - Main Hall	NO (-16.5%)	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?	YES		
Are any such measures included in the proposed design?	YES		

## Technical Data Sheet (Actual vs. Notional Building)

### **Building Global Parameters**

	Actual	Notional
Area [m²]	388.9	388.9
External area [m²]	559.2	559.2
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	854.44	269.87
Average U-value [W/m²K]	1.53	0.48
Alpha value* [%]	5.42	25.74

<sup>\*</sup> Percentage of the building's average heat transfer coefficient which is due to thermal bridging

### **Building Use**

### % Area Building Type

A1/A2 Retail/Financial and Professional services

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

B1 Offices and Workshop businesses

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

#### 100 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	109.87	32.25
Cooling	0	0
Auxiliary	1.89	1.03
Lighting	13.42	7.37
Hot water	70.43	62.19
Equipment*	17.11	17.11
TOTAL**	195.61	102.84

<sup>\*</sup> Energy used by equipment does not count towards the total for calculating emissions.

## Energy Production by Technology [kWh/m²]

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

## Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	365.4	155.11
Primary energy* [kWh/m²]	266.97	140.37
Total emissions [kg/m²]	46.9	24.7

<sup>\*</sup> Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

<sup>\*\*</sup> Total is net of any electrical energy displaced by CHP generators, if applicable.

ŀ	IVAC Sys	stems Per	formanc	е						
Sy	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[S]	[] Central h	eating using	water: rad	iators, [HS	LTHW boi	ler, [HFT] N	latural Gas	s, [CFT] Ele	ctricity	
	Actual	296.6	68.8	109.9	0	1.9	0.75	0	0.84	0
	Notional	95.1	60	32.3	0	1	0.82	0		

### Key to terms

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

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class) Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

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

# **Key Features**

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

### **Building fabric**

Element	U <sub>i-Typ</sub>	U <sub>i-Min</sub>	Surface where the minimum value occurs*
Wall	0.23	0.35	- 0 Basement - Dining Store_W_4
Floor	0.2	0.01	- 0 Basement - Store_S_3
Roof	0.15	2.8	- 0 Basement - Dining Area_R_11
Windows, roof windows, and rooflights	1.5	1	0 Ground - Main Hall_G_4
Personnel doors	1.5	1.4	- 0 Basement - Utility_D_6
Vehicle access & similar large doors	1.5	200	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
Uktus = Typical individual element Ukvalues (W//m²)	CVI		Lium = Minimum individual element Li-values (W/(m²K))

U<sub>I-Typ</sub> = Typical individual element U-values [W/(m²K)]

U<sub>I-Min</sub> = Minimum individual element U-values [W/(m<sup>2</sup>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	25	

# 17 Appendix F – Overheating Assessments

Calculated by Stroma FSAP 2012 program, produced and printed on 06 June 2017

#### Property Details: 101

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: Unspecified

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Medium

Night ventilation: False Blinds, curtains, shutters: None

Ventilation rate during hot weather (ach):

6 ( Windows fully open)

#### Overheating Details:

Summer ventilation heat loss coefficient: 389.66 (P1)

Transmission heat loss coefficient: 78.8

Summer heat loss coefficient: 468.47 (P2)

### Overhangs:

Overhangs:

Orientation:	Ratio:	Z_overhangs:
West (Terrace door)	0	1
North (Living)	0	1
East (Living 1)	0	1
East (Kitchen)	0	1
East (Bed 1 & Ensuite)	0	1
North (Bed 2)	0	1

#### Solar shading

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
West (Terrace door)	1	0.7	1	0.7	(P8)
North (Living)	1	0.9	1	0.9	(P8)
East (Living 1)	1	0.9	1	0.9	(P8)
East (Kitchen)	1	0.9	1	0.9	(P8)
East (Bed 1 & Ensuite)	1	0.9	1	0.9	(P8)
North (Bed 2)	1	0.9	1	0.9	(P8)

#### Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
West (Terrace door)	0.7 x	1.58	117.51	0.72	0.7	0.7	58.95
North (Living)	0.9 x	1.5	81.19	0.72	0.7	0.9	49.71
East (Living 1)	0.9 x	2.2	117.51	0.72	0.7	0.9	105.54
East (Kitchen)	0.9 x	1.8	117.51	0.72	0.7	0.9	86.35
East (Bed 1 & Ensuite)	0.9 x	5.4	117.51	0.72	0.7	0.9	259.04
North (Bed 2)	0.9 x	1.85	81.19	0.72	0.7	0.9	61.31
						Total	620.91 <b>(P3/P4</b> )

	June	July	August
Internal gains	429.04	413.59	420.88
Total summer gains	1090.41	1034.5	959.72 <b>(P5)</b>

Likelihood of high internal temperature	Not significant	Not significant	Not si	gnificant
Threshold temperature	18.58	20.36	20.1	(P7)
Thermal mass temperature increment	0.25	0.25	0.25	
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Summer gain/loss ratio	2.33	2.21	2.05	(P6)

Calculated by Stroma FSAP 2012 program, produced and printed on 06 June 2017

#### Property Details: 102

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: Unspecified

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Medium

Night ventilation:FalseBlinds, curtains, shutters:None

Ventilation rate during hot weather (ach):

6 ( Windows fully open)

#### Overheating Details:

Summer ventilation heat loss coefficient: 438.08 (P1)

Transmission heat loss coefficient: 68.8

Summer heat loss coefficient: 506.86 (P2)

### Overhangs

Overhangs:

Orientation:	Ratio:	Z_overhangs:
East (Terrace door)	0	1
East (Terrace 1)	0	1
West (Bed 2)	0	1
West (Living)	0	1
North East (Living 1)	0	1

#### Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
East (Terrace door)	1	0.9	1	0.9	(P8)
East (Terrace 1)	1	0.7	1	0.7	(P8)
West (Bed 2)	1	0.9	1	0.9	(P8)
West (Living)	1	0.9	1	0.9	(P8)
North East (Living 1)	1	0.9	1	0.9	(P8)

#### Solar gains:

Orientation		Area	Flux	$g_{-}$	FF	Shading	Gains
East (Terrace door)	0.9 x	3.15	117.51	0.72	0.7	0.9	151.11
East (Terrace 1)	0.7 x	0.78	117.51	0.72	0.7	0.7	29.1
West (Bed 2)	0.9 x	1.6	117.51	0.72	0.7	0.9	76.75
West (Living)	0.9 x	1.6	117.51	0.72	0.7	0.9	76.75
North East (Living 1)	0.9 x	6.75	98.85	0.72	0.7	0.9	272.38
						Total	606.1 <b>(P3/P4)</b>

	June	July	August
Internal gains	456.08	437.19	445.95
Total summer gains	1104.38	1043.29	962.38 <b>(P5)</b>
Summer gain/loss ratio	2.18	2.06	1.9 <b>(P6)</b>
Mean summer external temperature (Thames valley)	16	17.9	17.8

Thermal mass temperature increment 0.25 0.25

Threshold temperature 18.43 20.21 19.95 (P7)

Likelihood of high internal temperature Not significant Not significant

Calculated by Stroma FSAP 2012 program, produced and printed on 06 June 2017

#### Property Details: 201

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: Unspecified

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Medium

Night ventilation:FalseBlinds, curtains, shutters:None

**Ventilation rate during hot weather (ach):**6 ( Windows fully open)

#### Overheating Details:

Summer ventilation heat loss coefficient: 477.4 (P1)

Transmission heat loss coefficient: 57.1

Summer heat loss coefficient: 534.45 (P2)

### Overhangs:

Orientation:	Ratio:	Z_overhangs:
West (Terrace door)	0	1
North (Living)	0	1
East (Living 1)	0	1
East (Kitchen)	0	1
East (Bed 1 & Ensuite)	0	1
North (Bed 2)	0	1
West (Bath)	0	1

#### Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
West (Terrace door)	1	0.7	1	0.7	(P8)
North (Living)	1	0.9	1	0.9	(P8)
East (Living 1)	1	0.9	1	0.9	(P8)
East (Kitchen)	1	0.9	1	0.9	(P8)
East (Bed 1 & Ensuite)	1	0.9	1	0.9	(P8)
North (Bed 2)	1	0.9	1	0.9	(P8)
West (Bath)	1	0.9	1	0.9	(P8)

#### Solar gains:

Orientation		Area	Flux	$g_{-}$	FF	Shading	Gains
West (Terrace door)	0.7 x	1.58	117.51	0.72	0.7	0.7	58.95
North (Living)	0.9 x	2.88	81.19	0.72	0.7	0.9	95.45
East (Living 1)	0.9 x	1.44	117.51	0.72	0.7	0.9	69.08
East (Kitchen)	0.9 x	1.62	117.51	0.72	0.7	0.9	77.71
East (Bed 1 & Ensuite)	0.9 x	4.86	117.51	0.72	0.7	0.9	233.14
North (Bed 2)	0.9 x	1.85	81.19	0.72	0.7	0.9	61.31
West (Bath)	0.9 x	0.9	117.51	0.72	0.7	0.9	43.17
						Total	638.82 <b>(P3/P4)</b>

	June	July	August
Internal gains	430.02	412.2	420.4
Total summer gains	1111.33	1051.02	971.96 <b>(P5)</b>

Likelihood of high internal temperature	Not significant	Not significant	Not sig	nificant
Threshold temperature	18.33	20.12	19.87	(P7)
Thermal mass temperature increment	0.25	0.25	0.25	
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Summer gain/loss ratio	2.08	1.97	1.82	(P6)

Calculated by Stroma FSAP 2012 program, produced and printed on 06 June 2017

#### Property Details: 202

Dwelling type:MaisonetteLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes Number of storeys: 2

Front of dwelling faces: Unspecified

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Medium

Night ventilation:FalseBlinds, curtains, shutters:None

Ventilation rate during hot weather (ach): 8 (Windows fully open)

#### Overheating Details:

Summer ventilation heat loss coefficient: 531.46 (P1)

Transmission heat loss coefficient: 76.4

Summer heat loss coefficient: 607.91 (P2)

### Overhangs:

Overhangs:

Orientation:	Ratio:	Z_overhangs:
East (Bed 2)	0	1
West (Bed 1)	0	1
North East (Bed 1,	Bath, <b>G</b> ed 2)	1
East (Living )	0	1
West (Living)	0	1

#### Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
East (Bed 2)	1	0.9	1	0.9	(P8)
West (Bed 1)	1	0.9	1	0.9	(P8)
North East (Bed 1, Bath,	, <b>1</b> Bed 2)	0.9	1	0.9	(P8)
East (Living )	1	0.9	1	0.9	(P8)
West (Living)	1	0.9	1	0.9	(P8)

#### Solar gains:

Orientation		Area	Flux	$\mathbf{g}_{-}$	FF	Shading	Gains
East (Bed 2)	0.9 x	1.95	117.51	0.72	0.7	0.9	93.54
West (Bed 1)	0.9 x	3.28	117.51	0.72	0.7	0.9	157.35
North East (Bed 1, B	ath, <b>(B</b> . <b>9</b> dx2)	6.48	98.85	0.72	0.7	0.9	261.48
East (Living )	0.9 x	1.43	117.51	0.72	0.7	0.9	68.6
West (Living)	0.9 x	8.93	117.51	0.72	0.7	0.9	428.38
						Total	1009.35 <b>(P3/P4)</b>

	June	July	August
Internal gains	418.81	401.45	409.39
Total summer gains	1494.98	1410.8	1281.27 <b>(P5)</b>
Summer gain/loss ratio	2.46	2.32	2.11 <b>(P6)</b>
Mean summer external temperature (Thames valley)	16	17.9	17.8

Thermal mass temperature increment 0.25 0.25

Threshold temperature 18.71 20.47 20.16 (P7)

Likelihood of high internal temperature Not significant Not significant

Calculated by Stroma FSAP 2012 program, produced and printed on 06 June 2017

#### Property Details: 203

Dwelling type:MaisonetteLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 2

Front of dwelling faces: Unspecified

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Medium

Night ventilation:FalseBlinds, curtains, shutters:None

Ventilation rate during hot weather (ach): 4 (Windows fully open)

#### Overheating Details:

Summer ventilation heat loss coefficient: 256.57 (P1)

Transmission heat loss coefficient: 60.4

Summer heat loss coefficient: 317.01 (P2)

### Overhangs:

Orientation:	Ratio:	Z_overhangs:
East (Bed 2)	0	1
West (Bed 1)	0	1
East (Living )	0	1
West (Living)	0	1

#### Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
East (Bed 2)	1	0.9	1	0.9	(P8)
West (Bed 1)	1	0.9	1	0.9	(P8)
East (Living )	1	0.9	1	0.9	(P8)
West (Living)	1	0.9	1	0.9	(P8)

#### Solar gains:

Orientation		Area	Flux	$g_{-}$	FF	Shading	Gains
East (Bed 2)	0.9 x	0.63	117.51	0.72	0.7	0.9	30.22
West (Bed 1)	0.9 x	3.28	117.51	0.72	0.7	0.9	157.35
East (Living )	0.9 x	0.78	117.51	0.72	0.7	0.9	37.42
West (Living)	0.9 x	8.93	117.51	0.72	0.7	0.9	428.38
						Total	653.37 <b>(P3/P4)</b>

### Internal gains:

	June	July	August
Internal gains	408.73	391.84	399.73
Total summer gains	1102.3	1045.21	974.53 <b>(P5)</b>
Summer gain/loss ratio	3.48	3.3	3.07 <b>(P6)</b>
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	0.25	0.25	0.25
Threshold temperature	19.73	21.45	21.12 <b>(P7)</b>
Likelihood of high internal temperature	Not significant	Slight	Slight

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Assessment of likelihood of high internal temperature:	<u>Slight</u>
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Calculated by Stroma FSAP 2012 program, produced and printed on 06 June 2017

#### Property Details: 301

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: Unspecified

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Medium

Night ventilation:FalseBlinds, curtains, shutters:None

**Ventilation rate during hot weather (ach):**6 ( Windows fully open)

#### Overheating Details:

Summer ventilation heat loss coefficient: 451.63 (P1)

Transmission heat loss coefficient: 72.4

Summer heat loss coefficient: 524.01 (P2)

### Overhangs:

Overhangs:

Orientation:	Ratio:	<b>Z_overhangs:</b>
West (Terrace door)	0	1
North (Kitchen)	0	1
East (Kitchen 1)	0	1
East (Living)	0	1
East (Bed 1)	0	1
North (Bed 2)	0	1
West (Bath)	0	1

#### Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
West (Terrace door)	1	0.7	1	0.7	(P8)
North (Kitchen)	1	0.9	1	0.9	(P8)
East (Kitchen 1)	1	0.9	1	0.9	(P8)
East (Living)	1	0.9	1	0.9	(P8)
East (Bed 1)	1	0.9	1	0.9	(P8)
North (Bed 2)	1	0.9	1	0.9	(P8)
West (Bath)	1	0.9	1	0.9	(P8)

#### Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
West (Terrace door)	0.7 x	1.58	117.51	0.72	0.7	0.7	58.95
North (Kitchen)	0.9 x	1.3	81.19	0.72	0.7	0.9	43.09
East (Kitchen 1)	0.9 x	2.04	117.51	0.72	0.7	0.9	97.86
East (Living)	0.9 x	2.78	117.51	0.72	0.7	0.9	133.36
East (Bed 1)	0.9 x	2.04	117.51	0.72	0.7	0.9	97.86
North (Bed 2)	0.9 x	1.85	81.19	0.72	0.7	0.9	61.31
West (Bath)	0.9 x	0.9	117.51	0.72	0.7	0.9	43.17
, ,						Total	525.61 <b>(P3/P</b> 4

	June	July	August
Internal gains	431.43	413.63	422.05
Total summer gains	1002.11	949.23	886.29 <b>(P5)</b>

Likelihood of high internal temperature	Not significant	Not significant	Not significant
Threshold temperature	18.16	19.96	19.74 <b>(P7)</b>
Thermal mass temperature increment	0.25	0.25	0.25
Mean summer external temperature (Thames valley)	16	17.9	17.8
Summer gain/loss ratio	1.91	1.81	1.69 <b>(P6)</b>