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# **52 Tottenham Street**

# **Energy Statement**

Client Name:	Flower Island (UK) Ltd)	
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# **Quality Assurance Approval Status**

This document has been prepared and checked in accordance with Ensphere Group Ltd's Quality Management System.

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# 1. Executive Summary

- 1.1 This Energy Statement presents the energy strategy for a proposed scheme at 52 Tottenham Street, London, W1T 4RN.
- 1.2 Development proposals include the redevelopment of the site to 4No. residential flats above commercial. Consideration has primarily been given to the planning policy context and other requirements prior to establishing a strategy based upon the energy hierarchy; with a priority given to energy reduction and efficiency. Renewable and low carbon technologies have also been considered in the context of their technical feasibility and financial viability.
- 1.3 The following is therefore proposed:
  - High performance building fabric and energy efficient lighting, services and controls to reduce energy demand for space heating, cooling, ventilation and lighting;
  - Passive design measures to reduce energy demand.
  - Air Source Heat Pumps (ASHPs) to provide space heating and hot water for the commercial space, as well as hot water to all flats;
- 1.4 The development will satisfy the Council target for a 20% carbon reduction relative to Part L 2013 (equivalent to the mandatory requirement under Code Level 4). A copy of the GLA Carbon Emission Reporting Spreadsheet is appended to this report outlining the savings at each stage of the Energy Hierarchy; and demonstrating a >15% saving with fabric alone and >35% saving overall.
- 1.5 The proposed energy strategy is considered consistent with the National Planning Policy Framework, London Plan and policies of the Council. When implemented, the scheme will provide an efficient and low carbon development.



### Introduction 2.

2.1 Ensphere Group Ltd was commissioned by Flower Island (UK) Ltd to produce an Energy Statement for the proposed redevelopment at 52 Tottenham Street, Camden.

### **Site and Surroundings**

- The Application Site ("the Site") is located on Tottenham Street, a connecting road between 2.2 two much busier streets; Cleveland Street to the west and Charlotte Street to the east.
- 2.3 The Site is currently occupied by a four storey building, which was once part of a row of terrace houses.

### **Proposed Development**

2.4 Development proposals include the redevelopment of the site, following demolition of the existing building, to provide a mixed use development comprising ground floor affordable workspace (Class B1), four residential units (Class C3) on the upper floors (3 x 1 Bed Units and 1 x 3 Bed Unit), alongside lower ground floor plant, cycle parking and refuse storage.

### **Report Objective**

2.5 The purpose of the energy assessment is to demonstrate that the proposed climate change mitigation measures comply with energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the development's design and evolution.



### **Assessment Methodology** 3.

- 3.1 The assessment methodology follows the Energy Hierarchy, on the basis that it is preferable to firstly minimise carbon dioxide emissions through reduced energy demand; prior to considering low carbon and renewable energy supply options.
- 3.2 The tiers of the Energy Hierarchy are:
  - Be Lean **Demand Reduction** •
  - Be Clean Use Energy More Efficiently
  - Be Green Use Renewable Energy
  - Be Seen Monitor, Verify & Report
- 3.3 Where opportunities to improve the efficiency of the design have been maximised, consideration is then given to the second principle whereby priority is given to the efficient use of energy. This is on the basis that low carbon technologies can be cost-effective and provide significant carbon savings when compared to conventional technologies.
- 3.4 The third principle of the hierarchy promotes the use of renewable technologies. Whilst these technologies can be relatively expensive to install, they do offer the potential to significantly reduce carbon emissions.
- 3.5 Following the application of renewable technologies, the final tier of the Hierarchy requires monitoring, verification and reporting on energy performance.
- 3.6 The following sections of the report review the planning policy requirements prior to establishing a baseline from which the principles of the Energy Hierarchy are applied.



# Planning Context

4.1 Local planning policy relevant to sustainable development is considered below:

### **National Context**

National Planning Policy Framework (2021)

4.2 The National Planning Policy Framework (NPPF) was updated in July 2021. Paragraph 7 of the revised NPPF includes reference to the following:

> 7. "The purpose of the planning system is to contribute to the achievement of sustainable development.

4.3 Chapter 14 of the NPPF includes consideration of climate change and the use and supply of renewable and low carbon energy. Paragraph 152 states:

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure."

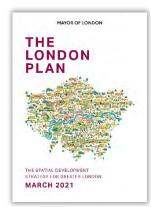
Planning Practice Guidance (2016; updated 2021)

- Climate Change Advises how planning can identify suitable mitigation and adaption measures in plan-making and the application process to address the potential for climate change.
- Renewable and Low Carbon Energy Guidance to help local councils in developing policies for renewable and low carbon energy and identifies the planning considerations.

### **London Context**

### London Plan (2021)

4.4 The London Plan is the overall strategic plan for London, it sets out an integrated economic, environmental, transport and social framework for development of London over the next 20-25 years. The London Plan is part of the Development Plan and covers a range of planning issues. The presented policies provide a vision for how London should sustainably grow and develop in the future. Policies considered pertinent to this report are presented below:



al Planning Policy Framework





- Policy SI 1 (*Improving air quality*) Development proposals should not lead to further deterioration of existing poor air quality.
- Policy SI 2 (Minimising greenhouse gas emissions) Major development should be net zero-carbon and minimise emissions in accordance with the following energy hierarchy: be lean, be clean, be green, be seen. A minimum on site reduction of 35% beyond Building Regulations will be required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Any short fall with the zero-carbon target should be addressed through a carbon offset payment. Development referable to the GLA should also calculate whole life-cycle carbon emissions.
- Policy SI 3 (*Energy infrastructure*) Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system.
- Policy SI 4 (*Managing heat risk*) Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems.

### **Energy Assessment Guidance (2022)**

- 4.5 This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor as set out in London Plan Policy SI 2. It states that the purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy.
- 4.6 Although primarily aimed at strategic planning applications, London boroughs are encouraged to apply the same structure for energy assessments related to non-referable applications and adapt it for relevant scales of development.

### **Local Context**

Camden Local Plan (July 2017)

- 4.7 The Local Plan sets out the planning policies, site allocations and land designations Borough-wide and is the central document in the Borough's Development Plan.
- 4.8 The following policies are considered relevant to this report:
  - Policy CC1 (*Climate Change Mitigation*) promotes zero carbon development, consideration of the Energy Hierarchy (encouraging connection to District Energy Networks), reduced

reliance on transport by car and resource efficiency. All new residential development will



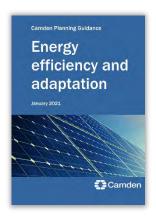


be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy). The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation, unless it can be demonstrated that such provision is not feasible;

- Policy CC2 (Adapting to Climate Change) requires development to seek to protect existing green space, use of SUDS, incorporating biodiverse roofs, consideration of overheating risks, encourages the use of the Home Quality Mark and Passivhaus Standards along with BREEAM "excellent" for non-domestic and refurbishment developments >500sqm and/or five or more dwellings;
- Policy CC4 (Air quality) Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution, with recommended measures adopted. In locations of poor air quality, developments that introduce sensitive receptors (i.e. housing, schools) will also need to be designed to mitigate the impact;

Camden Planning Guidance – Energy Efficiency & Adaptation (January 2021)

- 4.9 This guidance provides information on key energy and resource issues within the borough and supports Local Plan Policies CC1 Climate change mitigation and CC2 Adapting to climate change.
- 4.10 Includes requirements concerning credits under certain BREEAM categories (60% energy, 60% water and 40% materials); and reference the 20% renewables target.



- 4.11 Where developments are likely to be at risk of overheating applicants will be required to complete dynamic thermal modelling to demonstrate that any risk to overheating has been mitigated.
- 4.12 Based on the type of technology proposed, the guidance lists the Council's expectations and requirements. For example, if ASHP were considered, the Council expects carbon calculations to show that that their use for heating is more efficient than gas and that they have a COP of more than 4.



### **Baseline Emissions** 5.

- 5.1 This section establishes the baseline position from which carbon savings are to be achieved. For the purposes of this assessment, and in line with GLA and local authority policies and guidance, the baseline position equates to regulated carbon dioxide emissions, assuming compliance with Part L 2013 of the Building Regulations, as calculated using approved compliance software.
- 5.2 When determining this baseline, it has been assumed that heating would be provided by gas boilers and there will be no active cooling system.
- 5.3 Regulated emissions are emissions which are covered by the Building Regulations and include the energy consumed in the operation of the space heating / cooling and hot-water systems, ventilation and internal lighting.
- 5.4 Unregulated emissions (i.e. those associated with cooking and all electrical appliances and other small power) have been separately calculated.
- 5.5 All emissions have been assessed using the SAP10 carbon factors. Non-domestic unregulated emissions have been taken from the unregulated emissions values generated by the SBEM models; the domestic unregulated emissions calculated using BREDEM (BRE Domestic Energy Model).

Step	Carbon Dioxide Emissions (Tonnes CO <sub>2</sub> per annum)		
	Regulated Unregulated		
Baseline: Part L 2013	4.4	2.8	

Table 5.2	Carbon Dioxide	Emissions	(SAP10) -	Baseline	(Non-Domestic)
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Step	Carbon Dioxide Emissions (Tonnes CO <sub>2</sub> per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013	1.6	4.2	



# 6. Demand Reduction (Be Lean)

6.1 This section considers features of the proposed design (including indicative performance levels) relevant to passive design and energy efficiencies.

### **Passive Design**

6.2 Passive design seeks to maximise the use of natural sources of heating, cooling and ventilation to maintain thermal comfort levels within the building.

### **Building Massing & Orientation**

- 6.3 The building comprises flatted accommodation, reducing surface area and increasing the number of sheltered sides. This will help limit heat losses.
- 6.4 The site size and proximity of neighbouring properties limits the orientation options with glazing being located on the southern side.

**Passive Heating & Cooling** 

6.5 Balconies and the louvres will provide a degree of solar shading; limiting solar gains.

### Daylighting

6.6 Access to daylight is predominantly from the south side of the proposed development and larger windows are proposed on this elevation to improve light levels internally. Lower elevations may experience a degree of shading from properties on the southern side of Tottenham Street.

### **Fabric Efficiency**

6.7 Fabric efficiency concerns the thermal properties associated with the building fabric and construction.

### Insulation

- 6.8 Heat Transfer Coefficients, otherwise referred to as U-Values, are a measure of the rate of heat transfer through a building element over a given area, under standardised conditions (i.e. the rate at which heat is lost or gained through a fabric).
- 6.9 It is intended that the performance of the building fabric will incorporate relatively low U-Values to reduce the rate at which the buildings lose heat, preserving the heat within the space and reducing the requirement for mechanical heating.



Fabric Element	Part L1A (W/m <sup>2</sup> K)	Proposed (W/m <sup>2</sup> K)
External Wall	0.30	0.18
Roof	0.20	0.13
Ground Floor	0.25	0.13
Windows	2.00 (including frame)	1.4 (double glazed)

#### Table 6.1 **Proposed Building Fabric U-Values**

### **Air Tightness**

6.10 A high level of air tightness is proposed and a level below 4m<sup>3</sup>/h/m<sup>2</sup> is targeted, meaning that air infiltration between the internal and the external environment will be largely controlled and space heating demand further reduced.

### **Thermal Bridging**

- 6.11 Thermal bridging is the penetration of the insulation layer by a highly conductive non-insulating material allowing rapid heat transfer from an interior to exterior environment (and vice versa). In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges.
- 6.12 The building fabric shall be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements. A "Y" value of 0.04 has been assumed for the purposes of the indicative SAPs and it is expected that there will be a betterment on Accredited Construction Details (ACDs) values.

### **System Efficiencies**

### **Heating Systems**

- 6.13 It is proposed to incorporate conventional gas-fired boilers where low carbon and renewable technologies are not deemed feasible or viable (see sections below).
- 6.14 Where employed, boiler efficiencies in excess of 89.5% will be targeted. It is expected that boilers will be gas-fired condensing combi with automatic ignition with heat distributed via radiator or underfloor heating.

### **Cooling Systems**

6.15 It is proposed to incorporate mechanical cooling as contingency against hotter summers and to ensure comfort.



### Ventilation

6.16 It is expected that ventilation will be based on the whole house approach as defined in Approved Document Part L2 with Mechanical Ventilation Heat Recovery (MVHR) units to be installed in all apartments.

### **Extract Fans**

6.17 It is anticipated that extract fans will be employed in WC and kitchen areas. The specific fan power (SFP) for these systems will be efficient and target a power consumption rate of 0.3W/l/s.

### Metering

6.18 The major energy uses shall be monitored via separate "smart" energy meters with time and temperature zone control.

### **Lighting Efficiency**

- 6.19 At this stage, detailed lighting design calculations have not yet been undertaken, but lighting design is intended to be highly efficient and in excess of Building Standards requirements. In the domestic components it is intended that lighting efficacy shall be in excess of 100lumens/circuit Watt (likely predominantly LED).
- 6.20 Lighting controls (e.g. PIR occupancy sensors) shall be employed throughout the common areas to further reduce the energy consumption for artificial lighting.

### **Domestic Appliances**

6.21 Within the residential apartments, domestic appliances such as fridges, freezers and domestic dishwashers shall be specified in consideration of their energy performance; the EU energy label of these appliances shall be A+ or greater.

# **Overheating Mitigation**

- 6.22 The issue of overheating will need detailed and considered assessment at a later stage of design on the basis that, as buildings become progressively better sealed and insulated, the potential for overheating increases. However, given that the buildings will have large openable windows as well as the potential for mechanical cooling, it is considered probably that the risk will be mitigated.
- 6.23 The following is, nevertheless, relevant:

### **Limiting Summer External Gains**

- 6.24 The following shall be considered in conjunction and interrelationship with the ventilation strategy, to ensure thermal comfort for occupants and energy savings.
  - Solar control glazing shall be installed to the elevations most affected; the precise specification of glazing types for windows and glazed curtain walling is to be based upon



further analysis at later stages so that the appropriate balance is found between limiting summer heat gains without compromising daylight harvesting and winter solar gains.

 Thermal mass (discussed above) and internal occupant-controlled shading elements will be considered at the more detailed design stage along with heat reflective finishes of the external building surfaces.

### **Limiting Internal Heat Gains**

- 6.25 Heat losses from the Hot Water and Low Temperature Hot Water (LTHW) distribution network are considered to be a significant source of potential overheating in well insulated buildings. This issue can be a significant factor affecting comfort and will therefore need full consideration during the detailed design of the mechanical systems.
- 6.26 However, it is expected that attention will be given to:
  - The positioning of the distribution network and its potential impact on surrounding spaces;
  - The (mechanical) ventilation of spaces where heating pipework is distributed (e.g. corridors);
  - The implementation of combined passive/active ventilation systems for air exhaust of spaces into corridors and to the outside;
  - Maximising the natural ventilation potential of spaces;
  - The performance of the insulation, with calculations undertaken assessing heat losses from the pipework relative to the heat losses from the spaces.



# 7. Heating Infrastructure (Be Clean)

# **District Energy Networks (DEN)**

- 7.1 The term "district energy" applies to the energy distribution network, rather than the origins of the energy and the extent of any carbon savings will be largely determined by the energy source and heat losses on the network.
- 7.2 The London Heat Map is a tool provided by the Mayor of London to identify opportunities for decentralised energy projects in London and it builds on the 2005 London Community Heating Development Study.



Figure 7.1 Extract from the London Heat Map

- 7.3 The above extract from The London Heat Map shows the site located in an area of high heat density. The wider area, as with much of central London, is defined as being a Heat Network Priority Area. However, the Site is not within a zone defined as Heat Mapping Decentralised Energy Potential (purple shading).
- 7.4 No existing District Energy Networks (DEN) have been identified in close proximity to the site.
   The nearest potential network runs along Euston Road (red lines on the above image), circa 650m to the north.

### **District Energy Appraisal**

7.5 In the absence of a DEN in close proximity to the Site and small heating demand, it is not proposed to accommodate DEN as part of the energy strategy.



# Combined Heat & Power (CHP)

7.6 Combined Heat & Power (CHP) systems generate electrical energy and provide the waste heat from the process to be used on site. They are typically gas-fired but can be run off alternative fuel sources. CHP is a highly efficient means to supply heat in developments, providing significant carbon savings and wider environmental benefits (the power generation is much less resource intensive and carbon emitting compared to grid electricity from the average UK power station).

### **CHP** Appraisal

- 7.7 Whilst the site has a heating demand, it is modest and likely subject to daily / weekly / yearly fluctuation due to occupancy patterns. At this scale, it is generally not economic to install CHP as smaller CHPs tend to have lower electrical efficiencies and therefore higher carbon emissions. CHP also tends to emit higher levels of NO<sub>x</sub> than other heating systems; potentially adversely impacting local air quality.
- 7.8 A centralised CHP plant would create complex managerial arrangements and the administrative burden of managing CHP electricity sales to grid when the power is not required on site; combined with the relatively low unit price for small volumes of exported CHP electricity can create incentives for the CHP to be installed but not operated. CHP is therefore not proposed.



# 8. Renewable Energy (Be Green)

8.1 Renewable technologies are those which take their energy from sources which are considered to be inexhaustible (e.g. sunlight, wind etc.). Emissions associated with renewables are generally considered to be negligible and the technologies are frequently referred to as "zero carbon".

### **Biomass Systems**

8.2 Biomass systems are heating systems that use agricultural, forest, urban and industrial residues and waste to produce heat and (depending on the system) electricity. At the building scale, biomass boilers using wood pellets or woodchips are the norm. Biomass should be sourced locally to limit "embodied carbon" associated with transport and ideally be derived from waste wood products to limit the take-up of agricultural land for fuel crops.

### **Biomass Appraisal**

- 8.3 Whilst technically feasible, the site is in an urban setting and the absence of a readily available and diverse local fuel source creates risk associated with security of fuel supply. This has implications for operational viability.
- 8.4 Carbon emissions associated with cultivation, processing and transport of biomass are not normally considered in the context of planning or Building Regulations meaning that total carbon emissions are likely to be significantly higher than estimated. Biomass is also likely to cause other air quality impacts (e.g. particulates), which have implications for local air quality.
- 8.5 Biomass is therefore not a preferred technology for the scheme.

### **Heat Pumps**

- 8.6 Heat pumps draw thermal energy from the air, water or ground ("source") and upgrade it to be used as useful heat at another location ("sink"). Heat pumps require electricity to operate (or gas in the case of Gas Absorption Heat Pumps) as mechanical input is required to convert harvested energy to useful heat and complete its transport to the "sink".
- 8.7 Heat pumps are generally considered as renewable (despite an electrical or gas requirement) because the source of the heat is the ambient temperature in the exterior environment, which is ultimately heated via the sun.
- 8.8 Reversible systems can provide air conditioning comfort cooling; however, when in cooling mode, the system is not considered renewable as it is not taking advantage of a renewable source of energy.



Heat Pump Appraisal

8.9 ASHPs are therefore proposed on hot water to limit carbon emissions associated with the residential development in operation.

### **Micro Hydro Power**

8.10 Micro hydro power systems harness energy from flowing water by using height differences (called "head"); the minimum allowable head is 1.5m and ideally not lower than 10m.

Micro Hydro Appraisal

8.11 There is no surface water course immediately accessible to the site. Micro hydro is therefore not considered an option for the site, for technical feasibility reasons.

### **Micro Wind Power**

8.12 Wind turbines are used to generate electricity; with power production determined by the rotation of the blades and being proportionate to the speed of their rotation. The technology is most efficient for constant, low turbulence wind profiles.

**Micro Wind Appraisal** 

- 8.13 Whilst wind turbines are considered technically feasible in a limited capacity, wind speeds are relatively low and subject to turbulence. The technology is therefore likely to underperform;
- 8.14 Given the uncertainty over performance, the fact that any contribution will likely be quite minor, micro wind turbines are not proposed for the development.

### **Solar Systems**

8.15 Both solar thermal and photovoltaic (PV) systems convert energy from the sun into a form which can be applied within the building. Solar thermal generates energy for heating (usually for hot water) and PV generates electricity. Hybrid photovoltaic / solar thermal collectors are also available and co-generate heat and power.

**Solar System Appraisal** 

8.16 The absence of suitable roof space prohibits the application of these technologies.



# 9. Summary

- 9.1 This Energy Statement provides an overview of the energy strategy in consideration of the site context, anticipated energy requirements and local priorities and initiatives.
- 9.2 A review of Camden Council's planning policies has identified a number of requirements relating to energy. Of these, Local Plan policy CC1 (*Climate Change Mitigation*) is considered most pertinent along with Camden Planning Guidance *Sustainability* (CPG3). Consideration has also been given to the NPPF and GLA's London Plan and the targets contained therein.
- 9.3 The approach follows the Energy Hierarchy and the buildings' fabric shall be constructed to a high-performance standard, achieving high levels of thermal insulation and low air permeability. Energy efficient lighting and appropriate controls shall be employed throughout the development.
- 9.4 The opportunity for the incorporation of renewables has been maximised and use of ASHP on hot water is proposed to limit carbon emissions associated with the residential development in operation.

# **Carbon Savings – Residential**

9.5 Energy modelling has been undertaken using SAP and SBEM and the carbon savings delivered by each of the three steps of the Energy Hierarchy have been estimated (indicative outputs are included in the appendices).

Table 9.1CO2 Emissions after Each Stage of the Energy Hierarchy (SAP10)(Residential)

Step	Carbon Dioxide Emissions (Tonnes CO <sub>2</sub> per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013	4.4	2.8	
After energy demand reduction	3.7	2.8	
After CHP	3.7	2.8	
After renewable energy	2.1	2.8	



Regulated CO<sub>2</sub> Savings from Each Stage of the Energy Hierarchy Table 9.2 (Residential)

	Regulated Carbon Dioxide Savings		
	(Tonnes CO <sub>2</sub> per annum)	%	
Savings from energy demand reduction	0.8	17%	
Savings from CHP	0.0	0%	
Savings from renewable energy	1.6	36%	
Total Cumulative Savings	2.4	53%	

## **Carbon Savings – Non-Domestic**

Table 9.3 CO2 Emissions after Each Stage of the Energy Hierarchy (SAP10) (Non-Domestic)

Step	Carbon Dioxide Emissions (Tonnes $CO_2$ per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013	1.6	4.2	
After energy demand reduction	1.4	4.2	
After CHP	1.4	4.2	
After renewable energy	0.8	4.2	

Table 9.4 Regulated CO<sub>2</sub> Savings from Each Stage of the Energy Hierarchy (Non-Domestic)

	Regulated Carbon Dioxide Savings		
	(Tonnes CO <sub>2</sub> per annum)	%	
Savings from energy demand reduction	0.2	10%	
Savings from CHP	0.0	0%	
Savings from renewable energy	0.6	37%	
Total Cumulative Savings	0.8	48%	



- 9.6 The development will satisfy the Council target for a 20% carbon reduction relative to Part L 2013 (equivalent to the mandatory requirement under Code Level 4). A copy of the GLA Carbon Emission Reporting Spreadsheet is appended to this report outlining the savings at each stage of the Energy Hierarchy; and demonstrating a >15% saving with fabric alone and >35% saving overall.
- 9.7 Overall, the proposed energy strategy is considered consistent with the National Planning Policy Framework, London Plan and policies of the Council. When implemented, the scheme will provide an efficient and low carbon development.



# Appendices



# A. Site Plans







# **B. Key Local Planning Policy Requirements**



### London Planning Policy Framework

### Camden Local Plan (July 2017)

The Local Plan was adopted by Council on 3 July 2017 and has replaced the Core Strategy and Camden Development Policies documents as the basis for planning decisions and future development in the borough. Policies relevant to this report are presented below:

#### Policy G1 Delivery and Location of Growth [extract]

The Council will create the conditions for growth to deliver the homes, jobs, infrastructure and facilities to meet Camden's identified needs and harness the benefits for those who live and work in the borough.

#### Delivery of Growth

The Council will deliver growth by securing high quality development and promoting the most efficient use of land and buildings in Camden by:

a) Supporting development that makes best use of its site, taking into account quality of design, its surroundings, sustainability, amenity, heritage, transport accessibility and any other considerations relevant to the site;

[...]

#### Policy D1 Design [extract]

The Council will seek to secure high quality design in development. The Council will require that development:

[...]

- c) Is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation;
- d) is of sustainable and durable construction and adaptable to different activities and land uses;

[...]

### Policy D2 Heritage [extract]

The Council will preserve and, where appropriate, enhance Camden's rich and diverse heritage assets and their settings, including conservation areas, listed buildings, archaeological remains, scheduled ancient monuments and historic parks and gardens and locally listed heritage assets.

[...]

#### Listed Buildings

Listed buildings are designated heritage assets and this section should be read in conjunction with the section above headed 'designated heritage assets'. To preserve or enhance the borough's listed buildings, the Council will:

- i) resist the total or substantial demolition of a listed building;
- resist proposals for a change of use or alterations and extensions to a listed building where this would cause harm to the special architectural and historic interest of the building; and
- k) resist development that would cause harm to significance of a listed building through an effect on its setting.

#### Policy CC1 Climate Change Mitigation



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

We will:

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

For decentralised energy networks, we will promote decentralised energy by:

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

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

#### Policy CC2 Adapting to Climate Change

The Council will require development to be resilient to climate change.

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

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

Any development involving 5 or more residential units of 500sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

#### Sustainable Design and Construction Measures

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

- e) Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
- f) Encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;
- g) Encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and
- h) Expecting non-domestic developments of 500sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new developments from 2019.



#### Policy CC3 Water and flooding

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

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

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore

#### Policy CC4 Air quality

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

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

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

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

### Policy CC5 Waste

The Council will seek to make Camden a low waste borough.

We will:

- a) aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031;
- b) deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan;
- c) safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and
- d) make sure that developments include facilities for the storage and collection of waste and recycling.

### Policy DM1 Delivery and Monitoring [extract]

The Council will deliver the vision, objectives and policies of the Local Plan by:



[	•	•	•	]	

- d) Using planning contributions where appropriate to:
  - i. Support sustainable development;



# C. GLA Carbon Emissions Reporting Spreadsheet



### SAP 2012 Performance

### Domestic

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	5.1	6.2
After energy demand reduction (be lean)	4.7	6.2
After heat network connection (be clean)	4.7	6.2
After renewable energy (be green)	4.6	6.2

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO <sub>2</sub> per annum)	(%)
Be lean: savings from energy demand reduction	0.3	6%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.1	3%
Cumulative on site savings	0.5	9%
Annual savings from off-set payment	4.6	-
	(Tonne	es CO <sub>2</sub> )
Cumulative savings for off-set payment	138	-
Cash in-lieu contribution (£)	13,149	

\*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab SAP 10.0 Performance

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)		
	Regulated	Unregulated	
Baseline: Part L 2013 of the Building Regulations Compliant Development	4.4	2.8	
After energy demand reduction (be lean)	3.7	2.8	
After heat network connection (be clean)	3.7	2.8	
After renewable energy (be green)	2.1	2.8	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO <sub>2</sub> per annum)	(%)
Be lean: Savings from energy demand reduction	0.8	17%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	1.6	36%
Cumulative on site savings	2.4	53%
Annual savings from off-set payment	2.1	-
	(Tonne	es CO <sub>2</sub> )
Cumulative savings for off-set payment	62	-
Cash in-lieu contribution (£)	5,903	

\*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



### Non-domestic

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

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	2.2	9.4
After energy demand reduction (be lean)	2.1	9.4
After heat network connection (be clean)	2.1	9.4
After renewable energy (be green)	1.8	9.4

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

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO <sub>2</sub> per annum)	(%)
Be lean: savings from energy demand reduction	0.1	4%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.3	14%
Total Cumulative Savings	0.4	18%
Annual savings from off-set payment	1.8	-
	(Tonne	es CO <sub>2</sub> )
Cumulative savings for off-set payment	55	-
Cash in-lieu contribution (£)	5,232	
*carbon price is based on G	LA recommended price of £95 per	tonne of carbon dioxide unless

Local Planning Authority price is inputted in the 'Development Information' tab

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

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	1.6	4.2
After energy demand reduction (be lean)	1.4	4.2
After heat network connection (be clean)	1.4	4.2
After renewable energy (be green)	0.8	4.2

	(Tonnes CO <sub>2</sub> per annum)	(%)
Be lean: savings from energy demand reduction	0.2	10%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.6	37%
Total Cumulative Savings	0.8	48%
Annual savings from off-set payment	0.8	-
	(Tonne	s CO <sub>2</sub> )
Cumulative savings for off-set payment	25	-
Cash in-lieu contribution (£)*	2,349	

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

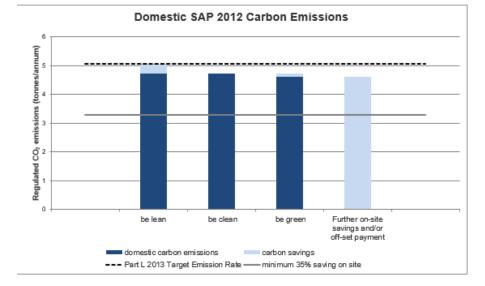


# SITE-WIDE

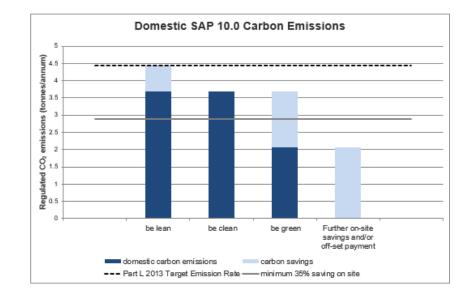
	Total regulated emissions (Tonnes CO <sub>2</sub> / year)	CO <sub>2</sub> savings (Tonnes CO <sub>2</sub> / year)	Percentage savings (%)
Part L 2013 baseline	7.3		
Be lean	6.9	0.4	6%
Be clean	6.9	0.0	0%
Be green	6.4	0.4	6%
Total Savings	-	0.9	12%
	-	CO <sub>2</sub> savings off-set (Tonnes CO <sub>2</sub> )	-
Off-set	-	193.5	-

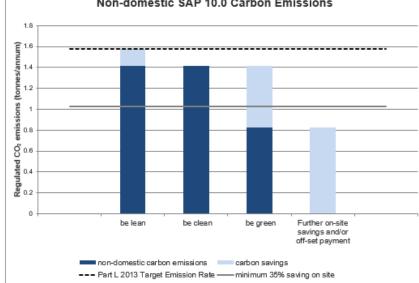
	Total regulated emissions (Tonnes CO <sub>2</sub> / year)	CO <sub>2</sub> savings (Tonnes CO <sub>2</sub> / year)	Percentage savings (%)	
Part L 2013 baseline	6.0			
Be lean	5.1	0.9	15%	
Be clean	5.1	0.0	0%	
Be green	2.9	2.2	37%	
Total Savings	-	3.1	52%	
	-	CO <sub>2</sub> savings off-set (Tonnes CO <sub>2</sub> )	-	
Off-set	-	86.9	-	





### Non-domestic SAP 2012 Carbon Emissions 2.5 Ê /ann 2 for 1.5 emissions Regulated CO<sub>2</sub> e 0 be lean be clean be green Further on-site savings and/or off-set payment non-domestic carbon emissions carbon savings --- Part L 2013 Target Emission Rate ---- minimum 35% saving on site





#### Non-domestic SAP 10.0 Carbon Emissions



# D. Indicative Energy Model Outputs (Be Lean)

$\bigcirc$	
$(\bigcirc)$ ensphere	

			User Details								
Assessor Name: Software Name:	Stroma FSA		Softw	Stroma Number: Software Version: Version: 1.0.5.51							
Address :	52 Tottenhan		OON, W1T 4RN	: WLC Proposed	I MI-						
1. Overall dwelling dime	nsions										
Ground floor			Area(m <sup>2</sup> )		ight(m)	Volume(m					
			38		2.6 (2a) =	98.8	(3				
First floor			31		2.6 (2b) =	80.6	(3				
Total floor area TFA = (1a	a)+(1b)+(1c)+(1	d)+(1e)+(1	n) 69	(4)							
Dwelling volume				(3a)+(3b)+(3c)+(3c)	d)+(3e)+(3n) =	179.4	(5				
2 Ventilation rate:	male		ather	444-4		minester					
in the second second	main heating	seconda	_	total	_	m <sup>3</sup> per ho	-				
Number of chimneys	0	• 0	• 0	• 0	x.40 =	0	(8				
Number of open flues	0	* 0	• 0	• 0	× 20 =	0	(8				
Number of intermittent far	15		_	0	× 10 =	0	0				
Number of passive vents Number of flueless gas fir				D	× 10 =	Q	0				
Infiltration due to chimney		15 = (0a)+(0b)+(	7a)+(7b)+(7c) =	0	Air ct + (5) =	anges per h	our (8)				
If a pressurpation test has be			d to (17), otherwise	continue from (9) to	(16)						
Number of storeys in th Additional infiltration	e dwelling (ns)				((9)-1)x0.1 =	0	(9				
Structural infiltration: 0.	25 for steel or f	imber frame o	r 0.35 for mason	ry construction	Relibert	0	-6				
if both types of wall are pr deducting areas of openin If suspended wooden fi	gs); if equal user 0	.35									
If no draught lobby, ent			a (actica), ciac	CINCI O		0					
Percentage of windows						0	0				
Window infiltration				2 x (14) + 100] =		0	(1				
Infiltration rate	-			+(11)+(12)+(13)		0	1				
Air permeability value, If based on air permeabili					envelope area	1.5	0				
Air permeability value applies					sed	0.08	0				
Number of sides sheltere						1	0				
Shelter factor			6.20	[0.075 x (19)] =		0.92	(2				
infiltration rate incorporati Infiltration rate modified for			(21) = (1)	3) × (20) =		0.07	(2				
<b></b>	Mar Apr	May Jun	Jul Aug	Sep Oct	Nov Dec	1					
Jan Feb	mail Ohi		and hug	J OOP   OC	inor Dec	1					
Jan Feb Monthly average wind sp	and from Table	7									

Wind F	Factor (2	(2a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	4,1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	
Adjust	ed infiltr	ation rat	e (allow	ng for st	neiter an	d wind s	speed) =	(21a) x	(22a)m					
Caland	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.07	0.07	0.08	0.08	]	
		dive air o al ventila		rate for t	he appin	cable ca	ise		-			-	0.5	(23a
				endix N. (2	(23a) = (23a	a) x Fmv (	equation (P	N5)), othe	wise (23)	a) = (23a)		. 13	0.5	(23b
			-				factor (from			1. 1.		1.1		(230
										20100 +	(22b) × 1	1 - (23c)	76.5	(200)
		0.2	0.2	0.19	0.19	0.18	0.18	0.18		2D)m +	(230) * 0.2	0.2	+ 100]	(24a
(24a)ma									0,19			0.2	1	(200
		-	_				covery (M						r	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b
							ventilatio			-				
			-				wise (24	-	-	-	-	_		100
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(246
							ventilatio							
	_	1 = 1, the		m = (22)	o)m othe		24d)m = (	0.5 + [(2	-			_	_	
24d)mm	D	01	0	Ū	0	0	0	0	0	D	a	0	Long or	(246
Effe	ctive air	change	rate - er	ter (24a	) or (241	a) ar (24	c) or (24	d) in bo	x (25)		1	-		
25)m=	0.21	0.2	0.2	0.10	0.19	0.18	0.18	0.18	0.19	0.16	0.2	0.2		(25)
1	-					1	-						1.00	1.1.1
	losse		055	115-6	-		-				-			
ELEN	AENT	Gros		Openin		Net Ar		U-val W/m2		AXL		k-value kJ/m²-k		AXK kJ/K
	ur Turn		unit.			-	the second second	(1/( 1.4 )+		1 425	-	North 1	·	
Minan	No Ayers	-			_	14.2				18.00				(27)
-		G				14.28	a   v1/	/[1/(1.4)+	0.04	18.93	3		-	(27)
Windo	ws Type	2	_	-	_						_			
Windo		14.2	8	14.2	8	0	*	0.18	_	0				(29)
Windo Walls 1	Type1	_		14.2	_	-			_	_			$\exists \vdash$	(29)
Windo Walls 1 Walls 1	Type1 Type2	14.2	28		_	0	* *	0.18	_	0				_
Windo Walls 1 Walls 1 Total a	Type1 Type2 area of e	14.2 14.2 lements	28 ., m²	14.2	8	0	× ×	0.18	3:	0	as alven in	1 paragraph		(29)
Window Walls 1 Walls 1 Total a	Type1 Type2 area of e	14.2 14.2 lements	28 , m² ows, use e	14.2	8 Indow U-va	0 0 28.50 alue calcul	× ×	0.18	3:	0	as given in	n paragraph	32	(29)
Window Walls 1 Walls 1 Total a for win	Type1 Type2 area of e adows and de the area	14.2 14.2 lements roof winds as on both	28 , m² ows, use e	14.2	8 Indow U-va	0 0 28.50 alue calcul	x x 0 lated using	0.18		0	as given in	n paragraph	32	(29)
Windor Walls 1 Walls 1 Total a for win "includ Fabric	Type1 Type2 area of e adows and in the area heat los	14.2 14.2 lements roof winds as on both	28 , m² sides of in = S (A x	14.2	8 Indow U-va	0 0 28.50 alue calcul	x x 0 lated using	0.18 0.18 formula 1	)) + (32) =	0 0 ue)+0.04j	as given in 32) + (32a)			(29) (31)
Walls 1 Walls 1 Total a for win "includ Fabric Heat c	Type1 Type2 area of e adows and de the anna heat los capacity	14.2 14.2 Itements I roof winds as on both as, W/K = Cm = S(	28 , m² owc, use e sidec of in = S (A x (A x k )	14.2 Hective with ternal walk	8 Indow U-ve	0 0 28.50 alue calcul titions	x x	0.18 0.18 formula 1	)) + (32) = ((28).	0 0 ue)+0.04j (30) + (	32) + (32a)	(32e) =	37.86	(29) (31)
Window Walls 1 Walls 1 Total a for win minetud Fabric Heat c Therm	Type1 Type2 area of e dowe and the the area heat los capacity al mass	14.2 14.2 Idements roof winds as on both as on both as, W/K = Cm = S( parame	28 a, m <sup>2</sup> owo, use e sides of in = S (A x (A x k) ter (TMF	14.21 Iffective with themail walk U) P = Cm +	B Indow U-wa Its and part	0 0 28.50 alue calcul titions	8 x x	0.16 0.18 formula 1 (28)(30	) + (32) = ((28), Indica	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	32) + (32a) e: Medium	(32e) =	37.86	(29) (31) (33) (34)
Window Walls 1 Walls 1 Total a * for win * includ Fabric Heat c Therma For deal	Type1 Type2 area of e adowe and ise the area heat los capacity isal mass ign access	14.2 14.2 14.2 Idements roof windk as on both ss, W/K : Cm = S( parame iments who	28 a, m <sup>2</sup> owo, use e sides of in = S (A x (A x k) ter (TMF	14.21 Iffective with ternal walk U) P = Cm 4 tails of the	B Indow U-wa Its and part	0 0 28.50 alue calcul titions	x x	0.16 0.18 formula 1 (28)(30	) + (32) = ((28), Indica	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	32) + (32a) e: Medium	(32e) =	37.86	(29) (31) (33) (34)
Windor Walls 1 Total a * for win * includ Fabric Heat c Therma For deal can be o	Type1 Type2 area of e dowe and de the area heat los capacity i val mass ign access used inste	14.2 14.2 Idements roof windk as on both ss, W/K : Cm = S( parame iments wh ad of a def	28 c, m <sup>2</sup> owo, use e sides of in = S (A x (A x k) ere the de tailed calco	14.21 Iffective with ternal walk U) P = Cm 4 tails of the	B Is and part ► TFA) ir construct	0 0 28.50 alue calcul titions n kJ/m²K sion are no	x x e ated using	0.16 0.18 formula 1 (28)(30	) + (32) = ((28), Indica	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	32) + (32a) e: Medium	(32e) =	37.86	(29) (31) (33) (34)
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Windon Walls 1 Total a * for win * includ Fabric Heat c Therm For deal can be o Therm if details Total fa	Type1 Type2 area of e alows and de the area heat los capacity is al mass ign assess used inste- al bridge of thermal abric he	14.2 14.2 14.2 Idements roof windk is on both is, W/K = Cm = S( parame isments wh ad of a del es : S (L W bridging at loss	28 , m <sup>2</sup> owe, use e sides of in = S (A x k) (A x k) ter (TMF mere the de tailed calcs x Y) cal are not kn	14.2 Itective withernal walk U) P = Cm 4 tails of the ulation. Iculated (	B Indow U-va Is and part TFA) in construct using Ap = 0.05 x (3	0 0 28.50 alue calcul titions n kJ/m²K sion are no	x x e ated using	0.16 0.18 formula 1 (28)(30	= = = = = = = = = = = = = = = = = = =	0 0 (30) + (: 35ve Values e values c + (38) =	32) + (32a) e: Medium	(32e) = Table 1f	37.86 0 250	(29) (31) (33) (34) (35) (36)
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Windo Walls 1 Walls 1 Total a * for win ** includ Fabric Heat c Therm for deal can be o Therm if details Total fa	Type1 Type2 area of endows and is the area heat los capacity is all mass ign assess used inste- sal bridge s of thermal abrich heat ation heat	14.2 14.2 14.2 Idements Iroof windd is on both is, W/K : Cm = S( parame iments wh ad of a del es : S (L w bridging at loss ca Feb	(A x k) ter (TMF ere the de tailed calcs (A x k) ter (TMF ere the de tailed calcs x Y) cal are not kn alculated Mar	14.21 Iffective with thermal walk U) P = Cm + tails of the ulation. (culated ( sown (36) = d monthly Apr	B TFA) in TFA) in construct using Ap 0.05 x (3 y May	0 0 28.54 alue calcul titions n kJ/m²K ion are no oppendix l r/ Jun	x x e ated using	0.18 0.18 0.18 1 (28)(30 recisely the Aug	= = = = = = = = = = = = = = = = = = =	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	32) + (32a) e: Medium f TMP in 1 (25)m x (2 Nov	((32e) =	37.86 0 250	(29) (31) (33) (34) (35) (36)
Windon Walls 1 Total a * for win " includ Fabric Heat c Therm. <i>For</i> deaile Total fi Total fi Ventila	Type1 Type2 area of e showe and de the area heat los capacity i cal mass ign assess used inste- lation de abric hea abric hea Jan 12.19	14.2 14.2 14.2 14.2 14.2 14.2 14.2 14.2	28 , m <sup>2</sup> owe, use e sides of in = S (A x (A x k ) ter (TMF ere the de tailed calor x Y) cal are not kn alculated Mar 11.99	14.21 Iffective with thermal walk U) P = Cm + tails of the ulation. Iculated to sown (36) = d monthly	B indow U-ve to and part > TFA) ir > construct using Ap = 0.05 x (3 y	0 0 28.54 alue calcul titions n kJ/m²K ion are no oppendix l	atted using	0.18 0.18 0.18 (20)(30	(38)m (38)m (38)m (38)m (38)m	0 0 (30) + (30)	32) + (32a) e: Medium & TMP in 7 (25)m x (2 Nov 11.58	((32e) =	37.86 0 250	(29) (31) (33) (34) (35) (36) (36)
Windoi Walls 1 Total a * for win Fabric Fabric Heat c Therm. <i>For deails</i> Total fi Ventila (38)m= Heat tr	Type1 Type2 area of e sdows and is the area is the area is the area is apacity i al mass ign assess used inste- ial bridge of therma iabric he ation hea Jan 12.19 ransfer of	14.2 14.2 14.2 lements roof winds se on both ss, W/K = Cm = S( parame cm = S( parame s : S (L w bridging at loss at loss ca Feb 12.09 coefficier	i, m <sup>2</sup> s, m <sup>2</sup> sides of in = S (A x k) iter (TMF ere the de tailed calcs x Y) call are not kn alculated Mar 11.99 nt, W/K	14.21 Hective with thermal walk U) P = Cm 4 tails of the ulation. (culated to sown (36) = 1 monthly Apr 11.47	* TFA) ir * TFA) ir onstruct using Ap = 0.05 x (3 y May 11.37	0 0 28.50 alue calcul titions n kJ/m²K son are no opendix l 10 10.86	Alted using	0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18	= = = = = = = = = = = = = = = = = = =	0 0 (30) + (; 30) + (;; 30) + (;;; 30) + (;;; 30) + (;;; 30) + (;;; 30) + (;;;; 30) + (;;;; 30) + (;;;;;;;;; 30) + (;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	32) + (32a) e: Medium & TMP in 1 (25)m x (2 Nov 11.58 (38)m	(32e) = (able ff (b) (b) (c) (11.78)	37.86 0 250	(29) (31) (33) (34) (35) (36) (36)
Windon Walls 1 Total a * for win " includ Fabric Heat c Therm. <i>For</i> deaile Total fi Total fi Ventila	Type1 Type2 area of e sdows and is the area is the area is the area is apacity i al mass ign assess used inste- ial bridge of therma iabric he ation hea Jan 12.19 ransfer of	14.2 14.2 14.2 14.2 14.2 14.2 14.2 14.2	28 , m <sup>2</sup> owe, use e bides of in = S (A x (A x k ) ter (TMF ere the de tailed calor x Y) cal are not kn alculated Mar 11.99	14.21 Iffective with thermal walk U) P = Cm + tails of the ulation. (culated ( sown (36) = d monthly Apr	B TFA) in TFA) in construct using Ap 0.05 x (3 y May	0 0 28.54 alue calcul titions n kJ/m²K ion are no oppendix l r/ Jun	atted using	0.18 0.18 0.18 1 (28)(30 recisely the Aug	(38)m (38)m (38)m (38)m (38)m	0 0 (30) + (30)	32) + (32a) e: Medium & TMP in 7 (25)m x (2 Nov 11.58	((32e) =	37.86 0 250	(29) (31) (33) (34) (34) (36) (36)



	nee nore	motor /	HLP), W/	m²l					1400-	= (39)m +	(4)			
40)m=	0.74	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.73	0.73	0.73	0.74		
	-										Sum(40)		0.73	(4
lumb			nth (Tabl			_		-		-	-			
41)m=	Jan 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(4
41)m=	31	-28	31	30	31	30	31	31	30	31	30	31		
4 W:	iter hea	tina ene	rgy requi	rement								kWh/ye	ar	
		jpancy, 9, N = 1	+ 1.76 x	(1 - exp	(-0.0003	49 x (TI	FA -13,9	)2)] + 0.0	013 x (1	FA -13.	9) 2	22		(*
	A £ 13.		ator upon	in litre	n nor da	w.V.d. au	-		. 26			-		
Reduce	the annua	al average	hot water	usage by	5% if the d	welling is	designed i			e target o	91	.54		(*
ot mor	e that 125	litres per	person per	day (all w	ater use, h	hot and co	vid)					_		
int wat	Jan	Feb	Mar day for ea	Apr	May	Jun	Jul Table for	Aug	Sep	Oct	Nov	Dec		
	100.89	97.03	93.37	89.71	86.05	82,39	82.39	88.05	89.71	93.37	97.03	100.69		
enjan-	100.04	97.03	82.21	09,71	00,00	04.39	04.38	80.00		1.	m(44)		1098.48	
nergy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,i	m x nm x C	Tm/360						
45)m=	149.33	130,6	134,77	117.5	112.74	97,29	90.15	103.45	104.68	122	133.17	144.61		
				-	-		-	-		Total = Su	m(45)		1440.28	
- 10	_	_	ng at point	1 . S. S. C.			-	-		-	-			
lð)m≈ Vater	22.4 storage	19.59	20.22	17.82	16.91	14.59	13.52	18.62	15.7	16.3	19.98	21.69		(
		1035												
torac	ie volum	e (litres)	) includin	g any se	plar or W	WHRS	storage	within sa	me vess	sel	-	0		
- 10			) includin and no ta	1000		A COLOR OF A	the second second		ime ves	sel		D		
com then	munity h vise if n	neating a o stored		nk in dv	velling, e	nter 110	litres in	(47)	Land .			D		(
com Otherv Vater	munity h vise if no storage	b stored loss:	and no ta hot wate	nk in dw er (this in	velling, e Includes i	nter 110 nstantar	) litres in neous co	(47)	Land .		47)		-	
f com Otherv Vater a) If n	munity h vise if ne storage nanufact	neating a o stored loss: turer's d	and no ta hot wate eclared k	nk in dw er (this in oss facto	velling, e Includes i	nter 110 nstantar	) litres in neous co	(47)	Land .		47)	D	1	(
Com Otherv Vater a) If n	munity r vise if no storage nanufact erature f	loss: turer's di actor fro	and no ta hot wate eclared k m Table	nk in dw er (this in oss facte 2b	velling, e icludes i or is kno	nter 110 nstantar	) litres in neous co h/day):	(47) ombi boil	ers) ente		47)	0		(
Com Othern Vater a) If n emple energ	munity r vise if no storage nanufact erature f y lost fro	neating a o stored loss: turer's di actor fro om water	and no ta hot wate eclared k m Table r storage	nk in dw er (this ir oss facto 2b , kWh/ye	velling, e ncludes i or is kno ear	nter 110 nstantar wn (kW)	) litres in neous co h/day):	(47)	ers) ente		47)	D		(
com Othern Vater a) If n emplo inerg	munity h vise if no storage nanufact erature f y lost fro nanufact	neating a o stored loss: turer's di actor fro om water turer's di	and no ta hot wate eclared k m Table	nk in dw er (this ir oss facto 2b , kWh/ye	velling, e ncludes i or is knov ear loss facto	nter 110 nstantar wn (kW) or is not	) litres in neous co h/day): known:	(47) ombi boil	ers) ente		47)	0		0
f com Othern Vater a) If n emple energ b) If n fot wa f com	munity h vise if no storage hanufact arature f y lost fro hanufact ater stor munity h	heating a o stored loss: turer's du actor fro om water turer's du age loss heating s	eclared k m Table storage factor fin see section	nk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl	velling, e ncludes i or is knov ear loss facto	nter 110 nstantar wn (kW) or is not	) litres in neous co h/day): known:	(47) ombi boil	ers) ente		47)	0		0
f com Othern Vater a) If n emplo nerg b) If n fot wa f com folum	munity h vise if no storage hanufact erature f y lost fro hanufact ater stor munity h e factor	heating a b stored loss: turer's di factor fro m water turer's di age loss heating s from Ta	and no ta hot wate eclared k m Table storage clared c factor fr see section ble 2a	nk in dw er (this ir 2b , kWh/ye cylinder I om Tabl on 4.3	velling, e ncludes i or is knov ear loss facto	nter 110 nstantar wn (kW) or is not	) litres in neous co h/day): known:	(47) ombi boil	ers) ente					
f com Othern Vater a) If n emple cherg b) If n fot wa f com folum	munity f vise if no storage nanufact erature f y lost fro nanufact ater stor munity f e factor erature f	heating a o stored loss: turer's di actor fro m water turer's di age loss heating s from Ta actor fro	and no ta hot wate eclared k m Table r storage eclared c factor fro see sector ble 2a m Table	nk in dw er (this ir 2b , kWh/ye cylinder I om Tabl on 4.3 2b	velling, e ncludes i or is knov ear oss facto i 2 (kWi	nter 110 nstantar wn (kW) or is not	) litres in neous co h/day): known:	(47) ombi boil (48) x (49	ers) ente	er '0' in (				
com then Vater a) If n empli inerg b) If n lot wa com folum empli inerg	munity r vise if no storage hanufact erature f y lost fro hanufact ater stor munity r e factor erature f y lost fro	heating a b stored loss: turer's dr actor fro m water turer's dr age loss heating s from Ta actor fro om water	and no ta hot wate eclared k m Table r storage eclared c factor fri see section ble 2a m Table r storage	nk in dw er (this ir 2b , kWh/ye cylinder I om Tabl on 4.3 2b	velling, e ncludes i or is knov ear oss facto i 2 (kWi	nter 110 nstantar wn (kW) or is not	) litres in neous co h/day): known:	(47) ombi boil (48) x (49	ers) ente	er '0' in (				
i com otherw Vater a) If n iempo inerg o) If n iot wa i com olum iempo inerg Enter	munity f vise if no storage nanufact erature f y lost fro autor stor munity h e factor erature f y lost fro (50) or	heating a b stored loss: turer's d actor fro m water turer's d age loss heating s from Ta actor fro om water (54) in (5	and no ta hot wate eclared k m Table r storage eclared c factor fr see section ble 2a m Table r storage 55)	nk in dw er (this ir 2b , kWh/ye cylinder I om Tabl on 4.3 2b , kWh/ye	velling, e ncludes i or is knov ear loss fact le 2 (kWI ear	nter 110 nstantar wn (kW) or is not	) litres in neous co h/day): known:	(47) ymbi boil (48) x (49 (47) x (51	ers) ente	53) =				
i com Othern Vater a) If n iempo inerg olum iempo inerg Enter Vater	munity r vise if no storage nanufact erature f y lost fro nanufact ater stor munity r e factor erature f y lost fro (50) or storage	heating a b stored loss: turer's d actor fro om water turer's d age loss heating s from Ta actor fro om water (54) in (! loss cal	ind no ta hot wate eclared k m Table r storage eclared c factor fin eee section ble 2a m Table r storage 55) culated f	nk in dw er (this ir 2b , kWh/ye cylinder i om Tabl on 4.3 2b , kWh/ye	velling, e includes i or is knov ear loss facti e 2 (kWi ear month	nter 110 nstantar wn (kW) or is not h/litre/da	) litres in neous co h/day): known: ay)	(47) mbi boil (48) × (49 (47) × (51 ((56)m = (	ers) ente = + x (52) x ( 55) x (41)	53) =				
com then Vater a) If n emplo inerg com for wa com for wa com	munity r vise if no storage hanufact erature f y lost fro hanufact ater stor munity r e factor erature f y lost fro (50) or storage	turer's de loss: turer's de lactor fro om water turer's de age loss neating s from Ta lactor fro om water (54) in (! loss cal	eclared k m Table storage eclared c factor fin ee section ble 2a m Table r storage 55) culated f	nk in dw er (this ir 2b , kWh/ye cylinder I om Tabl om 4.3 2b , kWh/ye for each	velling, e iccludes i or is know ear loss facture 2 (kWI ear month 0	nter 110 nstantar wn (kW) or is not h/litre/da	0 litres in neous cc h/day): known: ay) 0	(47) mbi boil (48) × (49 (47) × (51 ((58)m = ( 0	ers) ente = (x (52) x (5 (5) x (4)) 0	53) = 0	47)			
com then vater vater a) If n emplo inerg olum com com com com com com com co	munity f vise if no storage hanufact arature f y lost fro hanufact ater stor munity f e factor erature f y lost fro (50) or storage 0 er contain	eating a o stored loss: turer's de actor fro m water turer's de age loss reating s from Ta actor fro om water (54) in (! loss cal 0 s dedicate	nd no ta hot wate eclared k m Table storage eclared c factor fr factor factor fr factor factor fr factor factor fr factor factor fr factor factor fr factor f	nk in dw er (this ir 2b , kWh/ye cylinder 1 om Tabi om 4.3 2b , kWh/ye for each 0 rage, (57)	velling, e ccludes i or is kno- ear loss facte ear ear month 0 m = (58)m	nter 110 nstantar wn (kW) or is not h/litre/da	) litres in neous cc h/day): known: ay) 0 (H11)] + (5	(47) mbi boil (48) × (49 (47) × (51 ((56)m = ( 0), else (5	ers) ente = (x (52) x (1) (55) x (41) 0 7/m = (56)	er '0' in ( 53) = n 0 m where (	47)	00 00 00 00 00 00 00		
com to com vater vater a) If n iempo inerg olum iempo inerg com vater vater vater iempo iemo	munity r vise if ni storage hanufact erature f y lost fro hanufact ater stor munity r e factor erature f y lost fro (50) or storage 0 er contain	eating a o stored loss: turer's d actor fro m water turer's d age loss heating s from Ta actor fro m water (54) in (5 loss cal 0 s dedicate	and no ta hot wate eclared k m Table r storage eclared c factor fr see section ble 2a m Table r storage 55) culated f 0 d solar stor	nk in dw er (this ir 2b , kWh/ye cylinder I om Tabl on 4.3 2b , kWh/ye for each 0 rage. (57) 0	velling, e ccludes i or is know ear loss fact le 2 (kWI ear month 0 m = (58)m 0	nter 110 nstantar wn (kW) or is not h/litre/da	0 litres in neous cc h/day): known: ay) 0	(47) mbi boil (48) × (49 (47) × (51 ((58)m = ( 0	ers) ente = (x (52) x (5 (5) x (4)) 0	53) = 0	47)	0 0 0 0 0 0 0 0 0 0 0 0 0 0	cH	
com Vater Vater a) If n emplo inerg b) If n emplo inerg Enter Vater column	munity r vise if no storage hanufact erature f y lost fro hanufact ater stor munity r e factor erature f y lost fro (50) or storage or er contain	eating a o stored loss: turer's de actor fro om water turer's de age loss neating s from Ta actor fro om water (54) in (f loss cal 0 s dedicate	nd no ta hot wate eclared k m Table storage eclared c factor fr factor factor fr factor factor fr factor factor fr factor factor fr factor factor fr factor f	nk in dw er (this ir 2b , kWh/ye cylinder I om Tablo for each rage. (57) 0 m Table	velling, e ncludes i or is kno ear loss facte ear ear month 0 m = (50)m 0 2 3	nter 110 nstantar wn (kW) or is not h/litre/da x ((50) - ( 0	0         Ittres in neous cc           h/day):	(47) mbi boil (48) x (49) (47) x (51) ((56)m = ( 0), else (5) 0)	x (52) x (41) 0 7/m = (56) 0	er '0' in ( 53) = n 0 m where (	47)	00 00 00 00 00 00 00		
f com Othern Vater a) If n "emple Energ (olum f com f	munity f vise if no storage hanufact erature f y lost fro- hanufact adter stor munity f e factor erature f y lost fro (50) or storage o er contain y circuit	eating a o stored loss: turer's de actor from water turer's de age loss from Ta actor from om water (54) in (fill loss call o s dedicate o c loss (ar loss (ar loss call loss call loss call loss (ar loss call loss call l	and no ta hot wate eclared k im Table r storage eclared c factor fr see section ble 2a im Table r storage 55) culated f d solar stor d solar stor 0 nnual) fro	nk in dwer (this ir 2b , kWh/yi cylinder l om Tablo on 4.3 2b , kWh/yi for each 0 rage. (57) 0 m Table for each	velling, e includes i or is knowear loss facture ear month 0 m = (56)m 0 3 3 month (	nter 110 nstantar wn (kW) or is not h/litre/da × ((50) – ( 0 59)m = (	0         litres in neous cc           h/day):         known:           known:         ay)           v         (H11)] + (5)           0         (58) + 36	(47) prmbi boil (48) × (40 (47) × (51 ((56)m = ( 0 0). else (5 0 5 × (41)	ers) ente ( = (x (52) x (1) (55) x (41) (7)m = (56) 0 m	53) = n 0 m where ( 0	47)	0 0 0 0 0 0 0 0 0 0 0 0 0 0	cH	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

ombi	loss ca	culated	for each	month	(61)m =	(60) ÷ :	365 × (41	)m						
1)m=		44.66	47.58	44.24	43.85	40.63	41.98	43.8	5 44.24	47.58	47.85	50.96		(61)
tal h	leat regi	uired for	water h	eating c	alculated	for ea	ch month	(62)	n = 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
2)m=	200.29	175.26	182.35	161.74	156,59	137.91	132.13	147.	3 148.92	169.58	181.02	195.57		(62)
lar DH	W input of	calculated	using App	endix G o	r Appendi	c H (nega	tive quantity	y) (ente	er '0' if no sola	ar contribut	ion to wate	er heating)		
dd a	dditiona	l lines if	FGHRS	and/or	WWHR	applie	s, see Ap	pendi	ix G)		201			
)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
utput	from w	ater hea	iter	-		22-0	-	1.	-	-				
l)m=	200.29	175.26	182.35	161.74	156.59	137.91	132.13	147.	.3 148.92	169.58	181.02	195.57	1	
								0	Dutput from w	vater heate	r (annual),		1988.66	(64)
eat g	_		-	-	-	-	-	-	1)m] + 0.8 :			+ (59)m	1	
5)m=	62.39	54.59	56.71	50.13	48.45	42.5	40.47	45.3	45.87	52.46	56.24	60.82		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if (	cylinder	is in the	dwelli	ng or hot w	ater is fi	rom com	munity h	leating	
. int	iemal ga	ains (see	e Table 5	5 and 5a	):									_
etab	olic gain	s (Table	5), Wat	ts				_	-				-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	ig Sep	Oct	Nov	Dec		
)na=	111.09	111.08	111.08	111.08	111.08	111.08	111.08	1111	08 111.08	111.08	111.08	111.08		(66)
ghtin	g gains	(calcula	ted in A	opendix	L, equa	tion L9	or L9a), a	lso se	e Table 5		-			
')m=	17.38	15.44	12.55	9.5	7.1	6	6.48	8.4	2 11.31	14.36	16,76	17.86		(67)
oplia	nces ga	ins (calc	ulated in	Appen	dix L., ea	uation	L13 or L1	3a), a	lso see Ta	ible 5		1		
B)m=	194.95	196.97	191.88	191.02	187 32	154.45	145.85	943.	83 148,92	159.77	173.47	186.35		(68)
ookin	ig gains	(calcula	ated in A	ppendix	L, equa	tion L1	or L15a	), also	see Table	95				
=m(9	34.11	34.11	34.11	34.11	34.11	34.11	34,11	34.1	1 3411	34.11	34.11	34.11		(69)
Imps	and fai	ns gains	(Table !	5a)										
)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
sses	s e.g. ev	aporatio	on (nega	tive valu	ies) (Tal	ole 5)								
1)m=	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.8	-98.86	-88.86	-88.86	-88.86		(71)
ater	heating	gains (T	Table 5)											
2)m=	83.86	81.24	76.22	69.62	65.12	59.03	54.4	60.9	63.7	70.51	78.11	81.75		(72)
otal i	nternal	gains =			-	(8	6)m + (67)n	n + (68)	)m + (69)m +	(70)m + (7	1)m + (72	)m		
3)m=	382.51	359.97	346.97	326.47	305.87	285.81	273.05	279.	54 290.26	310.97	334.67	352.29		(73)
. So	lar gains	r.												
olar g	jains are o	alculated	using sola	r flux from	Table 6a	and asso	ciated equa	ations to	o convert to th	he applicat	ole orientat	tion.		
rienta		Access F Table 6d		Area m <sup>2</sup>			ux able 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
uthe	ast 0.9x	0.3	×	14.	28	×	36.79	× [	0.76	×	0.8		86.25	(77)
uthe	asto.9x	0.3	×	14	28	x	36,79	] x [	0.76	×	0.8		86.25	(77)
uthe	asto.9x	0.3	×	14	28	x	62.67	<b>x</b>	0.76	×	0.8	=	146.92	(77)
outhe	ast 0.9x	0.3	×	14	28	<b>x</b>	62.67	] × [	0.76	×	0.8	-	146.92	(77)
	ast 0.9x	0.3	×	14		×	85.75	1. Г	0.76		0.8	- 1	201.02	(77)

Southeast 0	9x 0.3	3 ×	14.28	3	c 3	85.75	1 × 1	0.76		0.8		-	201.02	
			14.28			06.25	i . F	0.76	-   ,	0.8	=		249.08	=
Southeast o.			14.28			08.25	i . i	0.76	H . i	0.8	۲.	F	249.08	=
Southeast o			14.26		_	19.01	1. 1	0.76	=	0.8	۲.	F	278.99	=
Southeast	-		14.28			19.01	i . F	0.76	H . i	0.8	=.		278.99	۲
Southeast o			14.28		-	18.15	i . F	0.76	=  _ i	0.8	۲.	F	276.97	-
Southeast 0.			14.28			18.15	1.1	0.76	H . i	0.8	=		276.97	=
Southeast o	9x 0.1	3 ×	14.28	. ,		13.91	i . i	0.76	i . ۲	0.8	-		267.03	-
Southeast o			14.28			13.91	i . i	0.76	i . ۲	0.8	۲.	F	267.03	=
Southeast 0	9x 0.1	3 ×	14.28	3		04.39	i . i	0.76	i . ۲	0.8	۲.	F	244.71	=
Southeast o	9x 0.1	3 *	14.28	,	1	04.39	i . i	0.76	i • ۲	0.8	=		244,71	
Southeast o	Px 0.3	3	14.28			92.85	i . i	0.76	i, F	0.8	Ξ.		217.66	
Southeast	9x 0.3	3 X	14.28	,		92.85	i . i	0.76	Ξ× Γ	0.8	-		217.68	
Southeast 0	9x 0.1	3 ×	14.28	,		89.27	i . ř	0.76	i . ۲	0.8	۲.	F	162.38	=
Southeast 0	9x 0.1	3 *	14.28	,		89.27	i . i	0.76	i • ۲	0.8	-		162.38	-
Southeast 0	9x 0.3	3 ×	14.28	3		44.07	i . i	0.76		0.8	-	F	103.31	=
Southeast o	9x 0.3	3 ×	14.28	3		44.07	i . i	0.76	i . ۲	0.8	-		103.31	
Southeasto	8× 0.	2 ×	94.28			31.49		0.76	x	0.6			73.81	
Southeast o	9× 0.3		14.28			31.49	i i	0.76		0.8	-		73.81	-
		-	(84)m = (		-	-	480.		324.75	206.62	147.63	1		
(84)m= 535		-		(73)m + 863.84	(83)m 839.74	and shares of	768.		324.75 635.72	-	147.63	1		
7. Mean ir	nz ( 863.81 stemal ten	749.02 nperature	s24.62 ( theating s	863.84 (eason)	839.74	, Watts B07.1	768.	96 725.89		-		1		
7 Mean in Temperat	nz 663.81 Itemal len ure during	749.02 nperature heating p	624.62 (heating speriods in t	eason) the livin	839.74 g area	, watts 807.1	768.	96 725.89		-		1	21	
7 Mean in Temperat Utilisation	az 803 si itemal ten ure during factor for	749.02 nperature heating p gains for	624.62 ( theating s periods in t living area	863.84 (28501) the livin 1, h1,m	g area (see Ta	, watts 807/1 from Tal able 9a)	768.0 ble 9,	e6 725.50 Th1 (*C)	635.72	541.29	499.92		21	
7 Mean in Temperat Utilisation	az 803 si Mernal len ure during factor for in Feb	749.02 nperature heating p gains for Mar	b24.62 ( theating s beriods in t living area Apr	eason) the livin a, h1,m May	g area (see Ta Jun	, watts 807/1 from Tal able 9a) Jul	768. ble 9, Au	96 725.59 Th1 (*C) 1g Sep	635.72 Oct	541.29 Nov	499.92 Dec		21	
Temperat Utilisation Ja (86)m= 0.0	az 803.81 Itemal len ure during factor for in Feb ie 0.95	749.02 nperature heating p gains for Mar 0.87	824.62 ( theating s periods in t living area Apr 0.72	863.84 (23501) the livin a, h1,m May 0.54	g area (see Ta Jun 0.38	watts B07.1 from Tal able 9a) Jul 0.27	768.1 ble 9, Au 0.3	66 725.89 Th1 (°C) 19 Sep 10.49	635.72	541.29	499.92		21	
7 Mean in Temperat Utilisation Ja (80)m= 0.0 Mean inte	az 603.81 Internal fem ure during factor for in Feb 9 0.95 mal tempo	rature perature heating p gains for Mar 0.87 erature in	824,62 ( theating s periods in t living area Apr 0.72 living area	863.84 (23500) the livin (1, h1,m) May 0.54 a T1 (fol	g area (see Ta Jun 0.38	watts 107/1 from Tal able 9a) Jul 0.27 eps 3 to 1	768.1 ble 9, Au 0.3 7 in Ta	ee 725.89 Th1 (*C) ig Sep 0.48 able 9c)	0ct 0.78	541.29 Nov 0.98	499.92 Dec 0.99		21	
7 Mean in Temperat Utilisation Ja (86)m= 0.9	az 603.81 Internal fem ure during factor for in Feb 9 0.95 mal tempo	rature perature heating p gains for Mar 0.87 erature in	824.62 ( theating s periods in t living area Apr 0.72	863.84 (23501) the livin a, h1,m May 0.54	g area (see Ta Jun 0.38	watts B07.1 from Tal able 9a) Jul 0.27	768.1 ble 9, Au 0.3	66 725.89 Th1 (°C) 19 Sep 10.49	635.72 Oct	541.29 Nov	499.92 Dec		21	
7 Mean in Temperat Utilisation (80)me 0.0 Mean inte (87)me 20. Temperat	ternal tern ure during factor for in Feb 0.05 mal tempo 52 20.71 ure during	749.02 nperature heating ; gains for Mar 0.87 erature in 20.87 heating ;	B24.62     1       (heatling s       periods in 1       living area       Apr       0.72       living area       20.97       periods in 1	883.84 (2350n) the livin 4, h1,m May 0.54 a T1 (fol 21 rest of c	g area (see Ta Jun 0.38 llow ste 21	, watts 807.1 from Tal able 9a) Jul 0.27 eps 3 to 7 21 a from Ta	768.1 ble 9, 0.3 7 in T2 21 able 9	ee         725.59           Th1 (*C)         ig           ig         Sep           id         0.48           able 9c)         21           i, Th2 (*C)         integral	035.72 Oct 0.78 20.96	541.29 Nov 0.96 20.73	469.92 Dec 0.99 20.47		21	
7 Mean in Temperat Utilisation (80)m= 0.0 Mean inte (87)m= 20.	ternal tern ure during factor for in Feb 0.05 mal tempo 52 20.71 ure during	749.02 Tetralure heating p gains for Mar 0.87 erature in 20.87	B24.62     1       (heatling s       periods in 1       living area       Apr       0.72       living area       20.97       periods in 1	883.84 (2350n) the livin (1, h1, m) May 0.54 a T1 (fol 21	g area (see Ta Jun 0.38 llow ste 21	, watts so7.1 from Tal able 9a) Jul 0.27 eps 3 to 1 21	768.1 ble 9, Au 0.3 7 in Ta 21	ee         725.59           Th1 (*C)         ig           ig         Sep           id         0.48           able 9c)         21           i, Th2 (*C)         integral	0ct 0.78	541.29 Nov 0.98	499.92 Dec 0.99		21	
7. Mean in Temperat Utilisation (80)m= 0.0 Mean inte (87)m= 20 Temperat (86)m= 20 Utilisation	ternal ten ure during factor for in Feb 9 0.95 mal temp 52 20.71 ure during 3 20.31 factor for	perature heating p gains for 0.87 erature in 20.87 heating p 20.31 gains for	B24,62         1           threating s         1           living area         Apr           0.72         1           living area         20.97           periods in r         20.31           rest of dwn         20.31	803.84 (22501) the livin a, h1,m May 0.54 a T1 (fol 21 rest of c 20.31 elling, h	g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32	, watts so7:1 from Tal able 9a) Jul 0.27 ops 3 to 7 21 a from Tal 20.32	768.0 ble 9, 0.3 7 in Ta 21 able 9 20.3 9a)	ae         725.59           Th1 (*C)         ag           ag         Sep           i         0.48           able 9c)         21           21         .Th2 (*C)           12         20.32	0ct 0.78 20.98 20.31	541.29 Nov 0.96 20.73 20.31	409.92 Dec 0.99 20.47 20.31		21	
7. Mean in Temperat Utilisation (80)m= 0.0 Mean inte (87)m= 20. Temperat (86)m= 20	ternal ten ure during factor for in Feb 9 0.95 mal temp 52 20.71 ure during 3 20.31 factor for	749.02 perature heating p gains for 0.87 erature in 20.87 heating p 20.31	B24.02         I           Inexting s         Inexting s           beriods in h         Iving area           Apr         0.72           living area         20.97           veriods in h         20.31	803.84 (193.84) (193.	g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32	, watts so7:1 from Tal able 9a) Jul 0.27 ops 3 to 7 21 a from Tal 20.32	768.1 ble 9, Au 0.3 7 in Ta 21 able 9 20.3	ae         725.59           Th1 (*C)         ag           ag         Sep           i         0.48           able 9c)         21           21         .Th2 (*C)           12         20.32	035.72 Oct 0.78 20.96	541.29 Nov 0.96 20.73	469.92 Dec 0.99 20.47		21	
7 Mean in Temperat Utilisation (80)m= 0.0 Mean inte (87)m= 20. Temperat (88)m= 20 Utilisation (89)m= 0.0	ternel len ure during factor for m Feb e 0.95 mal tempts 2 20.71 ure during 3 20.31 factor for e 0.94	A constraints of the second se	beriods in living area Apr 0.72 living area 20.97 beriods in l 20.31 rest of dwr 0.88	803.84 (20300) the livin a, h1,m May 0.54 a T1 (fol 21 rest of o 20.31 elling, h 0.5	830.74 g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32 2.32 0.34	, watts 807.1 from Tal able 9a) Jul 0.27 eps 3 to 1 21 a from Tal able 9a) Jul 0.27 eps 3 to 1 21 a from Tal able 9a) 21 a from Tal able 9a) 22 a from Tal able 9a) 23 a from Tal able 9a) 23 a from Tal able 9a) 23 a from Tal able 9a) 23 a from Tal able 9a)	768.1 ble 9, Au 0.3 7 in Ta 21 20.3 9 20.3 9 20.3	ae         725.59           Th1 (*C)         ag           ag         Sep           i         0.48           able 9c)         21           .         .           12         20.32	0ct 0.78 20.98 20.31 0.74	541.29 Nov 0.96 20.73 20.31	409.92 Dec 0.99 20.47 20.31		21	
7 Mean in Temperat Utilisation Ja (86)m= 0.5 Mean inte (89)m= 20 Utilisation (89)m= 0.0 Mean inte	ternal ten ure during factor for in Feb 9 0.95 mal tempo 52 20.71 ure during 3 20.31 factor for 18 0.94 mal tempo	r740.02 reactions pains for mains for mains for 0.87 erature in 20.87 heating p 20.31 gains for 0.85 erature in	824.62         Inecting s           periods in this         Inecting s           Apr         Apr           0.72         Ining area           20.97         Ining area           periods in r         20.31           rest of dwn         0.88           the rest of         Ining area	803.84 (20300) the livin a, h1,m May 0.54 a T1 (fol 21 rest of o 20.31 elling, h 0.5	830.74 g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32 2.m (se 0.34	, watts 807.1 from Tal able 9a) Jul 0.27 eps 3 to 1 21 a from Tal able 9a) Jul 0.27 eps 3 to 1 21 a from Tal able 9a) 21 a from Tal able 9a) 22 a from Tal able 9a) 23 a from Tal able 9a) 23 a from Tal able 9a) 23 a from Tal able 9a) 23 a from Tal able 9a)	768.1 ble 9, Au 0.3 7 in Ta 21 20.3 9 20.3 9 20.3	ae 728.88 Th1 (*C) ag Sep 0.48 able 9c) 21 , Th2 (*C) 12 20.32 5 0.43 to 7 in Tab 12 20.32	0ct 0.78 20.98 20.31 0.74 le 9c) 20.27	541.29 Nov 0.96 20.73 20.31 0.95 19.08	499.92 Dec 0.99 20.47 20.31 0.99 19.61		21	
7 Mean in Temperat Utilisation Ja (80)m= 0.0 Mean inte (80)m= 20 Utilisation (80)m= 0.0 Mean inte	ternal ten ure during factor for in Feb 9 0.95 mal tempo 52 20.71 ure during 3 20.31 factor for 18 0.94 mal tempo	r740.02 reactions pains for mains for mains for 0.87 erature in 20.87 heating p 20.31 gains for 0.85 erature in	824.62         Inecting s           periods in this         Inecting s           Apr         Apr           0.72         Ining area           20.97         Ining area           periods in r         20.31           rest of dwn         0.88           the rest of         Ining area	803.84 (93501) the livin h, h1,m May 0.54 a T1 (fol 21 rest of o 20.31 eiling, h 0.5 f dwellin	g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32 2,m (se 0.34 0.34 0.34	watts 807 1 from Tal able 9a) Jul 0.27 eps 3 to 1 21 a from Ta 20.32 ee Table 0.23 follow ste	768.1 ble 9, Au 0.3 7 in Ta 21 203 203 99a) 0.2 99a) 0.2 99a)	ae 728.88 Th1 (*C) ag Sep 0.48 able 9c) 21 , Th2 (*C) 12 20.32 5 0.43 to 7 in Tab 12 20.32	0ct 0.78 20.98 20.31 0.74 le 9c) 20.27	541.29           Nov           0.96           20.73           20.31           0.95	499.92 Dec 0.99 20.47 20.31 0.99 19.61		0.36	
7 Mean in Temperat Utilisation (80)m= 0.0 Mean inte (85)m= 20 Utilisation (89)m= 0.0 Mean inte (90)m= 19	DZ         663.8           ternal tenure during factor for in         Feb           p         0.95           mal temperature during         20.71           ure during         3           3         20.31           factor for is         0.94           mal temperature for         19.94	748.02 (perature heating p gains for 0.87 erature in 20.31 gains for 0.85 erature in 20.16	824.62         1           (neating is beriods in h living area         1           Apr         0.72           living area         20.67           beriods in i         20.31           rest of dwr         0.88           the rest of dwr         20.28	B03.84         B03.84           May         0.54           Constraint         B03.84           B03.84	836.74 g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32 2,m (se 0.34 0.34 ng T2 (f 20.32	, watts sor, i from Tal able 9a) Jul 0.27 eps 3 to 7 21 a from Ta 20.32 ee Table 0.23 follow ste 20.32	768.1 ble 9, Au 0.3 7 in T2 21 20.3 9a) 0.22 eps 3 20.3	ae 728.88 Th1 (*C) ag Sep 0.48 able 9c) 21 , Th2 (*C) 12 20.32 5 0.43 to 7 in Tab 12 20.32	0ct 0.78 20.96 20.31 0.74 le 9c) 20.27 t.A = Liv	541.29 Nov 0.96 20.73 20.31 0.95 19.08	499.92 Dec 0.99 20.47 20.31 0.99 19.61			
7 Mean in Temperat Utilisation (80)m= 0.0 Mean inte (85)m= 20 Utilisation (89)m= 0.0 Mean inte (90)m= 19	Image         design and second s	740.02 rperature heating p gains for 0.87 erature in 20.87 heating p 20.87 heating p 20.31 gains for 0.85 erature in 20.16	824,62         1           (neating is seriods in hiving area         Apr           0.72         1           fiving area         20.97           veriods in n         20.31           rest of dww         0.88           the rest of dww         20.28           or the whole         20.28	B03.84         B03.84           May         0.54           Constraint         B03.84           B03.84	836.74 g area (see Ta Jun 0.38 llow ste 21 dwelling 20.32 2,m (se 0.34 0.34 ng T2 (f 20.32	, watts sor, i from Tal able 9a) Jul 0.27 eps 3 to 7 21 a from Ta 20.32 ee Table 0.23 follow ste 20.32	768.1 ble 9, Au 0.3 7 in T2 21 20.3 9a) 0.22 eps 3 20.3	ce         728.88           Th1 (*C)         rg           sg         Sep           .         0.48           able 9c)         21           .         Th2 (*C)           .2         20.32           5         0.43           107 7 in Table           .2         20.32           -1LA) × T2	0ct 0.78 20.96 20.31 0.74 le 9c) 20.27 t.A = Liv	541.29 Nov 0.96 20.73 20.31 0.95 19.08	499.92 Dec 0.99 20.47 20.31 0.99 19.61			

(93)m=	19.83	20.07	20.27	20.38	20.41	20.42	20.42	20.42	20.41	20.37	20,1	19.77		(93)
		ting req		20,30	20.41	20,42	20.42	20,92	20.41	20.57	20,1	19,77		(00)
				moratu	re obtain	ind at et	en 11 of	Table Q	h so tha	t Tim-(	76\m an	d re-calcu	atel	
			or gains			icu ai su	op 11 of	Tuble 5	0, 30 uit	a 11,111-1	r o jini an	dire-carce	hate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilis	ation fac	tor for g	ains, hm	0	_			-						
94)m=	0.98	0.94	0.85	0.69	0.51	0.35	0.24	0.26	0.44	0.74	0.95	0.99		(94)
	_	-	W = (94		4)m					_				
(95)m=	524.68	614.33	635.79	566.01	437.33	290.02	190.35	199.95	315.81	473.06	512.57	493.29		(95)
		-	_	-	e from Ta				_		-			
=m(88)	-	4.9	6.5	8,9	11.7	14.6	16.6	16,4	14.1	10.6	7.1	4.2		(96)
	-				erature,						1000			
	795.19	775.1	702.27	579.77	438.83		190.35	199.96	316.2	492.37	657.78	791,08		(97)
	-	g require 108.04	ement fo	9.91	1.12	Wh/mon	h = 0.02	4 x [(97	)m – (95 0	5)m] x (4	-	221.55		
(98)m=	201.26	108.04	48.40	9.91	1.12	0	U		-		104.55		ala al	(98)
								Tota	e per year	(kWh/year	7 = Sum(9	= 0,44.0	710.24	
Spac	e heatin	g requin	ement in	kWh/m	/year								10.29	(99)
9a En	entry rec	uiremer	its – Indi	ividual h	eating s	vstems i	ncludino	micro-0	(HP)					
Spac Fract Fract Fract Efficient	e heatin ion of sp ion of sp ion of to ency of	ng: bace hea bace hea tal heati main spa	at from s at from m ng from ace heat	econdar nain syst main syste ing syste	stem 1 em 1	mentary	system	(202) = 1		(203)) =			0 ) ) 90.3	(201) (202) (204) (206)
Spac Fract Fract Fract Efficient	e heatin ion of sp ion of sp ion of to ency of	ng: bace hea bace hea tal heati main spa seconda	at from s at from m ng from ace heat	econdar nain syst main syste ing syste	y/supple tem(s) stem 1	mentary	system	(202) = 1	- (201) = 02) × [1 -				2	(202) (204)
Spac Fract Fract Fract Efficie Efficie	ion of sp ion of sp ion of to ency of Jan	ng: bace hea bace hea tal heati main spa seconda Feb	at from s at from m ng from ace heat ry/supple Mar	econdar nain syst main syste ing syste ementar Apr	y/supple tem(s) stem 1 eni 1 y heatin May	mentary g systen Jun	system	(202) = 1	-(201) =	(203)) = Oct	Nov	Dec	1 1 90.3	(202) (204) (206) (208)
Spac Fract Fract Fract Efficie Efficie	e heatin ion of sp ion of to ency of Jan e heatin	ng: pace hea pace hea tal heati main spo seconda Feb g requin	at from s at from m ng from ace heat ry/supple Mar ement (c	econdar nain syst main syste ing syste ementar Apr alculate	y/supple tem(s) stem 1 em 1 y heating May d above	mentary g system Jun	system 1, % Jul	(202) = 1 (204) = (2 Aug	- (201) = 02) × [1 - Sep	Oct			) 7 90.3 0	(202) (204) (206) (208)
Spac Fract Fract Efficie Spac	e heatin ion of sp ion of sp ion of to ency of ancy of Jan e heatin 201.26	ng: pace hea pace hea tal heati main spa seconda Feb g require 108.04	at from s at from m ng from ace heat ry/supple Mar ement (c 49,48	econdar nain syst ing syste ementar Apr alculate 9,91	y/supple tem(s) stem 1 en 1 y heating May d above	mentary g systen Jun	system	(202) = 1 (204) = (2	- (201) = 02) × [1 -		Nov 104,55	Dec	) 7 90.3 0	(202) (204) (208) (208) ear
Spac Fract Fract Efficie Spac	e heatin ion of sp ion of sp ion of to ency of Jan e heatin 201.28 n = {{(98	ng: pace hea pace hea tal heati main spa seconda Feb g requin 108.04 )m x (20	at from s at from m ng from ace heat ry/supple Mar ement (c 49,48	econdar nain syst main syst ementar Apr alculate 9,91 00 + (20	y/supple tem(s) stem 1 y heating d above 1.12 06)	mentary g system Jun 0	system 1, % Jul 0	(202) = 1 (204) = (2 Aug	- (201) = 02) × [1 - Sep 0	Oct 14.37	104.55	221.55	) 7 90.3 0	(202) (204) (206) (208)
Spac Fract Fract Efficie Spac	e heatin ion of sp ion of sp ion of to ency of ancy of Jan e heatin 201.26	ng: pace hea pace hea tal heati main spa seconda Feb g require 108.04	at from s at from m ng from ace heat ry/supple Mar ement (c 49,48	econdar nain syst ing syste ementar Apr alculate 9,91	y/supple tem(s) stem 1 en 1 y heating May d above	mentary g system Jun	system 1, % Jul	(202) = 1 (204) = (2 Aug 0	-(201) = 02) × [1 - Sep 0	Oct 14.37 15.91	104.55		7 90.3 0 KWh/ye	(202) (204) (206) (208) (208) ear
Spac Fract Fract Efficie Spac (211)n	e heatin ion of sp ion of to ency of to ency of to Jan e heatin 201.26 n = {[(98 222.88	ng: pace hea pace hea tal heati main spo seconda Feb g requin 108.04 119.84	at from s at from n ng from ace heat ry/supple Mar ement (c 49,48 (4)] } x 1 54.77	econdar main syst main syst ang syste ementar Apr alculate 9,91 00 ÷ (20 10.97	y/supple tem(s) stem 1 em 1 y heating May d above 1.12 06) 1.24	mentary g system Jun 0	system 1, % Jul 0	(202) = 1 (204) = (2 Aug 0	-(201) = 02) × [1 - Sep 0	Oct 14.37	104.55	221.55	1 7 90.3 0	(202) (204) (208) (208) ear
Spac Fract Fract Efficie Spac (211)n Spac	e heatin ion of sp ion of to ency of to ency of f Jan e heatin 201.26 n = {[(98 222.88 e heatin	ng: bace heat bace heat tal heat main sous seconda Feb g require 108.04 108.04 119.84 g fuel (s	th from s at from m ng from ace heat ry/supple Mar 49,48 4)] } x 1 54.77 econdar	econdar main syst ing syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/	y/supple tem(s) stem 1 em 1 y heating May d above 1.12 06) 1.24	mentary g system Jun 0	system 1, % Jul 0	(202) = 1 (204) = (2 Aug 0	-(201) = 02) × [1 - Sep 0	Oct 14.37 15.91	104.55	221.55	7 90.3 0 KWh/ye	(202) (204) (206) (208) (208) ear
Space Fract Fract Efficie Space (211)n Space = {[(98	e heatin ion of sp ion of to ency of a 201.26 n = {((98 222.88 e heatin )m x (20	ng: bace heat bace heat tal heat main so seconda Feb g require 108.04 108.04 (119.84 g fuel (s 01)] } x 1	th from s at from m ng from ace heat ry/supple Mar ement (c 49.48 49.] } x 1 54.77 econdar 00 + (20	econdar main syst ing syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/ 8)	y/supple tem(s) stem 1 en 1 y heating May d above 1.12 06) 1.24	g system	system 1, % JUI 0	(202) = 1 (204) = (2 Aug 0 Tots	- (201) = 02) × [1 - Sep 0 1 (kWhye	Oct 14.37 15.91 ar) =Sum()	104.55 115.78 211), 4	221.55 245.35	7 90.3 0 KWh/ye	(202) (204) (206) (208) (208) ear
Spac Fract Fract Efficie Spac (211)n Spac	e heatin ion of sp ion of to ency of a 201.26 n = {((98 222.88 e heatin )m x (20	ng: bace heat bace heat tal heat main sous seconda Feb g require 108.04 108.04 119.84 g fuel (s	th from s at from m ng from ace heat ny/supple Mar 49,48 4)] } x 1 54.77 econdar	econdar main syst ing syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/	y/supple tem(s) stem 1 em 1 y heating May d above 1.12 06) 1.24	mentary g system Jun 0	system 1, % Jul 0	(202) = 1 (204) = (2 Aug 0 Tota 0	- (201) = 02) × [1 - Sep 0 1 (kWhye 0	Oct 14:37 15:91 ar) =Sum()	104.55 115.78 211),	221.55	3 80.3 0 KWhYy 780.54	(202) (204) (208) (208) ear (211)
Space Fract Fract Efficie Space (211)n Space = ([(98	e heatin ion of sp ion of sp ion of to ency of Jan e heatin 201.26 h = {{(98 222.88 e heatin )m x (20 0	ng: pace heat pace heat tal heat main spa seconda Feb g requin 108.04 119.04 (20 119.04 g fuel (s 01)] } x 1 0	th from s at from m ng from ace heat ry/supple Mar ement (c 49.48 49.] } x 1 54.77 econdar 00 + (20	econdar main syst ing syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/ 8)	y/supple tem(s) stem 1 en 1 y heating May d above 1.12 06) 1.24	g system	system 1, % JUI 0	(202) = 1 (204) = (2 Aug 0 Tota 0	- (201) = 02) × [1 - Sep 0 1 (kWhye 0	Oct 14.37 15.91 ar) =Sum()	104.55 115.78 211),	221.55 245.35	7 90.3 0 KWh/ye	(202) (204) (206) (208) (208) ear
Space Fract Fract Efficie Space (211)n Space = ([(98 (215)m) Water	e heatin ion of sp ion of to ency of Jan e heatin 201.20 h = {[[(98 222.88 e heatin )m x (20 0 heatin	ng: pace heat bace heat tal heat main spo seconda Feb g requine 108.04 119.04 119.04 g fuel (s 01)] } x 1 0	th from s at from m ng from ace heat ry/supple Mar ement (c 49.48 49.] } x 1 54.77 econdar 00 + (20	econdar main syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/ 8) 0	y/supple tem(s) stem 1 em 1 y heatin May d above 1.12 06) 1.24 (month 0	g system	system 1, % JUI 0	(202) = 1 (204) = (2 Aug 0 Tota 0	- (201) = 02) × [1 - Sep 0 1 (kWh/ye 0	Oct 14:37 15:91 ar) =Sum(2	104.55 115.78 211),	221.55 245.35	3 80.3 0 KWhYy 780.54	(202) (204) (208) (208) ear (211)
Space Fract Fract Efficie Space (211)n Space = ([(98 (215)m) Water	e heatin ion of sp ion of to ency of Jan e heatin 201.20 h = {[[(98 222.88 e heatin )m x (20 0 heatin	ng: pace heat pace heat tal heat main spo seconda Feb g requine 108.04 ()m x (20 119.84 g fuel (s 01)] } x 1 0 g g fuel (s 01)] } x 1	t from so at from m rg from ace heat ry/suppl Mar ement (c 49.48 (4)] } x 1 54.77 econdar 00 + (20 0	econdar main syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/ 8) 0	y/supple tem(s) stem 1 em 1 y heatin May d above 1.12 06) 1.24 (month 0	g system	system 1, % JUI 0	(202) = 1 (204) = (2 Aug 0 Tota 0	- (201) = 02) × [1 - Sep 0 1 (kWh/ye 0	Oct 14:37 15:91 ar) =Sum(2	104.55 115.78 211),	221.55 245.35	3 80.3 0 KWhYy 780.54	(202) (204) (208) (208) ear (211)
Spac Fract Fract Effici Spac (211)n Spac = ([(98 215)m) Water Dutpu	e heating ion of sp ion of sp ion of sp ion of to ency of 201 20 e heating )m x (20 0 heating) t from w 202.28	ng: pace heat pace heat tal heat main spo seconda Feb g requine 108.04 ()m x (20 119.84 g fuel (s 01)] } x 1 0 g g fuel (s 01)] } x 1	tt from s at from n ng from ace heat ny/supple Mar ement (c 49,48 (4)] } x 1 54.77 econdar 00 + (20 0 102.35	econdar nain syst ing syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/ 8) 0	y/supple tem(s) stem 1 en 1 y heatin d above 1.12 06) 1.24 (month 0 bove)	g system	o Jul o o	(202) = 1 (204) = (2 Aug 0 Tota 0 Tota	- (201) = 02) × [1 - 0 0 (kWhye 0 (kWhye	0ct 14.37 15.91 ar) =Sum() 0 ar) =Sum()	104.55 115.78 211), 44 1 0 215), 44 1	221.55 245.35 0	3 80.3 0 KWhYy 780.54	(202) (204) (208) (208) ear (211)
Spac Fract Fract Effici Spac (211)n Spac (198 (215)m Water Dutpu	e heating ion of sp ion of sp ion of sp ion of to ency of 201 20 e heating )m x (20 0 heating) t from w 202.28	ng: bace heat bace heat tal heat main spa seconda Feb g require 108.04 ()m x (20 119.84 g fuel (s 01)] } x 1 0 g fuel (s 01)] } x 1 0 g fuel (s 01)] } x 1	tt from s at from n ng from ace heat ny/supple Mar ement (c 49,48 (4)] } x 1 54.77 econdar 00 + (20 0 102.35	econdar nain syst ing syste ementar Apr alculate 9.91 00 ÷ (20 10.97 y), kWh/ 8) 0	y/supple tem(s) stem 1 en 1 y heatin d above 1.12 06) 1.24 (month 0 bove)	g system	o Jul o o	(202) = 1 (204) = (2 Aug 0 Tota 0 Tota	- (201) = 02) × [1 - 0 0 (kWhye 0 (kWhye	0ct 14.37 15.91 ar) =Sum() 0 ar) =Sum()	104.55 115.78 211), 44 1 0 215), 44 1	221.55 245.35 0	3 90.3 0 WWhyt 760.64	(202) (204) (204) (208) (208) (208) (208) (211) (211) (211)
Spac Fract Fract Efficie Spac (211)n Spac = ([(98 Vater Outpu Efficie (217)m	e heating ion of sy ion of sy ion of sy ion of to ency of ancy of 201.28 an = {((98 222.88 a heatin) $m \times (22$ 0 heating 200.29 ncy of w 200.29 heating 20 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 200.29 heating 20 heat	ng: pace hest pace hest pa	tt from s it from m ng from m ace heat ry/supple Mar ement (c 49,48 49)] } x 1 54.77 econdar 00 + (20 0 ter (calc 182.35 tter	econdarnan systemain systemain systemain systemain systematra Apr 4, 2000 (2000) (2000	y/supple tem(s) stem 1 en 1 y heatin May d above 1.12 06) 1.24 (month 0 155.59	umentary	system 96 JUI 0 0 132.13	(282) = 1 (204) = (2 (204) = (2)) = (2 (204) = (2)) = (	- (201) = 12) × [1 - 0 0 1 (W/hyte 148.62	0ct 14.37 15.91 ar) =Sum() 0 ar) =Sum() 189.58	104.55 115.78 211), 4	221.55 245.35 7 0 195.57	3 90.3 0 WWhyt 760.64	(202) (204) (206) (208) (208) (208) (211) (211) (211) (215)
Space Fract Fract Efficie Space (211)m Space (198 (215)m Water Outpu Efficie (217)m Fuel fo	the heating of seven the seven the seven terms of seven terms of seven terms of the seven terms of the seven terms of the seven terms of the seven terms of	ng: pace hesis pace hesis tal heati tal heati main spis- seconda Feb g require 108.04 119.04	tt from s tt from r ng from marce heat marce heat	econdarian systemain systemain systemain systemain systematar Apr alculate 9.91 10.97 10.9	y/suppletem(s) stem 1 y heatinn May d above 1.124 month 0 bove) 156.59 81.06	un         0           0         0           137.01         81	system 10, % JUI 0 0 132.13 81	(202) = 1 (204) = (2 (204) = (2 0 0 Tots 147.3 81	= (201) = (201) × (1 - Sep) 0 0 0 0 0 0 0 0 0 148.02 81	Oct 14.37 15.91 ar) =Sum() ar) =Sum() 169.58 81.68	104.55 115.78 211), 14, 15 0 215), 14, 17 181.02 84,17	221.55 245.35 0 195.57 85,09	3 90.3 0 WWhyt 760.64	(202) (204) (206) (208) (208) (208) (211) (211) (211) (215)
Space Fract Fract Efficie Space (211)m Space (198 (215)m Water Outpu Efficie (217)m Fuel fo	e heating ion of sp ion of	ng:           pace hes           pace hes           tai heati           main spose           secondoa           Feb           g requirn           108.04           gfuel (s           01)] > x1           0           ater heaa           175.20           ater header head           94.31           heating,	tt from s tt from r ng from mace heat ry/suppli Mar ement (c 49.49 43) } x 1 54.77 econdar 00 + (20 0 182.35 ter (calcc ter econdar 00 + (20 0 182.35 ter econdar 82.82 kWh/m	econdari nain syst main syst ementar 9,01 00 + (2020 10,97 1	y/supple tem(s) stem 1 en 1 y heatin May d above 1.12 06) 1.24 (month 0 155.59	umentary	system 96 JUI 0 0 132.13	(202) = 1 (204) = (2 (204) = (2)) = (2 (204) = (2)) =	- (201) = 202) × [1 - Sep 0 0 1 (Whyse 148.92 81 183.88	Oct 14.37 15.91 ar) =Sum() 0 ar) =Sum() 169.58 81.66 207.67	104.55 115.78 211), 4	221.55 245.35 7 0 195.57	3 5 60.3 0 WWhyte 788.54 0	(202) (204) (206) (208) (208) (211) (211) (211) (215) (216) (217)
Space Fract Fract Fract Effici Space 211)n Space 211)n Space 210,000 Space 210,000 Space 211,000 Space 21,000 Space 211,000 Spac	e heatin ion of sy ion of sy ion of to ency of join of to ency of join of to ancy of join of to ancy of join of to ancy of anc	10: sace hese tal heati main spice secondas Feb 108.04 (108.04 119.64 (108.04 (119.64 (119.	tt from s tt from r ng from marce heat marce heat	econdarian systemain systemain systemain systemain systematar Apr alculate 9.91 10.97 10.9	y/suppletem(s) stem 1 y heatinn May d above 1.124 month 0 bove) 156.59 81.06	un         0           0         0           137.01         81	system 10, % JUI 0 0 132.13 81	(202) = 1 (204) = (2 (204) = (2)) = (2 (204) = (2)) =	= (201) = (201) × (1 - Sep) 0 0 0 0 0 0 0 0 0 148.02 81	Oct           14.37           15.91           15.91           15.91           15.91           160.58           81.66           207.67           199.3, a	104.55 115.78 211), 14.0 0 215), 14.0 181.02 84.17 215.06	221.55 245.35 7 195.57 86.00 228.24	7 60.3 0 0 768.54 0 81	(202) (204) (206) (208) (208) (211) (211) (211) (215) (216) (217)
Space Fract Fract Fract Efficie Space (198 211)m Space (198 215)m Water Outpu Efficie (219)m Fuel fc (219)m	e heating ion of system o	10: pace hese tal healt main spu- seconda Feb g requin- 108.04 119.84	tt from s tt from r ng from marce heat marce heat	econdair main syst main syst main syst main syst main syst main syst and syst approximation (00 + (2(2)) 10.97 10.	y/supple tem(s) stem 1 mon 1 m	un         0           0         0           137.01         81	system 10, % JUI 0 0 132.13 81	(202) = 1 (204) = (2 (204) = (2)) = (2 (204) = (2)) =	- (201) = 202) × [1 - Sep 0 0 1 (Whyse 148.92 81 183.88	Oct           14.37           15.91           15.91           15.91           15.91           160.58           81.66           207.67           199.3, a	104.55 115.78 211), 14, 15 0 215), 14, 17 181.02 84,17	221.55 245.35 7 195.57 86.00 228.24	3 5 60.3 0 WWhyte 788.54 0	(202) (204) (206) (208) (208) (211) (211) (211) (215) (216) (217)



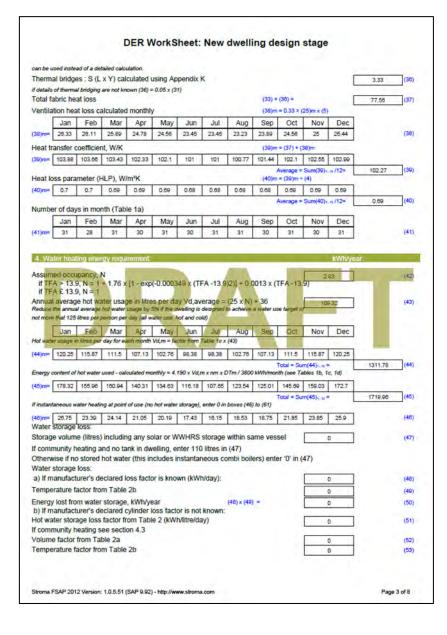
	ating fuel used			Γ	2404.29
Electricity	for pumps, fans and electric keep-l	hot			
mechanie	cal ventilation - balanced, extract o	r positive input from outside	e [	294.16	(230)
central h	eating pump:		[	120	(230)
fotal elect	tricity for the above, kWh/year	sum	of (230a)(230g) =	[	414.16 (231)
Electricity	for lighting			[	306.94 (232)
	rered energy for all uses (211)(22			[	3911.92 (338)
12a. CO	2 emissions – Individual healing sy	slems including micro-CHP	a,		
		Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/year
Space hea	ating (main system 1)	(211) x	0.216	• [	169.89 (261)
Space hea	ating (secondary)	(215) x	0,519	• [	0 (263)
Vater hea	iting	(210) x	0.216	• [	519.33 (264)
Space and	d water heating	(261) + (262) + (263) + (	(264) =	[	689.22 (265)
Electricity	for pumps, fans and electric keep-	hot (231) x	0.519	· 1	214.95 (207)
Electricity	for lighting	(232) ×	0.519	-	150 3 (268)
fotal CO2	, kg/year		sum of (265)(271) =	[	1063 47 (272)
Owelling	CO2 Emission Rate		(272) + (4) =	[	15.41 (273)

DER Wo	orkSheet: N	ew dwelling	design	stage		
		User Details:				
Assessor Name: Software Name: Stroma FS			na Num vare Ve	rsion:		on: 1.0.5.51
Address : 52 Tottenha		DON, WIT 4RN	and the second hit	Toposed Tr		
1. Overall dwelling dimensions:						
		Area(m²)		Av. Heigh		Volume(n
Ground floor		53	(1a) ×	2.6	(2a) =	137.8
First floor		42	(1b) x	2.6	(2b) =	109.2
Second floor		34	(1c) ×	2.6	(20) =	88.4
Third floor		20	(1d) ×	2.6	(2d) =	52
Total floor area TFA = (1a)+(1b)+(1c)+(	1d)+(1e)+(1	n) 149	(4)			
Dwelling volume			(3a)+(3	o)+(3c)+(3d)+(3	3e)+(3n) =	387.4
2. Ventilation rate	Training and	-			-	
main heating	seconda heating			total		m' per ho
Number of chimneys 0	+ 0	+ 0	- [	D	×40 =	0
Number of open flues 0	+ 0	* 0	] • [	Q	x 20. #	0
Number of intermittent fans			Ĩ	0	x 10 =	0
Number of passive vents			i 🗸	0	a 10 -	0
Number of flueless gas fires			i /	D	× 40 =	0
		15-			Aircl	hanges per h
Infiltration due to chimneys, flues and fa	ans = (6a)+(6b)+	(7a)+(7b)+(7c) =		0	7 + (5) =	0
If a pressurisation test has been carried out or			e continue f		- (5) =	0
Number of storeys in the dwelling (ns	)					0
Additional infiltration					[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or if both types of wall are present, use the val				ruction		0
deducting areas of openings); if equal user		to the greater was a	rea (aner			
If suspended wooden floor, enter 0.2	6 / · · · · · · · · · · · · · · · · · ·	0.1 (sealed), els	e enter 0			0
If no draught lobby, enter 0.05, else e Percentage of windows and doors dra						0
Window infiltration	and it suithed	0.25 - (0	.2 x (14) +	100] =		0
Infiltration rate				12) + (13) + (1	5) =	0
Air permeability value, q50, expresse	d in cubic metr					1.5
If based on air permeability value, then						0.08
Air permeability value applies if a pressurisatio Number of sides sheltered	n test has been do	one or a degree air p	ermeability	is being used		
Shelter factor		(20) = 1	- [0.075 x (	19)] =		1
Infiltration rate incorporating shelter fact	tor		18) x (20) =			0.02
Infiltration rate modified for monthly win						

22)m= 5.1	age wind sp	beed fro	om Tabl	e 7									
with the second	5	4.9	4.4	4.3	3,8	3.8	3.7	4	4.3	4.5	4,7		
Vind Factor (	22a)m = (2	2)m + -	4										
22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0,95	0.92	1	1,08	1,12	1.18		
djusted infilt	ration rate	allowin	no for sh	elter an	d wind s	need) =	(21a) x /	22a)m					
0.09	0.09	0.08	0,08	0.07	0.07	0.07	0.08	0.07	0,07	0.08	0.08		
alculate effe			ate for t	he appli	cable cat	se			2		F		Time
If exhaust air I			ndix N. (2	3b) = (23)	a) × Fmv (e	guation (	N5)), other	wise (23b	) = (23a)		F	0.5	(23a) (23b)
If balanced with											F	76.5	(23c)
a) If balanc	ed mechan	ical ve	ntilation	with he	at recove		HR) (24a	)m = (22	2b)m + ()	23b) × [1	- (23c) -	10/10/1	
4a)m= 0.21	0.2	0.2	0.19	0,19	0.18	0.18	0,18	0.19	0.19	0,2	0.2		(24a)
b) If balanc	ed mechan	ical ve	ntilation	without	heat rec	overy (I	MV) (24b	)m = (22	2b)m + (2	23b)			
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole I	house extra	ict ven	tilation o	or positiv	e input v	entilatio	on from o	utside	-	-	_		
if (22b)	m < 0.5 × (	23b), tł	hen (240	:) = (231	); otherw	vise (24	c) = (22b	) m + 0.	5 × (23b	)			-
4c)mt G	0	0	0	0	0	0	, Ó	0	0	0	D	-	(240)
d) II natural													
-	m = 1, then	0	n = (22)	o)m othe	o l	4d)m =	0.5+1(2	0 m- x	0.5]	0	0		(24d)
			-	-			-		v	v			(240)
Effective ai	r change ra	0.2	0.19	0.19	0,18	0 18	0,18	0.19	0.19	0.2	0.2		(25)
10.21	1	0.2	0.10	U.Te	0.10	0.10	0.10	0.19	0.10	0.2	0.2		(=0)
<ol> <li>Heat loss</li> </ol>	es and hea	loss p	aramete	ir:	1								
LEMENT	Gross area (n		Openin		Net Are		U-valu W/m2		AXU (W/)	0	k-value kJ/m²-K	A kJ	X k /K
Indexe Tur		.,			13.28	_	/[1/( 1.4 )+		17.58	7	1.0111. 13		(27)
Indows Typ					13.28	_	/[1/( 1.4 )+		17.58	=			(27)
					13.26		(1/( 1.4 )+		17.58	=			(27)
/indows Typ	e 3				13.26	_	(1/( 1.4 )+		17.58	4			(27)
vindows Typ vindows Typ					19.20				11,00			-	(29)
Vindows Typ Vindows Typ Vindows Typ Vindows Typ Valls Type1	ie 4	-	12.26		0				0		_		
Vindows Typ Vindows Typ Vindows Typ Valls Type1	13.26	Ę	13.26	_	0	-*	0.18	]•[	0				-
/indows Typ /indows Typ /indows Typ /alls Type1 /alls Type2	13.26		13.26	3	0	×	0.18	_	0				(29)
/indows Typ /indows Typ /indows Typ /alls Type1 /alls Type2 /alls Type3	13.26 13.26 13.26		13.26	3	0	x	0.18	]•[	0				(29) (29)
vindows Typ vindows Typ vindows Typ valls Type1 valls Type2 valls Type3 valls Type4	e 4 13.26 13.26 13.26 13.26		13.26 13.26 13.26	3	0	×	0.18 0.18 0.18 0.18	]•[	0 0 0				(29) (29) (29)
Vindows Typ Vindows Typ Vindows Typ Valls Type1 Valls Type2 Valls Type3 Valls Type4 oof	e 4 13.26 13.26 13.26 13.26 30		13.26	3	0	x	0.18	]•[	0				(29) (29) (29) (30)
Vindows Typ Vindows Typ Vindows Typ Valls Type1 Valls Type2 Valls Type3 Valls Type4 oof otal area of	e 4 13.26 13.26 13.26 13.26 13.26 30 elements, r		13.20 13.20 13.20	3	0 0 0 30 83.04	- × - × - ×	0.18 0.18 0.18 0.18 0.18 0.13		0 0 0 3,9				(29) (29) (29)
indows Typ indows Typ indows Typ alls Type1 alls Type2 falls Type3 falls Type4 oof otal area of or windows an	e 4 13.26 13.26 13.26 13.26 13.26 30 elements, r d roof window	s, use et	13.20 13.20 13.20 0	3 3 3 ndow U-va	0 0 0 30 83.04 alue calcula	- × - × - ×	0.18 0.18 0.18 0.18 0.18 0.13		0 0 0 3,9	s given in	paragraph 3		(29) (29) (29) (30)
indows Typ indows Typ indows Typ alls Type1 alls Type2 alls Type3 alls Type4 oof otal area of or windows an include the and	e 4 13.26 13.26 13.26 13.26 30 elements, r d roof window was on both size	s, use ef dea of int	13.26 13.26 13.26 0 ffective with ternal wall	3 3 3 ndow U-va	0 0 0 30 83.04 alue calcula	- × - × - ×	0.18 0.18 0.18 0.18 0.18 0.13	=     =     =     =     =	0 0 0 3,9	= [ = [ = [ = [ = ]	paragraph 3	74.22	(29) (29) (29) (30)
/indows Typ /indows Typ /indows Typ /alls Type1	e 4 13.26 13.26 13.26 13.26 30 elements, r d roof window was on both siz sss, W/K = 3	s, use ef des of int S (A x I	13.26 13.26 13.26 0 ffective with ternal wall	3 3 3 ndow U-va	0 0 0 30 83.04 alue calcula	- × - × - ×	0.18 0.18 0.18 0.18 0.18 0.13	= [   + (32) =	0 0 0 3,9		Ē		(29) (29) (29) (30) (31)
indows Typ indows Typ indows Typ ialls Type1 ialls Type2 ialls Type3 ialls Type4 oof otal area of otal area of otal area of otations an indude the and abric heat lo	e 4 13.26 13.26 13.26 13.26 13.26 30 elements, r d roof window was on both sis ss, W/K = 3 r Cm = S(A	s, use ef des of int S (A x I x k )	13.20 13.20 13.20 0 ffective with ternal wall U)	3 5 ndow U-va Is and part	0 0 30 83.04 alue calcula titions	- × - × - ×	0.18 0.18 0.18 0.18 0.18 0.13	((1/U-value) + (32) =	0 0 3,9 we)+0.04] a	!) + (32a).	Ē	74.22	(29) (29) (29) (30) (31) (33)

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			er storage	e, kWh/y	ear			(47) × (51	) × (52) × (	53) =		0	(	(54)
	(50) or		(55) alculated									0	(	55)
vvater	storage		iculated	for each	month	0	0	((00)m = (	55) × (41)	m 0	0	0	1	56)
		-		-					-		-	om Append		
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		57)
	L circuit	loce in	innual) fr	om Tabl	.2			-	-	-	-	0		58)
			alculated			59)m =	(58) + 36	55 × (41)	m		-	-		-
(mo	dified by	/ factor	from Tab	le H5 if	there is a	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	D	0	0	0	0	0	0	0	0	0	0	0		59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41	)m						
(61)m=	50.96	46.03	50.96	49.32	50.96	48.52	50.14	50,96	49,32	50.96	49.32	50.96	(	61)
Total I	neat req	uired fo	r water h	eating c	alculated	for eac	h month	(62)m =	0.85 × (	45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	229.28	201.99	211.9	189.63	185.59	164.69	157.79	174.49	174.33	198.65	208.34	223.65	(	62)
			d using App							r contribut	ion to wat	er heating)		
		-	FGHRS						-	_				
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(	(63)
	from w	-	-		I second	-	-	-				1	1	
(64)m=	229.28	201.99	211.9	189.83	185.59	164.69	157.79	174.49	174.33	196,65	208.34		-	64)
					-			1. 1.	out from w	1.00				04)
100	-	m wate 63.36	r heating	KWh/m	1	5 (0.85	× (45)π 48.33	-	-		+ (57)1	+ (59)m		651
(65)m=	72.03			1.000	57.5		and the second second	53.82	53.89	01.18		1.00		00)
	ide (57)	m in ca	Table	and the second second		yinderi	s in the	awelling	or not w	ateristi	om con	nmunity h	leating	
5.	in the late	THE ST		the second s	ι)¢	-	-			-				
Metab	olic gair Jan	Feb	e 5), Wa Mar	Apr	May	Jun	dul	Aug	Sep	Oct	Nov	Dec		
(66)m=	148.63	146.63		146.63	148.63	146.63	146.63	146.63	146.63	146.63	146.63	146.63		(66)
· · · · ·		- Celler	ated in A		113134		1.111.0			140.00	110,000			5
(67)m=		25.29	20.57	15.57	11.64	9.83	10.62	13.8	18.53	23.52	27.48	29.27		67)
			culated in											
	319.43			296.61	274.16	1.1.1.1	238.97	235.66	244.01	261.79	284.24	305.34		(68)
1.00		-	lated in A	opendix	Legua	tion L 15	or L15a	) also se	e Table	5				
(09)m=	37.66	37.66	37.66	37.66	37.66	37.68	37.68	37.66	37.66	37.66	37.66	37.66		(9)
Pump	s and fa	ns gain	s (Table	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(	70)
Losse	se.g. e	aporat	ion (nega	tive valu	ies) (Tab	le 5)								
(71)m=	-117.3	-117.3	-	-117.3	-117.3	-117.3	-117.3	-117.3	-117.3	-117.3	-117.3	-117.3		71)
Water	heating	gains (	Table 5)	-	1									
(72)m=	96.82	94.29	89.05	81.92	77.29	70.5	64.96	72.33	74.85	82.23	90.56	94.3	(	72)
Total	internal	gains				(66	)m + (67)n	n + (68)m -	+ (69)m + (	(70)m + (7	1)m + (72	?)m		
	521.72	519.32	501	471.09	440.09	410.38	391.54	398.78	414.38	444.54	479.25	505.9	(	73)
			1				-	-				1.00		Ċ.
(73)m=	lar gain													



#### DER WorkSheet: New dwelling design stage Orientation: Access Factor Flux FF Gains Area 9\_ Table 6b Table 6c Table 6d m². Table 6a (W) Southeast 0.9x 13.26 36.79 0.78 0.8 80.09 (77) 0.3 Southeast 0.9x 0.3 13.26 36.79 0.76 8.0 80.09 (77) Southeast 0.9x (77) 0.54 13.26 36.79 0.72 0.8 138.58 Southeast 0.9x 0.77 13,26 38,79 0.72 0.8 194,75 (77) Southeast 0.9x 0.3 62.67 0.76 (77) 13.26 0.8 136.43 Southeast 0.9x 0.3 13.26 62.67 0.76 0.8 138.43 (77) Southeast 0.9x 0.54 13.26 82.87 0.72 0.8 (TT) 232.64 Southeast 0.9x 0.77 13.26 62.67 0.72 0.8 331.73 (77) Southeast 0.9x (77) 03 85.75 0.76 0.8 188.66 13.26 Southeast 0.9x 0.3 13.26 85.75 0.76 0.8 186.68 (77) Southeast 0.9x 0.54 13.26 85.75 0.72 0.8 318.31 (77) Southeast 0.9x 0.77 13.26 85,75 0.72 0.8 453.89 (77) Southeast 0.9x (TT) 0.3 13.26 108.25 0.76 0.8 231,28 Southeast 0.9x 0.3 13.26 106.25 0.76 0.8 231.28 (77) Southeast 0.9x 0.54 13.26 108.25 0.72 0.8 394.4 (77) Southeastore 0.77 13.26 106.25 0.72 0.8 562.39 Southeast 0.9x 0.8 13.26 119.01 0.78 0.8 259.05 Southeast 0.9x 0.3 259.08 13.26 119.01 0.76 0.8 (77) Southeast 0.9x 0.54 13.26 119.01 8.0 441.78 (77) 0.72 Southeast 0.9x 0.77 13.28 119.01 0.72 0.8 829.92 (77) Southeast 0.9x 0.3 257.18 (77) 118.15 0.78 13.28 0.8 Southeast 0.9+ 0.3 13.26 118.15 0.78 0.8 257.18 (77) Southeast 0.9x (77) 0.54 13.26 118.15 0.72 0.8 438.57 Southeast 0.9x 0.77 13.28 118.15 0.72 0.8 825.38 (77) Southeast 0.9x (77) 0.3 13.26 113.91 0.76 8.0 247.95 Southeast 0.9x 0.3 13.26 113.91 0.76 8.0 247.95 (77) Southeast 0.9x 0775 0.54 13.26 113.91 0.72 0.8 422.83 Southeast 0.9x 0.77 13.26 113.91 0.72 0.8 602.92 (77) Southeast 0.9x (77) 0.3 13.26 104.39 0.78 0.8 227.23 Southeast 0.9x 0.3 13.26 104.39 0.78 8.0 227.23 (77) Southeast 0.9x 0.54 13.26 104.39 0.72 387.49 0.8 Southeast 0.9x 0.77 13.26 104.39 0.72 0.8 552.54 (77) Southeast 0.9x (77) 03 13.26 92.85 0.76 0.8 202.12 Southeast 0.9x 0.3 13.26 92,85 0.76 0.8 202.12 (77) Southeast 0.9x 1775 0.54 13.26 92.85 0.72 0.8 344.66 Southeast 0.9x 0.77 13.26 0.72 0.8 (77) 92.85 491.46 Southeast 0.9x 0.3 13.26 69.27 0.76 0.8 150.78 ന Southeast 0.9x 0.3 13.26 69.27 0.78 0.8 150.78 (77) Southeast 0.9x (77) 0.54 13.26 89.27 0.72 0.8 257.12 Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com Page 5 of 8

Southe	asto.9x	0.77		-		x	-		1 • [		-	× F		_			107
	ast 0.9x	0.77	- :	_	26	x	-	9.27		0.72		F	8.0	-		366.63	
	ast 0.9x	0.3	<b>-</b>	_	26	×	_	4.07		0.76		F	0.8	=	-	95.93	
	astos	0.54	=	_	26	ĵ.	_	4.07		0.76	_	F	0.8	-		163.59	- ("
	ast 0.9x	0.77	=:	_	26	2		4.07	ן <u>ר</u> ו	0.72	_	F	0.8	=		233.26	
	ast 0.9x	0.77	-1		26	2		1.49	i î i	0.72	-	Ì	0.8	-		68.54	
	asto.ex	0.3	=		26	*	-	1.49		0.76	_	F	0.8	=		68.54	
	ast o.ex	0.54	- ×	-	26	×		1.49	i x i	0.72		È	0.8	=		116.88	-0
Southe	ast 0.9x	0.77	*	13	26	×	3	1.49	j • [	0.72		× E	0.8		•	106.66	0
Solar	nains in	watts ca	alculated	for eac	h month				(83)m	= Sum(74)n	n. (82	-					
(83)m=			1145.52		1	-	578.3	1521.65		49 1240.3	-	-	588.71	420.6	3		(83
Total	gains - i	nternal a	nd solar	(84)m	= (73)m	+ (8	33)m ,	watts							_		
(84)m=	1013.23	1356.54	1646.52	1890.45	2029.88	19	88.68	1913.19	1793	28 1654.7	4 136	9.85	1067.96	926.5	53		(84
7. M	ean inter	nal temp	erature	(heating	season	1											
							area f	rom Tal	ble 9,	Th1 (°C)	-					21	(88
Utilis	ation fac	tor for g	ains for I	iving an	ea, h1,n	1 (S	ee Tal	ble 9a)							-		_
1	Jan	Feb	Mar	Apr	May		Jun	Jul	At	g Sep	G	)ct	Nov	De	C		-
(86)m=	0.99	0.95	0.84	0.65	0.47	0	1.32	0.23	0.2	0.42	0	75	0.97		1	-	(86
Mean	n interna	temper	ature in	living an	ea T1 (f	ollo	w step	os 3 to 7	7 in T	able 9c)	1						
(87)m=	20.5	20,74	20.92	20.99	21		21	21	21	21	20	97	20.73	20.4	4		(87
Tem	perature	during h	eating p	enods i	n rest of	dw	elling	from Ta	able 9	Th2 ("C	)	1.1					
(88)m=	20.34	20.34	20.35	20.35	20.35	2	0.36	20.38	20.3	0 20.30	20	35	20.35	20.3	5		(98
Utilis	ation fac	tor for a	ains for	rest of d	welling.	h2.	m (se	e Table	9a)								
=m(98)		0.94	0.81	0.61	0.43	-	0.29	0.2	0.2	2 0.38	0.	71	0.96	1			(80
Mear	interna	temper	ature in	the rest	of dwell	ina	T2 (fo	llow ste	eps 3	to 7 in Ta	ble 9d	:)		-			
=m(09)	19.68	20.02	20.25	20.34	20.35	-	0.36	20.36	20.3	-	-	.33	20.02	19.6	5		(90
		_	-	-					-		fLA =	Livin	g area ÷ (4	) =		0.2	(9)
Mear	n interna	temper	ature (fo	r the wh	iole dwe	lline	a) = fL	A × T1	+ (1-	-fLA) × T	2				_		_
(92)m=		20.17	20.39	20.47	20.48	-	0.49	20.49	20.4		-	48	20.16	19.7	7		(93
Appl	y adjustr	nent to t	he mean	interna	I temper	atu	re from	n Table	4e, 1	where app	ropria	te		-			
(93)m=	19.69	20.02	20.24	20.32	20.33	2	0.34	20.34	20.3	4 20.34	20	31	20.01	19.6	2		(90
8. Sp	ace hea	ting requ	uirement														
						ned	at ste	p 11 of	Table	9b, so th	nat Ti,	m=()	76)m and	re-c	alcula	te	
the u			or gains		-	-	ture 1	h.d.	1 4	- 0	1		Mary	-	-		
Litilie	Jan ation fac	Feb tor for a	Mar ains, hm	Apr	May	1	Jun	Jul	Au	g Sep	10	oct	Nov	De	C.		
(94)m=		0.94	0.81	0.61	0.43		0.29	0.2	0.2	0.38	0	71	0.98	0.99			(94
	ul gains,		W = (94	1)m x (8	1.121.12	-	-		-		1	-					
	1001.63		1333.78	1157.78	-	5	79.61	377.64	397.	07 632.44	967	.64	1021.01	920.3	8		(98
Mont	hly aver	age exte	mai tem	peratur	e from T	abl	e 8				-						
(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			(96
Heat			_		-	-	-		-	)m- (96)r	-	_	_	-	_		
		1566.95	1420.98	1168.72	881.48	1.00	79.63	377.64	397.	08 632.66	1 004	.34	1324.01	1588.	201		(97



Space heat a Energy r Space heat Fraction of	requiremen		kWh/m	Moor			Tota	I ner verr	(MATA AND A	A = Cum/D			
a Energy r Space hea	requiremen		kWh/m	Thioat				a best James	(and a loss	/ - Sounde	8)	1448.35	(98
Space hea		nts – Indi		ryear							[	9.72	(99
	ting		vidual h	eating s	stems i	ncluding	micro-C	HP)					
		at from a	acondar	vieunnia	montan	evetom					Ē	0	1(20
Fraction of					incritally		(202) = 1	- (201) =			- F	1	(20
Fraction of							(204) = (2		(203)] =		F	1	(20
Efficiency of											F	89.5	- (20
Efficiency of					1 system	1. %					F	0	- (20
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	_
Space heat					Juli	Jui	nug	Jeb	04	1404	Dec	KWINY	cai
444.	4 198.33	64.88	7.88	0.58	0	0	0	0	17.63	217.73	496.92		
211)m = {[(	(98)m x (20	(4)] } x 1	00 + (20	06)									(2)
498.5	54 221.6	72.49	8.81	0.64	0	0	0	0	19,7	243.27	555.22		
100	-			Terra and			Tota	i (kWh/ye	ar) =Sumf	215] 60.0	-	1818.27	12
Space near	iting fuel (s												
				/month				K					
and the second se	(201)] } x 1	00 + (20	(8)	-		-			0				
215)m= 0				/month	0	ø	D	0 (MAD/ve	a ar) -Sumi	Ø	0		
215)m= 0	(201)] } x 1 0	00 + (20	(8)	-	0	p			ar) =Sume	0.0	0	o	_(2
and the second se	(201)] } x 1 0 ing	00 + (20	8) 0	0	0	p			10	0.0	•	0	](2
215)m=0 Vater heati Dutput from 229.2	(201)] } x 1 0 ing 1 water hea 28 201.99	00 + (20 0 ter (calc 211.9	8) 0	0	0	p 157.79			10	0.0	0	0	
215)m= 0 Vater heati Dutput from 229.2 Efficiency of	(201)] } x 1 0 ing water hea 28 201.99 f water hea	00 + (20 0 ter (calc 211.9 ater	8) 0 ulated a 189.63	0 bove) 185.59	164.09	157.79	Tota 174.49	174.33	ar) =Sump 198.65	208.34	223.65	0 89.5	](2)
215)m= 0 Vater heati Dutput from 229.2 Efficiency of 217)m= 89.5	(201)] } x 1 0 ing water hea 28 201.99 f water hea 5 89.5	00 + (20 0 tter (calc 211.9 ater 89.5	8) 0 ulated a 189.63	o bove)		1	Tota	i (kWitvye	ar) =Surrij	215), 14.3			](2
215)m= 0 Vater heati Dutput from 2229.2 Efficiency of 217)m= 89.5 Fuel for wate	(201)] } x 1 0 ing water hea 28 201.99 f water hea 5 89.5 ter heating.	00 + (20 0 211.9 ater 89.5 , kWh/mc	8) 0 189.63 89.5 onth	0 bove) 185.59	164.09	157.79	Tota 174.49	174.33	ar) =Sump 198.65	208.34	223.65		](2
215)m= 0 Vater heati Dutput from 229.2 Efficiency of 217)m= 89.5	(201)] } x 1 0 ing water hea 28 201.99 f water hea 5 89.5 ter heating, 54)m x 100	00 + (20 0 211.9 ater 89.5 , kWh/mc	8) 0 189.63 89.5 onth	0 bove) 185.59	164.09	157.79	Tota 174.49	174.33	ar) =Sump 198.65	208.34	223.65		](2)
Vater heati Dutput from 229.2 Efficiency of 217)m= 89.5 Fuel for wate 219)m = (6	(201)] } x 1 0 ing water hea 28 201.99 f water hea 5 89.5 ter heating, 54)m x 100	00 + (20 0 211.9 ater 39.5 , kWh/mc 0 + (217)	8) 0 189.63 89.5 0nth m	0 bove) 185.59 89.5	164.69	157.79	Tota 174.49 89.5 194,97	174.33 89.5	ar) =Sum2 198.65 89.5 219,72	208.34	223.65		(2
215)me         0           Vater heati         229.2           Efficiency of         229.2           Efficiency of         217)me           217)me         89.5           Fuel for wate         219)m = (6           219)m = 256.1         256.1	(201)] } x 1 o ing water hea 28 201.99 f water hea 5 89.5 f water heating. 54)m x 100 18 225.69 als	00 + (20 0 211.9 ater 99.5 , kWh/mc 0 + (217) 236.76	8) 0 189.63 89.5 onth m 211.87	0 185.59 89.5 207.36	164.69	157.79	Tota 174.49 89.5 194,97	174.33 89.5 194.78	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34	223.65 89.5 249.89	89.5 2590.32 kWh/yea	(2 (2
Vater heati Vater heati Dutput from 2292 Efficiency of 217jm= 89.5 Fuel for wate 219)m = (6 219)m = (5 219)m = 256.1 Annual tota Space heati	(201)] } x 1 o ing iwater hea 28 201.99 f water hea 5 89.5 ter heating, 24)m x 100 18 225.69 als ing fuel use	00 + (20 0 211.9 atter 89.5 , KWh/mc 0 + (217) 236.76 ed, main	8) 0 189.63 89.5 onth m 211.87	0 185.59 89.5 207.36	164.69	157.79	Tota 174.49 89.5 194,97	174.33 89.5 194.78	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34 89.5 232.79	223.65 89.5 249.89	89.5 2590.32 <b>kWh/yea</b> 1618.27	(2 (2
215)me         0           Vater heati         229.2           Efficiency of         229.2           Efficiency of         217)me           217)me         89.5           Fuel for wate         219)m = (6           219)m = 256.1         256.1	(201)] } x 1 o ing iwater hea 28 201.99 f water hea 5 89.5 ter heating, 24)m x 100 18 225.69 als ing fuel use	00 + (20 0 211.9 atter 89.5 , KWh/mc 0 + (217) 236.76 ed, main	8) 0 189.63 89.5 onth m 211.87	0 185.59 89.5 207.36	164.69	157.79	Tota 174.49 89.5 194,97	174.33 89.5 194.78	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34 89.5 232.79	223.65 89.5 249.89	89.5 2590.32 kWh/yea	(2 (2
Vater heati Vater heati Dutput from 2292 Efficiency of 217jm= 89.5 Fuel for wate 219)m = (6 219)m = (5 219)m = 256.1 Annual tota Space heati	(201)] } x 1 o ing water hea 28 201.99 f water hea 5 80.5 5 80.5 5 80.5 ing fuer heating 54)m x 100 18 225.69 als ing fuel use ng fuel use	00 + (20 0 211.9 ater 99.5 , kWh/mc 0 + (217) 236.76 ed, main ed	8) 0 189.63 89.5 001th m 211.87 system	0 bove) 185.59 89.5 207.36	184.00 89.5 184.02	157.79	Tota 174.49 89.5 194,97	174.33 89.5 194.78	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34 89.5 232.79	223.65 89.5 249.89	89.5 2590.32 <b>kWh/yea</b> 1618.27	(2 (2
Vater heati Vater heati 229.2 Construction Constructio	(201)] } x 1 o ing water hea 28 201.99 f water heating. 5 80.5 5 80.5 18 225.69 als ing fuel use or pumps, f	00 + (20 0 211.9 ater 89.5 , kWh/mc 0 + (217) 236.76 ed, main ed fans and	8) a 189.63 89.5 onth m 211.87 system electric	0 185.59 207.36 1 keep-ho	164.09 89.5 184.02	157.79 89.5 176.3	Tota 174.49 89.5 194.97 Tota	174.33 89.5 194.78 I = Sum(2	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34 89.5 232.79	223.65 89.5 249.89	89.5 2590.32 <b>kWh/yea</b> 1618.27	(2 (2 )
Vater heati Dutput from 228,2 Efficiency of 217,m= 88,5 219,m= 256,1 219,m= 256,1 Annual tota Space heatii Vater heatii Electricity fo	(201)] } x 1 0 ing i water heat 28 201.66 f water heating 5 80.5 f water heating 5 80.5 f water heating 5 80.5 ing fuel use ing fuel use or pumps, f al ventilation	00 + (20 0 11.9 ater 90.5 , KWh/mc 0 + (217) 236.76 ed, main ed fans and n - balan	8) a 189.63 89.5 conth m 211.87 system electric	0 185.59 89.5 207.36 1 keep-ho	164.09 89.5 184.02	157.79 89.5 176.3	Tota 174.49 89.5 194.97 Tota	174.33 89.5 194.78 I = Sum(2	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34 89.5 232.79	223.85 89.5	89.5 2590.32 <b>kWh/yea</b> 1618.27	(2 (2 (2 (2 (2 (2) (2) (2)
Vater heating Dutput from 2003 control the control the	(201)] } x 1 0 ing water heat 28 201.99 f water heating 5 80.5 f water heating 5 80.5 f water heating 5 80.5 f water heating 5 80.5 ing fuel use or pumps, f al ventilation ating pump	00 + (20 9 10 11 11 11 12 11 21 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 10 10 10 10 10 10 10 10 10 10	8) 0 189.63 189.5 onth m 211.87 system electric iced, ext	0 185.50 89.5 207.36 1 keep-ho tract or p	164.09 89.5 184.02	157.79 89.5 176.3	Tota 174.49 89.5 194.97 Tota m outside	174.33 89.5 194.78 1 = Sum(2	ar) =Sum0 198.65 89.5 219.72 199. <sub>L.0</sub> =	208.34 99.5 232.79 Wh/year	223.65 89.5 249.89	89.5 2590.32 <b>kWh/yea</b> 1618.27	(2) (2) (2) (2) (2) (2) (2) (2)
Vater heati Dutput from 2020, 2015 Efficiency of 217,	(201)] ) x 1 0 ing water heat 28 201.99 f water heat 5 80.5 f water heating 5 80.5 f water heating 6 80.5 f water heating 7 80.5 f water heating 8 80.5 f wa	00 + (20 9 10 11 11 11 12 11 21 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 12 11 19 10 10 10 10 10 10 10 10 10 10	8) 0 189.63 189.5 onth m 211.87 system electric iced, ext	0 185.50 89.5 207.36 1 keep-ho tract or p	164.09 89.5 184.02	157.79 89.5 176.3	Tota 174.49 89.5 194.97 Tota m outside	174.33 89.5 194.78 1 = Sum(2	ar) =Sump 198.85 89.5 219.72 199. <sub>1.0</sub> = k	208.34 99.5 232.79 Wh/year	223.65 89.5 249.89	89.5 2590.32 <b>kWh/yea</b> 1618.27 2590.32	(2) (2) (2) (2) (2) (2) (2) (2) (2) (2)
Vater heatin Dutput from 2020; Efficiency of 217)m= 80.5 uel for wata 219)m = (6 210)m = 250.1 Annual tota Space heatin Vater heatin Electricity fo mechanica central hea	(201)] ) x 1 0 ing water heat 28 201.99 f water heat 5 90.5 ter heating, 54/m x 100 18 225.69 als ing fuel use or pumps, f al ventilation ating pump city for the or lighting	00 + (20 0 211.9 ater 80.5 , KWh/mco 0 + (217) 238.76 ed, main ed, main adans and n - balan c above, I	8) 1 166 (3) 1 166 (3) 1 166 (3) 1 167 (	0 185.50 207.36 1 keep-ho tract or p	104.00 98.5 184.02 t	157.79 89.5 178.3	Tota 174.49 89.5 194.97 Tota moutside sum	174.33 89.5 194.78 1 = Sum(2 8 8	ar) =Sump 198.85 89.5 219.72 199. <sub>1.0</sub> = k	208.34 99.5 232.79 Wh/year	223.65 89.5 249.89	89.5 2590.32 <b>kWh/yea</b> 1618.27 2590.32 755.21	(2 (2 )(2 )(2 )(2 (2) (2) (2)

ar kg CO2/kl 0.218 0.519 0.218 0.519 0.218 0.519 sum of (205)(271) (272) + (4) =	= 349.55 ( = 0 ( = 559.51 ( = 000.06 ( = 391.96 ( = 281.02 (
12) + (263) + (264) = 0.519 0.519 0.519 sum of (265)(271)	- 0 0 - 556,61 0 - 000.06 0 - 391,96 0 - 281,02 0 - 1562,03 0 10.48 0
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12) + (283) + (284) = 0.519 0.519 sum of (285)(271)	909.09 () = 391.96 () = 281.02 () = 1562.03 () 10.48 ()
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0,519 sum of (265)(271)	= 261.02 (0 = 1562.03 (0 10.48 (0
sum of (265)(271)	= <u>1562,03</u> (0 10.48 (0
(272) + (4) +	10.48
ĄF	
ĄF	

### 

Compliance with England Building Regulations Part L 2013

### Project name

### Tottenham Street\_Be Lean

Date: Tue May 31 13:10:56 2022

### Administrative information

### **Building Details**

Address: 52 Tottenham St, London, W1T 4RN

### **Certification tool**

Calculation engine: SBEM Calculation engine version: v5.6.b.0 Interface to calculation engine: Virtual Environment Interface to calculation engine version: v7.0.14 BRUKL compliance check version: v5.6.b.0

Certifier details Name: Pete Jeavons Telephone number: Phone Address: 52 Grosvenor Gardens, London, SW1W DAU

As designed

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

CO, emission rate from the notional building, kgCO,/m².annum	13.6	-
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	13.6	
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> annum	13	
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.

Element	Us-Limit	Ua-Cato	ULCale	Surface where the maximum value occurs
Wall**	0.35	0.2	0.2	"RM000000_W1"
Floor	0.25	0.22	0.22	"RM000000_F"
Roof	0.25	0.13	0.13	"RM000001_C"
Windows***, roof windows, and rooflight	s 2.2	1.4	1.4	"PL000000_W-1_00"
Personnel doors	2.2	-		"No external personnel doors"
Vehicle access & similar large doors	1.5	-		"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U+cer = Calculated area-weighted average U-vali		•		alculated maximum individual element U-values [W/(m/K)
	pply to curta ded from the or swimming	U-value o pool basin	heck. ns are mor	selled or checked against the limiting standards by the too
** Automatic U-value check by the tool does not a *** Display windows and similar glazing are exclu N.B.: Neither roof ventilators (inc. smoke vents) n	pply to curta sed from the or swimming	U-value o pool basin	heck. ns are mor	selled or checked against the limiting standards by the too

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### **Building services**

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

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

### 1-ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.84	-	4	÷	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic moni	toring & targeting w	ith alarms for out-of	-range values for th	is HVAC system	m YES
		ns <=2 MW output. For sing nulti-boiler system, limiting		r multi-boiler system	ns. (overall) limiting

### 2- DWH

1	Heating efficiency	<b>Cooling efficiency</b>	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	-range values for th	is HVAC system	n YES
* Standard shown is	for gas single boiler system	s <=2 MW output. For sing	le boiler systems >2 MW o		

#### 1- SYST0004-DHW

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

### General lighting and display lighting Luminous efficacy [lm/W]

Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Resi cycle storage -1F	-	80	-	32
Plant room -1F	80	4000	-	185
Store -1F	80	- 1.1	÷	14
Refuse holding -1F	80	-	-	13
Circulation area -1F	7	80	-	94
Circulation area GF	-	80	-	119
Toilet GF	-	80	-	51
Commercial GF	80	-	5	381

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Commercial GF	YES (+149.3%)	NO

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

Separate submission

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## Oensphere

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

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

	Actual	Notional	% Ar
Area [m <sup>2</sup> ]	164.6	164.6	-
External area [m <sup>2</sup> ]	358.1	358.1	-
Weather	LON	LON	100
Infiltration (m³/hm²@ 50Pa)	4	5	
Average conductance [W/K]	97.65	136.34	
Average U-value [W/m <sup>2</sup> K]	0.27	0.38	S
Alpha value* [%]	24.87	16.5	

uild	ing 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
	82 to 87 General Industrial and Special Industrial Groups 88 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

	Actual	Notional
Heating	23.79	30.62
Cooling	0	0
Auxiliary	1.45	0.72
Lighting	13.92	12.8
Hot water	0.5	0.46
Equipment*	57.23	57.23
TOTAL**	39.66	44.6

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

Energy Production by Technology [kWh/m <sup>2</sup> ]
---

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

	Actual	Notional
Heating + cooling demand [MJ/m2]	127.24	153.78
Primary energy* [kWh/m <sup>2</sup> ]	75.64	78.39
Total emissions [kg/m <sup>2</sup> ]	13	13.6

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HVAC Sys	tems Per	formanc	e						
System Type	Heat dem MJ/m2	MJ/m2	kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central he	67.6	59.7	23.8	O	1.4	0.79	Gas, [CF1]	0.84	0
Actual	90.3	63.5	30.6	0	0.7	0.82	0	0.64	0
Indudital	5015	00.0	50.0		0.7	0.02			
Key to terms									
Heat dem [MLIm2] Heat con JWMim2 Cool dem [MLIm2] Heat con JWMim2 Cool con RWMim2 Cool SSEER Heat SSEFF Cool gen SSEER ST HS HFT CFT	= Cooling e = Heating e = Cooling e = Auxiliary e = Heating s = Cooling s = Heating g	nergy demand mergy consum mergy consum energy consum ystem season yenerator seas enerator seas enerator seas roe uel type	l ption nption al efficiency (f al energy effic onal efficiency	iency ratio		epends on ac	tivity glazing d	lass)	

## **Key Features**

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

Element	ULTYP	ULAND	Surface where the minimum value occurs
Wall	0.23	0.2	"RM000000_W1"
Floor	0.2	0.22	"RM000000_F"
Roof	0.15	0.13	"RM000001_C"
Windows, roof windows, and rooflights	1.5	1.4	"PL000000_W-1_00"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U-Tw = Typical individual element U-values [W/(mH * There might be more than one surface where the	KOJ	Lvalue or	U-w== Minimum individual element U-values [W/(m*K)]

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

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## E. Indicative Energy Model Outputs (Be Green)

	DER WorkSheet: New		
0		Jser Détails:	
Assessor Name: Software Name:	Stroma FSAP 2012		ion: 1.0.5.51
Address :	52 Tottenham Street, LONDO	perty Address: WLC Proposed MF N, W1T 4RN	
1. Overall dwelling dim	ensions:		
		Area(m <sup>2</sup> ) Av. Height(m)	Volume(m
Ground floor		38 (1a) x 2.6 (2a) =	98.8
First floor		31. (1b) x 2.6 (2b) =	80.6
Total floor area TFA = (	1a)+(1b)+(1c)+(1d)+(1e)+(1n)	69 (4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =	179.4
2. Ventilation rate;	the second s		
	main secondary heating heating	other total	m <sup>3</sup> per hou
Number of chimneys		+ 0 = 0 x 40 =	0
Number of open flues		+ 0 = 0 x 20 =	0
and the second second second	- · · · · · · · · · · · · · · · · · · ·		
Number of intermittent f	ans		0
Number of passive vent	s	0 x 10 = 0 x 10 = 0 x 40 =	0
If a pressurisation lest has	s fires eys, flues and fans = (60)*(6b)*(7a) been carried out or is intended, proceed i	0 x 10 = 0 x 10 = 0 x 40 = Air o +(7b)+(7c) = 0 - (5) =	0 a changes per h
Number of passive vent Number of flueless gas Infiltration due to chimm	s fires eys, flues and fans = (60)*(6b)*(7a) been carried out or is intended, proceed i	0   x   10 = 0   x   10 = 0   x   10 = 0   x   40   x	changes per h
Number of passive vent Number of flueless gas Infiltration due to chimm If a prosurfactor liest hay Number of storeys in Additional infiltration	s fires eys, flues and fans = (60)*(6b)*(7a) been carried out or is intended, proceed i	0   x   10 = 0   x   40 = 0   0   x   40 = 0   0   x   40 = 0   0   0   x   40 = 0   0   0   0   0   0   0   0   0	changes per h
Number of passive vent Number of flueless gas Infiltration due to chimm <i>If a prossurisation lest nav</i> Number of storeys in Additional infiltration Structural infiltration: <i>If both types of wall are</i>	s hres eys, flues and fans = (66)+(6b)+(7a) been canred out or is intended, proceed i the dwelling (ns) 0.25 for steel or timber frame or O present, use the value corresponding to th	$c_{(0)-1 >0.1} = c_{(0)-1 >0.1} = c_{($	changes per h
Number of passive vent Number of flueless gas Infiltration due to chimm if a prossutisation test has Number of storeys in Additional infiltration Structural infiltration: if both types of wait are ideducting areas of oper	s fires eys, flues and fans = (60)+(6b)+(7a) been carried out or is intended, proceed if the dwelling (ns) 0.25 for steel or timber frame or O prosent, use the value corresponding to th angs); if equal user 0.35	0       x 10 =         0       x 10 =         0       x 10 =         0       x 40 =         Air of       - (5) =         0 (17), otherwise contenue from (9) is (16)       - (5) =         ((9)-1)x0.1 =       .35 for masonry construction         re greater wall area (after	0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm if a prossutisation test has Number of storeys in Additional infiltration Structural infiltration: if both types of wal are ideducing areas of open If suspended wooden	s hres eys, flues and fans = (66)+(6b)+(7a) been canred out or is intended, proceed i the dwelling (ns) 0.25 for steel or timber frame or O present, use the value corresponding to th	0       x 10 =         0       x 10 =         0       x 10 =         0       x 40 =         Air of       - (5) =         0 (17), otherwise contenue from (9) is (16)       - (5) =         ((9)-1)x0.1 =       .35 for masonry construction         re greater wall area (after	changes per h
Number of passive vent Number of flueless gas Infiltration due to chimm If a prostatisation list hay Number of storeys in Additional infiltration: if both types of wat are deducing areas of open If suspended wooden If suspended wooden	s fires eys, flues and fans = (%)+(%) been carred out or is intended, proceed if the dwelling (ns) 0.25 for steel or timber frame or 0 present, use the value corresponding to t ings); if equal user 0.35 if oor, enter 0.2 (unsealed) or 0.1	0       x 10 =         0       x 10 =         0       x 10 =         0       x 40 =         Air of       - (5) =         0 (17), otherwise contenue from (9) is (16)       - (5) =         ((9)-1)x0.1 =       .35 for masonry construction         re greater wall area (after	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prostatisation list hay Number of storeys in Additional infiltration: if both types of wat are deducing areas of open If suspended wooden If suspended wooden	s fires and fans = (64)+(6b)+(7e) been carried out or is intended, proceed the dwelling (ns) 0.25 for steel or timber frame or 0 present, use the value corresponding to things); if equal user 0.35 filoor, enter 0.2 (unsealed) or 0.1 inter 0.05, else enter 0	0       x 10 =         0       x 10 =         0       x 10 =         0       x 40 =         Air of       - (5) =         0 (17), otherwise contenue from (9) is (16)       - (5) =         ((9)-1)x0.1 =       .35 for masonry construction         re greater wall area (after	0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prossurisation test hav Number of storeys in Additional infiltration Structural infiltration Structural infiltration deducting areas of oper if suspended wooden if no draught lobby, et Percentage of window Window infiltration Infiltration rate	s hires eys, flues and fans = (60)+(6b)+(7a) been camed out or is intended, proceed it the dwelling (ns) 0.25 for steel or timber frame or 0 present, use the value corresponding to th angs); if equal user 0.35 effoor, enter 0.2 (unsealed) or 0.1 inter 0.05, else enter 0 vs and doors draught stripped	(10) + (7c) = 0 + (10) + (10) = 0 + (10) + (10) = 0 + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) + (10) + (10) = 0 + (10) + (10) + (10) + (10) + (10) = 0 + (10) + (1	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prostatisation test has Number of storeys in Additional infiltration Structural infiltration Structural infiltration If both types of walf are, deducting areas of open If suspended wooden If no draught lobby, ee Percentage of window Window infiltration Infiltration rate Air permeability value	s fires eys, flues and fans = (64)+(6b)+(7a) been carred out or is intended, proceed the dwelling (ns) 0.25 for steel or timber frame or 0 present, use the value corresponding to th ingor; # equal user 0.35 floor, enter 0.2 (unsealed) or 0.1 nter 0.05, else enter 0 vs and doors draught stripped c, q50, expressed in cubic metres	$c_{1} = c_{2} + c_{1} + c_{2} + c_{2$	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prostatisation test hay Number of storeys in Additional infiltration Structural infiltration Structural infiltration If both types of wal are deducing areas of open If suspended wooden If no draught lobby, et Percentage of window Window infiltration Infiltration rate Air permeability value If based on air permeability	s fires eys, flues and fans = (64)+(6b)+(7a) been carried out or is intended, proceed the dwelling (ns) 0.25 for steel or timber frame or 0 prosent, use the value corresponding to th ings): if equal user 0.36 floor, enter 0.2 (unsealed) or 0.1 inter 0.05, else enter 0 vs and doors draught stripped	(9)-1)x0.1 = (8) + (10) + (10) = (8) + (10) + (12) + (13) + (15) = (16)	0 changes per h 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prosurfaction that hay Number of storeys in Additional infiltration Structural infiltration Structural infiltration If suspended wooden If no draught lobby, e Percentage of window Window infiltration Infiltration rate Air permeability value If based on air permeability value	s three three three terms is interesting to the value or responding to the value corresponding to the value of 0.3 the value corresponding to the value corresponding to the value value of 0.3 the value corresponding to the value corresponding to the value value corresponding to the value value corresponding to the value value corresponding to the value corresponding to the value value corresponding to the value correspond	$c_{1} = c_{2} + c_{1} + c_{2} + c_{2$	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm <i>If a prossulisation lies has</i> Number of storeys in Additional infiltration Structural infiltration Structural infiltration If both types of wall are i deducing areas of oper If suspended wooden If no draught lobby, ei Percentage of window Window infiltration Infiltration rate Air permeability value If based on air permeability Number of sides shelter	s three three three terms is interesting to the value or responding to the value corresponding to the value of 0.3 the value corresponding to the value corresponding to the value value of 0.3 the value corresponding to the value corresponding to the value value corresponding to the value value corresponding to the value value corresponding to the value corresponding to the value value corresponding to the value correspond	(9)-1)x0.1 = (8) + (10) + (10) = (8) + (10) + (12) + (13) + (15) = (16)	0 changes per h 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prostatisation test hay Number of storeys in Additional infiltration Structural infiltration Structural infiltration If both types of wal are deducing areas of open If suspended wooden If no draught lobby, et Percentage of window Window infiltration Infiltration rate Air permeability value If based on air permeability	s three the stand fans = $(60t+(6t)+(7a))$ been canned out or is intended, proceed it the dwelling (ns) 0.25 for steel or timber frame or 0 present, use the value corresponding to the anaps); if equal user 0.35 effoor, enter 0.2 (unsealed) or 0.1 inter 0.05, else enter 0 vs and doors draught stripped c, q50, expressed in cubic metres ility value, then (18) = $[(17) + 20] + (8)$ , ies if a pressumation test has been done red	(10) + (7c) = 0 $(10) + (7c) = 0$ $(10) + (7c$	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm <i>If a prossurisation test nav</i> Number of storeys in Additional infiltration Structural infiltration <i>If both types of walf are</i> <i>deducting areas of oper</i> <i>If suspended wooden</i> <i>If no draught lobby, ee</i> Percentage of window Window infiltration Infiltration rate Air permeability value <i>If based on air permeability value appli</i> Number of sides shelter Shelter factor	s interse eys, flues and fans = $(60t+(6b)+(7a)$ been camed out or is intended, proceed it the dwelling (ns) 0.25 for steel or timber frame or 00 prosent, use the value corresponding to th angs); if equal user 0.35 afloor, enter 0.2 (unsealed) or 0.1 inter 0.05, else enter 0 vs and doors draught stripped a, q50, expressed in cubic metress ility value, then $(18) = [(17) + 20] + (8)$ , ies if a pressumation test has been done red ating shelter factor	(10) + (7c) = 0 $(10) + (7c) = 0$	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm If a prossurisation test hav Number of storeys in Additional infiltration Structural infiltration Structural infiltration deducting areas of open if suspended wooden if no draught lobby, et Percentage of window Window infiltration Infiltration rate Air permeability value If based on air permeab Air permeability value appli Number of sides shelter Shelter factor Infiltration rate incorpora	s interse eys, flues and fans = $(60t+(6b)+(7a)$ been camed out or is intended, proceed it the dwelling (ns) 0.25 for steel or timber frame or 00 prosent, use the value corresponding to th angs); if equal user 0.35 afloor, enter 0.2 (unsealed) or 0.1 inter 0.05, else enter 0 vs and doors draught stripped a, q50, expressed in cubic metress ility value, then $(18) = [(17) + 20] + (8)$ , ies if a pressumation test has been done red ating shelter factor	(10) + (7c) = 0 $(10) + (7c) = 0$	0 0 0 0 0 0 0 0 0 0 0 0 0 0
Number of passive vent Number of flueless gas Infiltration due to chimm <i>If a prosturtisation test hus</i> Number of storeys in Additional infiltration Structural infiltration Structural infiltration If both types of wal are, deducing areas of open If suspended wooden If no draught lobby, et Percentage of window Window infiltration Infiltration rate Air permeability value appl Number of sides shelter Shelter factor Infiltration rate incorpora	s fires eys, flues and fans = $(64)^{+}(6b)^{+}(7a)$ been carried out or is intended, proceed the dwelling (ns) 0.25 for steel or timber frame or 0 prosent, use the value corresponding to the ings): if equal user 0.35 floor, enter 0.2 (unsealed) or 0.1 nter 0.05, else enter 0 vs and doors draught stripped c, q50, expressed in cubic metres illity value, then (18) = [(17) * 20]*(8), ise if a pressurisation test has been done red ating shelter factor for monthly wind speed Mar Apr May Jun	$c_{1} = c_{1} + c_{2} + c_{2$	0 0 0 0 0 0 0 0 0 0 0 0 0 0

	-		(22)m ÷	4							_			
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjust	ed infiltr	ation rat	e (allowi	ng for sh	elter an	d wind s	speed) =	(21a) x	(22a)m					
	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.07	0.07	0.08	0.08	Ê l	
			change i	ate for t	he appli	able ca	se					1		-
	echanica			ndiv NL (2	3h) - (23a	x Emy (	acustian (t	(5)) othe	rwise (23b	- (230)		- 6	0.5	(23a)
			very: effici							/- (200)			0.5	(23b) (23c)
									a)m = (22	2h)m + /	23b) x [	1 - (23c)	76.5	(zuc)
24a)m=	-	0.2	0.2	0.19	0.19	0.18	0.18	0.18	0.19	0.19	0.2	0.2	+ 100]	(248)
	1000								o)m = (22	1221		**		Acres 1
24b)m=	-	0	0	0	0	0		0	0	0	0	0	n	(24b)
		-	tract ven								<u> </u>			
									b) m + 0.	5 × (23b	)			
(24c)m=	-	0	0	D	Ø	0	0	0	0	0	Q	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilatio	on from	loft					
	if (22b)n	n = 1, th	en (24d)	m = (22)	)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		_	-	
(24d)m=	D	0	0	0	a	0	0	0	0	Ø	D	0	-	(24d)
Effe	ctive air	change	rate - en	ter (24a	) or (24b	) or (24	c) or (24	d) in bo	x (25)	-				
25)m=	0.21	0.2	02	0 19	0 19	0.18	0.18	0.18	0.19	0 19	0.2	0,2		(25)
3.11	losse	s and l	- loss	-		-	_			-			_	-
	MENT	Gros		Openin	as	Net Ar	ea	U-val	ue	AXU		k-value	A	Xk
		area	(m²)	m		л, А	and the second se	W/m2		(VV/	<)	kJ/m²-l		J/K
Windo	ws Type	11				14.2	x1	(1/(1.4))	0.041 =	18,95			1000	(27)
Windo	ws Type	2				14.28	3 ×1	[1/(14)+	0.04] =	18,93				(27)
Walls '	Type1	14.2	8	14.2	3	0	x	0.18	=	0				(29)
	Type2	14.2	8	14.2	3	0	x	0.18		0		1.000		(29)
Walls	area of e	lements	, m <sup>2</sup>			28.5	3	-	100	1.1	7.0			(31)
							ated using	formula	1/[(1/U-valu	e)+0.04] a	is given in	paragraph	3.2	
Total a			sides of in	temal wal										_
Total a for win '' incluo	le the area				s and part	tions		1001 100	1 (00)				37.86	(33)
Total a for win <i>incluo</i> Fabric	le the area heat los	s, W/K	= S (A x		s and part	tions		(26). (30	) + (32) =			_ []		_
Total a for win fincluo Fabric Heat c	<i>le the arei</i> heat los apacity	s, W/K Cm = S	=S(Ax (Axk)	U)				(26). (30	((28)	(30) + (33		(32e) =	0	(34)
Total a for win incluo Fabric Heat c Therm	le the area heat los apacity al mass	s, W/K Cm = S parame	= S (A x A x k ) ter (TMF	U) 9 = Cm +	TFA) in	kJ/m²K			((28) Indica	tive Value	Medium		0 250	_
Total a for win fabric Fabric Heat c Therm	le the area heat los apacity al mass	s, W/K Cm = S parame ments wh	= S (A x A x k ) ter (TMF	U) P = Cm + Pails of the	TFA) in	kJ/m²K			((28)	tive Value	Medium			(34)
Total a for win incluo Fabric Heat c Therm For desi can be c	le the area heat los apacity al mass ign assess used inste	s, W/K Cm = So parame ments wh ad of a de	= S (A x A x k ) ter (TMF ere the del	U) P = Cm + Pails of the ulation.	- TFA) in constructi	kJ/m²K	t known pr		((28) Indica	tive Value	Medium			(34)
Total a * for win * incluo Fabric Heat c Therm For desi can be c Therm	le the area heat los apacity al mass ign assess used inste al bridge	ss, W/K Cm = So parame ments wh ad of a de es : S (L	= S (A x A x k ) ter (TMF ere the del talled calcu	U) P = Cm + tails of the ulation. culated (	- TFA) in constructi using Ap	kJ/m²K on are no pendix l	t known pr		((28) Indica	tive Value	Medium		250	(34) (35)
Total a for win Fabric Heat c Therm For desi can be c Therm	le the area heat los apacity al mass ign assess used inste al bridge	ss, W/K = So parame ments wh ad of a de es : S (L al bridging	= S (A x (A x k ) ter (TMF ere the del tailed calcu x Y) calc	U) P = Cm + tails of the ulation. culated (	- TFA) in constructi using Ap	kJ/m²K on are no pendix l	t known pr		((28) Indica	tive Value values of	Medium		250	(34) (35)
Total a for win Fabric Heat c Therm For desi can be c Therm f details Total f	le the area heat los apacity al mass ign assess used inste al bridge of therme abric he	ss, W/K : Cm = Si parame ments wh ad of a de es : S (L al bridging at loss at loss ca	= S (A x (A x k ) ter (TMF ere the del tailed calcu x Y) calc	U) P = Cm + tails of the ulation. culated ( own (36) =	- TFA) in constructi using Ap = 0.05 x (3	kJ/m²K on are no pendix l	t known pr		((28) Indical e indicative (33) +	tive Value values of	Medium TMP in T	able 1f	250	(34) (35) (36)
Total a for win incluo Fabric Heat c Therm For desi can be c Therm if details Total fi Ventila	le the area heat los apacity al mass ign assess used inste al bridge of thermi abric hea ation hea	es, W/K : Cm = Si parame ments wh ad of a de es : S (L al bridging at loss at loss ca Feb	= S (A x (A x k ) ter (TMF ere the del tailed calcu x Y) cali are not kno alculated Mar	U) P = Cm + tails of the ilation. culated culated bown (36) = monthly Apr	- TFA) in constructi using Ap 0.05 x (3 / May	kJ/m²K on are noi pendix l 1) Jun	t known pr K	ecisely Ih	((28) Indicative (33) + (38)m Sep	(36) = = 0.33 × ( Oct	Medium TMP in T 25)m x (5 Nov	able 1f	250	(34) (35) (36) (37)
Total a for win incluo Fabric Heat c Therm For desi can be c Therm if details Total fi Ventila	le the area heat los apacity al mass ign assess ised inste al bridge of thermo- abric he ation heat	ss, W/K : Cm = Si parame ments wh ad of a de es : S (L al bridging at loss at loss ca	= S (A x (A x k ) ter (TMF ere the del tailed calcu x Y) calc are not known	U) P = Cm + tails of the lation. culated ( own (36) + monthl)	- TFA) in constructi using Ap = 0.05 x (3	kJ/m²K on are noi pendix l 1)	t known pr	ecisely th	((28) Indical e indicative (33) + (38)m	tive Value values of (36) = = 0.33 × (	Medium TMP in T 25)m x (5	able 1f	250	(34) (35) (36)
Total a for win Fabric Heat c Therm For desi can be c Therm if details Total fi Ventila (38)m=	le the area heat los apacity al mass ign assess used inste al bridge of thermi abric hea ation hea	ss, W/K : Cm = Si parame sments wh ad of a de ess : S (L al bridging at loss at loss at loss t loss ca Feb	= S (A x A x k ) ter (TMF ere the delta tailed calcu x Y) calc are not kn alculated Mar 11.99	U) P = Cm + tails of the ilation. culated culated bown (36) = monthly Apr	- TFA) in constructi using Ap 0.05 x (3 / May	kJ/m²K on are noi pendix l 1) Jun	t known pr K	ecisely Ih	((28) Indicative (33) + (38)m Sep 11.06	(36) = = 0.33 × ( Oct	Medium TMP in T 25)m x (5 Nov 11.58	able 1f	250	(34) (35) (36) (37)
Total a * for win ** incluo Fabric Heat c Therm For desi can be c Therm if details Total fi Ventila (38)m=	le the area heat los apacity al mass ign assess used inste al bridge a of therme abric he ation heat Jan 12.19	ss, W/K : Cm = Si parame sments wh ad of a de ess : S (L al bridging at loss at loss at loss t loss ca Feb	= S (A x A x k ) ter (TMF ere the delta tailed calcu x Y) calc are not kn alculated Mar 11.99	U) P = Cm + tails of the ilation. culated culated bown (36) = monthly Apr	- TFA) in constructi using Ap 0.05 x (3 / May	kJ/m²K on are noi pendix l 1) Jun	t known pr K	ecisely Ih	((28) Indicative (33) + (38)m Sep 11.06	(36) = = 0.33 × ( Oct 11.37	Medium TMP in T 25)m x (5 Nov 11.58	able 1f	250	(34) (35) (36) (37)



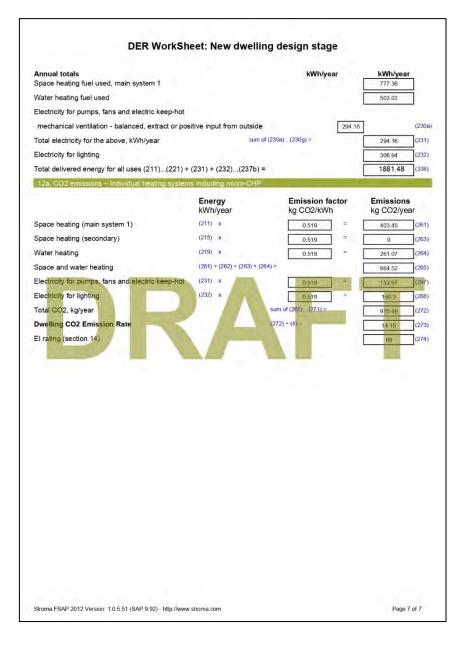
1									140:	(10)				
40)m=	0.74	0.74	HLP), W/	0.73	0.73	0.72	0.72	0.72	(40)m	= (39)m =	0.73	0.74		
(u)		0.51	0.74	0.15	0.10	9.76	9.14	0.72		6.4.6	Sum(40)		0.73	(40
lumb			nth (Tabl	e 1a)		-	-							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(4
4. W	ater heal	ing ener	igy requi	rement	c							kWhive	ar.	
ssun	ned occu	ipancy, I	N								2	22		(4
if TF	A > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	49 x (TF	A -13.9	)2)] + 0.0	0013 x (	TFA -13		ch.		
	A £ 13.9	200 J 10	ater usag	e in litre	s per da	v Vd av	erage =	(25 x N)	+ 36		01	.54		(4
educe	the annua	al average	hot water	usage by s	5% if the d	welling is	designed			se target o				1.
nt mor	_		person per	122.0					201		1.202			
ot wat	Jan	Feb	Mar day for ea	Apr ch month	May Vd m = fau	Jun	Jul able 1c x	Aug	Sep	Oct	Nov	Dec		
	100.69	97.03	93.37	89.71	86.05	82 39	82 39	86.05	89.71	93.37	97.03	100 69		
a jin-	100.09	97.00	93.31	09.71	80.05	02.39	02.39	80.05	10404-102	1.0000	m(44)12=	100.00	1098.48	(4
ergy	content of	nol water	used - cal	alland mo	anthis = 4	190 x Vd,n	n x nm x E	0Tm / 3600			ubles Ib, I		1000.40	
5)m=	149.33	130 6	134.77	117.5	112.74	97.29	90.15	103 45	104,68	122	133.17	144,61		
	1					1	1	71		Total - Su	am(45)1_12 =		1440.28	(4
nstan	taneous w	ater heatil	ng at point	of use (no	hot water	siorage),	enter V In	boxes (46,	10 (61)					
		19.59	20.22	17,62	16.91	14.59	13.52	15.52	15.7	18,3	19.98	21.69		(4
/ater	storage	loss:	7			1		-			-			(4
later torag	storage le volum	loss: e (litres)	includin	g any so	blar or W	WHRS	storage	within sa			19.98			
later torag	storage le volum munity h	loss: e (litres) eating a	includin and no ta	g any so nk in dw	olar or W velling, e	/WHRS	storage litres in	within sa (47)	ime ves	sel	20			
ater torag com	storage le volum munity h	loss: e (litres) eating a stored	includin	g any so nk in dw	olar or W velling, e	/WHRS	storage litres in	within sa (47)	ime ves	sel	20			
later torag com then later	storage wolum munity h vise if no storage	loss: e (litres) eating a stored loss:	includin and no ta	g any so nk in dw er (this in	olar or W velling, e icludes in	WHRS nter 110 nstantar	storage litres in neous co	within sa (47)	ime ves	sel	20	01	-	(4
/ater torag com therv /ater ) If n	storage munity h vise if no storage	loss: e (litres) eating a o stored loss: urer's de	includin and no ta hot wate	g any so nk in dw er (this in coss facto	olar or W velling, e icludes in	WHRS nter 110 nstantar	storage litres in neous co	within sa (47)	ime ves	sel	(47)	01		(4
/ater torag com therv /ater ) If n empe	storage munity h wise if no storage nanufact erature fa	loss: e (litres) eating a o stored loss: urer's de actor fro	) includin and no ta hot wate	g any so nk in dw er (this in oss facto 2b	blar or W relling, e ucludes in pr is know	WHRS nter 110 nstantar	storage litres in neous co n/day):	within sa (47)	ame vess	sel	(47)	54		(4
/ater torag com then /ater ) If n emperence ) If n	storage munity h vise if no storage nanufact erature fa y lost fro nanufact	loss: e (litres) eating a o stored loss: urer's de actor fro m water urer's de	includin and no ta hot wate eclared la m Table storage eclared c	g any so nk in dw er (this in oss facto 2b , kWh/ye	olar or W relling, e Includes in or is know ear oss facto	WHRS nter 110 nstantar wn (kWh	storage litres in neous co n/day): known:	within sa (47) ombi boil	ame vess	sel	(47)	01 54 694		(4 (4 (4 (5
torag com then (ater ) If n empe nerg ) If n ot wa	storage re volum munity h wise if no storage nanufact erature fa y lost fro nanufact ater stora	loss: e (litres) eating a stored loss: urer's de actor fro m water urer's de age loss	r includin and no ta hot wate eclared lu m Table storage eclared c factor fr	g any so nk in dw er (this in oss facto 2b , kWh/ye cylinder i om Tabl	olar or W relling, e Includes in or is know ear oss facto	WHRS nter 110 nstantar wn (kWh	storage litres in neous co n/day): known:	within sa (47) ombi boil	ame vess	sel	(47)	01 54 694		(4 (4 (4 (5
/ater torag com then /ater ) If n empe nerg ) If n ot wa com	storage munity h vise if no storage hanufact erature fa y lost fro hanufact ater stora munity h	loss: e (litres) eating a stored loss: urer's de actor fro m water urer's de age loss eating s	rincludin and no ta hot wate eclared lu m Table storage eclared c factor fr see sectio	g any so nk in dw er (this in oss facto 2b , kWh/ye cylinder i om Tabl	olar or W relling, e Includes in or is know ear oss facto	WHRS nter 110 nstantar wn (kWh	storage litres in neous co n/day): known:	within sa (47) ombi boil	ame vess	sel	(47) 0 0.8	54 694 0		(4 (4 (5 (5
/ater torag com then /ater ) If n empe nerg ) If n ot wa com	storage wolum munity h vise if no storage hanufact erature fa y lost fro hanufact ater stora munity h e factor	loss: e (litres) eating a stored loss: urer's de actor fro m water urer's de age loss eating s from Ta	rincludin and no ta hot wate eclared lo m Table storage eclared c factor fr see sectio ble 2a	g any so nk in dw r (this in oss facto 2b , kWh/ye cylinder i om Tabl on 4.3	olar or W relling, e Includes in or is know ear oss facto	WHRS nter 110 nstantar wn (kWh	storage litres in neous co n/day): known:	within sa (47) ombi boil	ame vess	sel	(47) 0.8	54 694 0 0		(4 (4 (5) (5)
/ater torag com therv /ater ) If n empe nerg ) If n ot wa com olum empe	storage re volum munity h vise if no storage nanufact erature fa y lost fro nanufact ater stora munity h e factor erature fa	loss: e (litres) eating a o stored loss: urer's de actor fro m water urer's de age loss eating s from Ta actor fro	includin and no ta hot wate eclared la m Table storage eclared c factor fr see section ble 2a m Table	g any so nk in dw er (this in 2b , kWh/ye sylinder i om Tabl on 4.3 2b	olar or W relling, e rcludes ii or is know ear oss facte e 2 (kWi	WHRS nter 110 nstantar wn (kWh	storage litres in neous cc n/day): known: yy)	within sa (47) ombi boil (48) x (49	ers) ente	sel	(47)	54 694 0 0 0		(4 (4 (5 (5) (5)
/ater torag com then /ater ) If n empo nerg ) If n ot wa com olum empo nerg	storage revolum munity h vise if no storage nanufact erature fr y lost fro nanufact ater stora munity h e factor erature fr y lost fro	loss: e (litres) eating a o stored loss: urer's de actor fro m water urer's de age loss eating s from Ta actor fro m water	includin and no ta hot wate eclared lo m Table storage eclared c factor fr aee section ble 2a m Table storage	g any so nk in dw er (this in 2b , kWh/ye sylinder i om Tabl on 4.3 2b	olar or W relling, e rcludes ii or is know ear oss facte e 2 (kWi	WHRS nter 110 nstantar wn (kWh	storage litres in neous cc n/day): known: yy)	within sa (47) ombi boil	ers) ente	sel	(47)	54 694 0 0 0 0 0		(4 (4 (5) (5) (5) (5) (5)
(ater torag com then (ater ) If n emponency ) If n ot wa com olum emponency inter	storage re volum munity h vise if no storage hanufact erature fr y lost fro hanufact ater stora munity h e factor erature fr y lost fro (50) or (	loss: e (litres) e ating a o stored loss: urer's de actor fro m water urer's de age loss eating s from Ta actor fro m water 54) in (5	includin and no ta hot wate eclared la m Table storage eclared c factor fr ee section ble 2a m Table storage storage 55)	g any so nk in dw rr (this in oss facto 2b , kWh/ye om Tabl on 4.3 2b , kWh/ye	olar or W relling, e cludes i or is know ear oss facto e 2 (kWi ear	WHRS nter 110 nstantar wn (kWh	storage litres in neous co n/day): known: iy)	within sa (47) ombi boil (48) x (49	ime ves ers) ente i =	sel er '0' in ( 53) =	(47)	54 694 0 0 0		(4 (4 (5) (5) (5) (5) (5)
ater orag com then ater ) If n empo- nerg of the ater nerg nter ater	storage revolum munity h vise if no storage hanufact erature fa y lost fro hanufact ater stora munity h e factor erature fa y lost fro (50) or ( storage	loss: e (litres) eating a o stored loss: urer's de actor fro m water urer's de age loss eating s from Ta actor fro m water (54) in (5 loss cal	includin and no ta hot wate eclared la m Table storage eclared o factor fr actor fr actor fr factor	g any so nk in dw er (this in oss facto 2b , kWh/ye om Tabl on 4.3 2b , kWh/ye or each	olar or W relling, e cludes i or is know ear oss facto e 2 (kWi ear month	WHRS nter 110 nstantar wm (kWh or is not h/litre/da	storage litres in neous cc v/day): known: vy)	within sa (47) ombi boil (48) x (49 (47) x (51) ((56)m = (	ime ves: ers) ente i = i x (52) x (i 55) x (41)	sel er '0' in i 53) =		54 694 0 0 0 0 0 87		(4) (4) (4) (5) (5) (5) (5) (5) (5)
(ater torag com then (ater ) If n empo nerg of m empo com olum empo com olum empo com olum empo com dater (f)	storage revolum munity h vise if no storage nanufact arature fr y lost fro nanufact ater stora- munity h e factor erature fr y lost fro (50) or ( storage 26.95	loss: e (litres) eating a o stored loss: urer's de actor fro m water urer's de age loss eating s from Ta actor fro m water (54) in (5 loss cal 24.34	includin and no ta hot wate eclared lu m Table storage eclared c factor fr eee sectio ble 2a m Table storage storage 55) culated f 28.95	g any so nk in dw er (this in obs facto 2b , kWh/ye on Tabl on 4.3 2b , kWh/ye or each 26.08	olar or W relling, e cludes i or is know ear oss facto e 2 (kW) ear month 28.95	WHRS nter 110 nstantar wn (kWh or is not h/litre/da	storage litres in neous cc v/day): known: vy) 26.95	(47) (47) (48) x (49) (47) x (51) ((56)m = ( 26.95	ame vess ers) ente i = i × (52) × (i 55) × (41) 26.08	sel er '0' in i 53) = m 26.95	26.08	54 694 0 0 0 0 0 0 87 26.95	×H	(4) (4) (4) (5) (5) (5) (5) (5) (5)
(ater torag com then (ater ) If n emperies () If n emperi	storage revolum munity h wise if no storage nanufact erature fr y lost fro nanufact ater stora munity h e factor erature fr y lost fro (50) or ( storage 26.95 er contains	loss: e (litres) eating a b stored loss: urer's de actor fro m water urer's de actor fro m water seating s from Ta actor fro m water 54) in (5 loss cal 24.34 s dedicate	includin and no ta hot wate eclared lu m Table storage eclared of factor fr ee section ble 2a m Table storage 55) culated f 26.95 d solar stor	g any so nk in dw r (this in oss facto 2b , kWh/ye com Tabl on 4.3 2b , kWh/ye or each 26.08 rage, (57)r	oblar or W relling, e cdudes in or is know ear oss facto ear ear month 26.95 n = (58)m	26.08 × 1(50) – (	storage litres in heous co v/day): known: yy) 26.95 H11)] + (5	within sa (47) mbi boil (48) x (49) (47) x (51) ((56)m = ( 26.95 0), else (5	<ul> <li>ame vess</li> <li>ers) enters</li> <li>a x (52) x (52) x (55) x (41)x</li> <li>26 08</li> <li>7/m = (56)</li> </ul>	sel 53) = m 26.95 m where (	26.08 (H11) is from	54 694 0 0 0 0 0 87	×H	(4 (4) (4) (5) (5) (5) (5) (5)
(ater torag com then (ater ) If n empo nerg of the com olum empo nerg (ater 6)m= cylind	storage revolum munity h vise if no storage hanufact erature fa y lost fro hanufact ater stora munity h e factor erature fa y lost fro (50) or ( storage 26.95 26.95	loss: e (litres) eating a p stored loss: urer's de actor fro m water urer's de age loss eating s from Ta actor fro m water 54) in (5 loss cal 24.34	vincludin and no ta hot wate eclared lum Table storage eclared of factor fin- see sectio ble 2a m Table storage 55) culated fi 26.95 d solar stor 26.95	g any so nk in dw r (this in oss facto 2b , kWh/ye om Tabl on 4.3 2b , kWh/ye or each 26.08 rage; (57)r 26.08	blar or W relling, e cludes i or is know ear oss facto e 2 (kWi ear month 26.95 m = (58)m 26.95	WHRS nter 110 nstantar wn (kWh or is not h/litre/da	storage litres in neous cc v/day): known: vy) 26.95	(47) (47) (48) x (49) (47) x (51) ((56)m = ( 26.95	ame vess ers) ente i = i × (52) × (i 55) × (41) 26.08	sel er '0' in i 53) = m 26.95	(47) 0. 0.8 0.8 0.0 0.0 26.08 (H11) is from 26.08	54 694 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	×H	(4 (4 (5) (5) (5) (5) (5)
(ater torag com then (ater ) If n empo nerg () If n ot wa com olum empo (ater (ater 6)m= cylind 7)m=	storage e volum munity h vise if no storage nanufact atar storage nanufact ater stora munity h e factor erature fa y lost fro (50) or ( storage 26.95 er contains 26.95 ry circuit	loss: e (litres) leating a p stored loss: urer's de actor fro m water urer's de age loss leating s from Ta actor fro m water 54) in (5 loss cal 24.34 s dedicate 24.34 loss (an	vincludin and no ta hot wate eclared lum Table storage eclared of factor fr ece sectio ble 2a m Table storage 55) culated f 26.95 d solar stor 26.95 anual) fro	g any so nk in dw r (this in oss facto 2b , kWh/ye om Table or each 26.08 rage, (57)r 26.08 m Table	blar or Welling, e coludes in or is known ear oss facto e 2 (kWM ear month 26.95 m = (58)m 26.95 e 3	26.08 × ((50) – ( 26.08	storage litres in eous cc v/day): known: yy) 26.95 H111)1 = (5 26.95	(47) mbi boil (48) x (49) (47) x (51) ((56)m = ( 26.95 0), else (5 26.95	<ul> <li>arme vess</li> <li>arme vess</li></ul>	sel 53) = m 26.95 m where (	(47) 0. 0.8 0.8 0.0 0.0 26.08 (H11) is from 26.08	54 694 0 0 0 0 0 87 26.95 m Appendi	хH	(4 (4) (4) (5) (5) (5) (5) (5)
(ater com therv (ater ) If n emponency ) If n emponency ) If n emponency ) If n emponency ) If n emponency (ater (ater (ater (ater (ater (ater))) (ater) ((ater)) ((ater)) ((ater)) ((at	storage le volum munity h wise if no storage hanufact arature fa y lost fro hanufact atter stora- munity h e factor erature fa y lost fro (50) or ( (50) or ( (50) or ( (50) storage (26.95) 26.95) ry circuit ry circuit	loss: e (litres) eating a stored loss: urer's de actor fro m water urer's de age loss seating s from Ta actor fro m water 54) in (5 loss cal 24.34 s dedicate 24.34 loss (ar loss cal loss cal loss cal loss cal	includin and no ta hot wate eclared la m Table storage eclared c factor fr ee sectio ble 2a m Table storage 55) culated f 26.95 d solar stor 26.95 nnual) fro culated f	g any so nk in dw r (this in coss factor 2b , kWh/ye yilinder I com Tabl on 4.3 2b , kWh/ye or each 26.08 arage, (57) 26.08 mm Tableon cor each	elling, e elling, e cludes i or is know ear oss factor e 2 (kWi 26.95 n = (56)m 26.95 a 3 month (s	26.06 x ((50) - (26.08 x ((50) - (26.08 59) m = (	storage           litres in           litres in           litres in           v/day):           known:           26.95           H11)1+(5           26.95           58)+ 36	within sa (47) ambi boil (48) x (49) (47) x (51) ((56)m = ( 26.95 0), else (5 26.95 26.95 35 × (41)	me ves ers) ente = = = = = = = = = = = = = = = = = = =	sel 933) = m 26.95 26.95	26.08 (H11) is fro	54 694 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	xH	(4) (4) (4) (5) (5) (5) (5) (5) (5)
/ater torag com therv /ater ) If n empo nerg )) If n ot wa com olum empo nerg (ater 6/m= 6/m= 7/m=	storage le volum munity h wise if no storage hanufact arature fa y lost fro hanufact atter stora- munity h e factor erature fa y lost fro (50) or ( (50) or ( (50) or ( (50) storage (26.95) 26.95) ry circuit ry circuit	loss: e (litres) eating a stored loss: urer's de actor fro m water urer's de age loss seating s from Ta actor fro m water 54) in (5 loss cal 24.34 s dedicate 24.34 loss (ar loss cal loss cal loss cal loss cal	vincludin and no ta hot wate eclared lum Table storage eclared of factor fr ece sectio ble 2a m Table storage 55) culated f 26.95 d solar stor 26.95 anual) fro	g any so nk in dw r (this in coss factor 2b , kWh/ye yilinder I com Tabl on 4.3 2b , kWh/ye or each 26.08 arage, (57) 26.08 mm Tableon cor each	elling, e elling, e cludes i or is know ear oss factor e 2 (kWi 26.95 n = (56)m 26.95 a 3 month (s	26.06 x ((50) - (26.08 x ((50) - (26.08 59) m = (	storage           litres in           litres in           litres in           v/day):           known:           26.95           H11)1+(5           26.95           58)+ 36	within sa (47) ambi boil (48) x (49) (47) x (51) ((56)m = ( 26.95 0), else (5 26.95 26.95 35 × (41)	me ves ers) ente = = = = = = = = = = = = = = = = = = =	sel 933) = m 26.95 26.95	26.08 (H11) is fro	54 694 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	хH	(4) (4) (4) (5) (5) (5) (5) (5) (5)

	-		_				65 × (41	-	1		Î		i l	100
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61
	-				-				-		1		(59)m + (61)m	
(62)m=	176.28	154.95	161.72	143.58	139.69	123.37	117.1	130.4	130.77	148.95	159 25	171.57	I.	(62
							ive quantit s, see Ap		0' if no sola	r contribut	tion to wate	er heating)		
(add a (63)m=	0 n	0	0	and/or v	0	o	o see Ap	o	0	0	0	0	ñ	(63
	t from w			U	u	U	0	U		U	0	U	0	100
(64)m=	176.28	154.95	161.72	143.58	139.69	123.37	117.1	130.4	130.77	148.95	159.25	171.57	<u> </u>	
		14276-51				1.00000		Ou	tput from w		r (annual)		1757.61	(64
Heat	ains from	m water	heating.	kWh/m	onth 0.2	5 [0.85	5 × (45)m	+ (61)	m] + 0.8 x	((46)m	+ (57)m	+ (59)m	1	-
(65)m=	49.65	43.43	44.81	39.07	37.49	32.35	29.97	34.4	34.81	40.56	44.28	48.08	Ê .	(65
inclu	ude (57)	m in calo	ulation of	of (65)m	only if c	vlinder	is in the	dwelling	or hot w	ater is f	rom com	munity h	eating	
		010101010	Table 5											
			5), Wat			-								
Wetab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ê.	
(66)m=	111 08	11108	111.08	311.08	111.08	111.08	111.08	111.08	111.08	111 08	111.08	111.08		(60
Lightir	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 c	or L9a), a	Iso see	Table 5	1	-			
(67)m=	7.38	15.44	12 55	8.5	7.1	6	6.48	8.42	11.31	14.36	16.76	17.86		(67
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5				
(68)m=	194.95	196.97	191,88	181 02	167 32	154.45	145.85	143 82	148.92	159 77	173 47	186.35		(68
Cooki	ng gains	(calcula	ted in A	opendix	L, equa	tion L15	or L15a	), also s	see Table	5				
(69)m=	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11	34.11		(69
Pump	s and fai	ns gains	(Table 5	ia)		_	-	-	-	-				
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70
Losse		aporatio	n (negat	ive valu	es) (Tab	le 5)								
(71)m=	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86	-88.86		(71
	heating			_										
(72)m=	66.74	64 62	60.23	54.26	50.38	44.93	40.29	46.23	48.34	54.52	61.5	64.63		(72
	internal	-	_		_				+ (69)m +)			-		
	345.39	343.36	330.98	311.11	291.14	271.7	258,94	264.8	274.9	294:98	318.05	335.17		(73
	lar gains				T. 11. 0.	and a local		For Lar	convert to th			1		
	ation: A		1000	Area		Ent assoc		alions to d	g_	ie applicat	FF	uon.	Gains	
Onem		Table 6d	actor	m²			ble 6a		Table 6b	т	able 6c		(W)	
	ast 0.9x	0.3	×	14.	28	×	36.79	*	0,76	×	0.8		86.25	(77
	ast0.9x	0.3	x	14.	28	x	36.79	x	0.76	] × [	0.8	, in the	86.25	(77
	ast 0.9x	0,3	×	14.	28	×	62.67	*	0,76	×	0,8	=	146,92	(77
	ast 0.9x	0.3	×	14.	28	x	62.67	*	0.76	] × [	0.8	-	146.92	](77
Southe	asto 9x	0.3	x	14.	28	x	85.75	×	0.76	- ×	0.8	= 1 =	201.02	(77

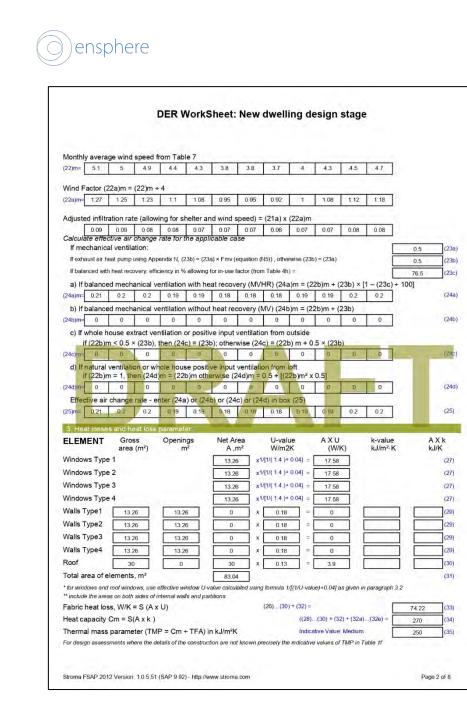
	asto.9x	0.3	×	14.	28	x	85.75	1 × [	0.76	x	0.8	=	201.02	(77
Southea	asto 9x	0.3	- x	14		×Ē	106.25	1 . F	0.76		0.8	-	249.08	077
Southea		0.3	×	14		×Ē	106.25	1 . F	0.76	- *	0.8	-	249.08	(77
Southea		0.3	- x	14		×E	119.01	1	0.76		0.8		278.99	(77
Southea	0.000	0.3	- x	14	_	×Ē	119.01	1	0.76		0.8	-	278.99	(77
Southea		0.3	- x	14	28	x	118.15	i . F	0.76	=	0.8	-1-1	276.97	(77
Southea		0.3		14		× [	118 15	1	0.76	= _ =	0.8		276.97	- (77
Southea	-	0.3	×	14		×	113.91	1 <u>.</u> F	0.76	=	0.8	-	267.03	1(77
Southea	-	0.3	×	14	_	×	113.91	i . F	0 76		0.8	= 1	267.03	1077
Southea	-	0.3	- x	14.		×	104 39	1 × F	0.76		0.8	-	244.71	177
Southea	-	0.3	×	14.		×E	104.39	i . F	0.76		0.8	-	244.71	177
Southea		0.3	×	14		×	92.85	╡┊╞	0.76		0.8	=	217.66	- (77
Southea		0.3		14	_	×	92.85	╡┊╞	0.76	= ÷	0.8		217.66	- 177
Southea		0.3		14		×Ē	69.27	1 . F	0.76	= . F	0.8	-	162.38	-177
Southea		0.3	- x	14.		×F	69.27	1 . F	0.76		0.8	=-   _	162.38	
Southea	L	0.3	- ×	14.		×F	44.07	1 .	0.76	= .	0.8	-	103.31	- 177
Southea	and a start of the	0.3		14.	_	×F	44.07	╡┊╞	0.76		0.8	-	103.31	- (77
Souther		0.3		14.		ĴF	31.49		0.76		0.8	-	73.61	(77
Southea		0.3	= ĵ	14.	_	x	31.49		0.76		0.8	-	73.81	
(83)m= Total g	72.5	watts, ca 293.84 nternal a 637.2	402.04	498,15	557.97	553	B)m , watts	(83)m = 489 4 754 2		(82)m 324.75 619.73	206.62 524.67	147.63 482.79		(83 (84
(83)m= Totalg (84)m= 7. Me	172.5 Jains — İ 517.9 Jan İnter	293.84 nternal a 637.2 nal temp	402.04 ind solar 733.03 berature	498,15 (84)m = 809,26 (heating	557 97 = (73)m 849.11	553 + (83 825	B)m , watts	489.4	3 435.33 3 710.22	324.75			21	
(83)m= Total g (84)m= 7. Me Temp	172.5 Jains — I 517.9 Jan Inter Derature	293.84 nternal a 637.2 nal tem during h	402.04 ind solar 733.03 berature beating p	498.15 (84)m = 809.26 (heating eriods in	557 97 = (73)m 849.11 season n the livi	553 + (83 825	3)m , watts 63 792.99	489.4	3 435.33 3 710.22	324.75			21	(84
(83)m= Total g (84)m= 7. Me Temp	172.5 Jains — I 517.9 Jan Inter Derature	293.84 nternal a 637.2 nal tem during h	402.04 ind solar 733.03 berature beating p	498.15 (84)m = 809.26 (heating eriods in	557 97 = (73)m 849.11 season n the livi	553 + (83 825 ing ai n (see	8)m , watts 63 792.99 rea from Ta	489.4	3 435.33 3 710 22 Th1 (°C)	324.75			21	(84
(83)m= Total g (84)m= 7. Me Temp	172.5 Jains – i 517.9 Jan Inter perature	293.84 nternal a 637.2 nal term during h ctor for g	402.04 ind solar 733.03 perature reating p ains for l	498.15 (84)m = 809.26 (heating eriods in iving are	557 97 = (73)m 849.11 season n the livi ea, h1,n	553 + (83 825 ing ai n (see	3)m, watts 63 792.99 rea from Ta e Table 9a) un Jul	489.4 754.2 able 9, 7	3 435.33 3 710 22 Th1 (°C)	324.75	524.67	482.79	21	(84
(83)m= Total g (84)m= 7. Me Temp Utilisa (86)m=	172.5 ains – i 517.9 an inter perature ation fac Jan 0.99	293.84 nternal a 637.2 nal term during h ctor for g Feb 0.96	402.04 and solar 733.03 berature teating p ains for l Mar 0.88	498,15 (84)m = 809,26 (heating eriods in iving are Apr 0,73	557 97 = (73)m 849.11 Season n the livi ea, h1,n May 0.55	553 + (83 825 1) ing ai n (see Ji 0.3	3)m, watts 63 792.99 rea from Ta e Table 9a) un Jul	489.4 754.2 ble 9, 7 Aug 0.3	3 435.33 3 710.22 Th1 (°C) g Sep 0.49	324.75 619.73 Oct	524.67 Nov	482.79	21	(84
(83)m= Total g (84)m= 7. Me Temp Utilisa (86)m=	172.5 ains – i 517.9 an inter perature ation fac Jan 0.99	293.84 nternal a 637.2 nal term during h ctor for g Feb 0.96	402.04 and solar 733.03 berature teating p ains for l Mar 0.88	498,15 (84)m = 809,26 (heating eriods in iving are Apr 0,73	557 97 = (73)m 849.11 Season n the livi ea, h1,n May 0.55	553 + (83 825 1) ing ai n (see Ji 0.3	8)m , watts 63 792 99 rea from Ta e Table 9a) un Jul 39 0.28 steps 3 to	489.4 754.2 ble 9, 7 Aug 0.3	3 435.33 3 710.22 Th1 (°C) g Sep 0.49	324.75 619.73 Oct	524.67 Nov	482.79	21	(84
83)m=   Total g (84)m=   7. Me Temp Utilisa (86)m=   Mean (87)m=	172.5 ains – i 517.9 an inter- berature ation fac Jan 0.99 i interna 20.5	293.84 Internal a 637.2 nal terms during h stor for g Feb 0.96 I temper 20.69	402.04 and solar 733.03 herature ains for l Mar 0.88 ature in 20.86	498,15 (84)m = 809,26 (heating eriods in iving are 0,73 living ar 20,97	557 97 = (73)m 849.11 SEASON n the livi ea, h1,n May 0.55 ea T1 (f 21	553 + (83 826 n (see 0.3 0.3 00llow	B)m         watts           63         792.99           rea from Ta         rea           a Table 9a)         Jul           Jun         Jul           39         0.28           steps 3 to         1           21         21	489.4 754.2 ble 9, 7 Aug 0.3 7 in Ta 21	3         435.33           3         716.22           Th1 (°C)         g           g         Sep           0.49         0.49           ble 9c)         21	324.75 619.73 Oct 0.79	524.67 Nov 0,97	482.79 Dec 0.99	21	(84
83)m=   Total g (84)m=   7. Me Temp Utilisa (86)m=   Mean (87)m=	172.5 ains – i 517.9 an inter- berature ation fac Jan 0.99 i interna 20.5	293.84 Internal a 637.2 nal terms during h stor for g Feb 0.96 I temper 20.69	402.04 and solar 733.03 herature ains for l Mar 0.88 ature in 20.86	498,15 (84)m = 809,26 (heating eriods in iving are 0,73 living ar 20,97	557 97 = (73)m 849.11 SEASON n the livi ea, h1,n May 0.55 ea T1 (f 21	553 + (83 826 n (see 0.3 0.3 00llow	B)m         watts           63         792.99           rea from Ta         rea           a Table 9a)         Jul           39         0.28           steps 3 to         1           21         Illing from T	489.4 754.2 ble 9, 7 Aug 0.3 7 in Ta 21	3 435.33 3 710.22 Th1 (°C) g Sep 0.49 ble 9c) 21 Th2 (°C)	324.75 619.73 Oct 0.79	524.67 Nov 0,97	482.79 Dec 0.99	21	(84
83)m=   Total g (84)m=   7. Me Temp Utilisa (86)m=   Mean (87)m=   Temp (88)m=	172.5 ains – i 517.9 an inter- perature ation fac Jan 0.99 interna 20.5 perature 20.63	293.84 nternal a 837.2 nal temp during h tor for g Feb 0.96 I temper 20.69 during h 20.63	402.04 and solar 733.03 betalure teating p ains for l Mar 0.88 ature in 20.86 teating p 20.63	498,15 (84)m = 809,26 (heating eriods in iving an 0,73 living an 20.97 eriods in 20.63	557 97 = (73)m 849.11 SEBSON n the livi ea, h1,n May 0.55 ea T1 (f 21 n rest of 20.63	5533 8256 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1)	3)m, watts.           3)m, watts.           rea from Ta           a Table 9a)           un           Jul           39           0.28           steps 3 to           1           21           lling from T           64           20.64	489.4 754.2 ble 9, 7 Aug 0.3 7 in Ta 21 able 9, 20.64	3 435.33 3 710.22 Th1 (°C) g Sep 0.49 ble 9c) 21 Th2 (°C)	324.75 619.73 Oct 0.79 20.95	524.67 Nov 0.97 20.71	482.79 Dec 0.99 20.45	21	(84 (85 (86 (87
83)m=   Total g (84)m=   7. Me Temp Utilisa (86)m=   Mean (87)m=   Temp (88)m=	172.5 ains – i 517.9 an inter- perature ation fac Jan 0.99 interna 20.5 perature 20.63	293.84 nternal a 837.2 nal temp during h tor for g Feb 0.96 I temper 20.69 during h 20.63	402.04 and solar 733.03 betalure teating p ains for l Mar 0.88 ature in 20.86 teating p 20.63	498,15 (84)m = 809,26 (heating eriods in iving an 0,73 living an 20.97 eriods in 20.63	557 97 = (73)m 849.11 SEBSON n the livi ea, h1,n May 0.55 ea T1 (f 21 n rest of 20.63	5533 8256 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1) 1)	3)m, watts.         63         792.99           rea from Ta         a         Table 9a)           un         Jul         390         0.28           steps 3 to         1         21           lling from T         64         20.64           o (see Table)         a         a	489.4 754.2 ble 9, 7 Aug 0.3 7 in Ta 21 able 9, 20.64	3         435.33           3         716.22           Th1 (°C)         3           g         Sep           0.49         0.49           ble 9c)         21           Th2 (°C)         4           20.64         20.64	324.75 619.73 Oct 0.79 20.95	524.67 Nov 0.97 20.71	482.79 Dec 0.99 20.45	21	(84 (85 (86 (87
83)m=   Total g (84)m=   7. Me Temp Utilisa (86)m=   Mean 87)m=   Temp 88)m=   Utilisa 89)m=	172.5 ains – i 517.9 an inter- perature ation fac 20.5 perature 20.63 ation fac 0.99	293.84 nternal a 637.2 nal temp during h tor for g Feb 0.96 I temper 20.69 during h 20.63 tor for g 0.95	402.04 and solar 733.03 berablic eating p ains for I Mar 0.88 ature in 20.86 eating p 20.63 ains for r 0.87	498,15 (84)m = 800,26 (heating eriods in iving an 0.73 iving an 20.97 eriods in 20.63 rest of d 0.71	557 97 = (73)m 849.11 555 ea T1 (f 21 n rest of 20.63 welling, 0.53	553 + (83 825 ) ing an (see 0.0 0.0 00 00 00 00 00 00 00 00 00 00 0	3)m, watts.         63         792.69           rea from Ta         a         Table 9a)           un         Jul         Jul           39         0.28           rsteps 3 to         1           1         21           11ing from T         64           20.64         1           10(see Table           36         0.25	489.4 754.2 bble 9, 7 Aug 0.3 7 in Ta 21 able 9, 20.64 e 9a) 0.28	3         435,33           3         716,22           Fh1 (°C)         3           g         Sep           0.49         0.49           ble 9c)         21           Th2 (°C)         1           20.64         0.46	324.75 619.73 Oct 0.79 20.95 20.63 0.77	524.67 Nov 0.97 20.71 20.63	482.79 Dec 0.99 20.45 20.63	21	(84 (85 (86 (87 (88
83)m= Total g 84)m= 7 Mee Temp Utilisa 86)m= Mean 87)m= Temp 88)m= Utilisa 89)m= Mean	72.5 ains - i 517.9 earl inter- eation fac Jan 0.99 interna 20.5 earature 20.63 ation fac 0.99 interna	293.84 Internal a 637.2 nal temp tor for g Feb 0.96 I temper 20.69 during h 20.63 tor for g 0.95 I temper	402.04 and solar 733.03 berabure eating p ains for I Mar 0.88 ature in 20.86 eating p 20.63 ains for r 0.87 ature in	498,15 (84)m = 809,26 (healing eriods in iving an 0,73 iving an 20.97 eriods in 20.63 rest of d 0,71 the rest	557 97 = (73)m 849.11 = 449.11 =	5533 + (83 825 ) ing an (see 0.3 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3)m         watts           63         792 59           rea from Ta         rea           a Table 9a)         Jun           Jun         Jul           39         0.28           steps 3 to         1           21         1           1064         20.64           10(see Table         36           36         0.25           2         (follow std)	489.4 754.2 bble 9, 7 Aug 0.3 7 in Ta 21 able 9, 20.64 e 9a) 0.28 eps 3 t	3         435.33           3         710.22           Th1 (°C)         3           g         Sep           0.49         0.49           ble 9c)         21           Th2 (°C)         4           0.64         0.46           0.46         o 7 in Tab	324.75 619.73 0ct 0.79 20.95 20.63 0.77 le 9c)	524.67 Nov 0.97 20.71 20.63 0.96	482.79 Dec 0.99 20.45 20.63 0.99	21	(84 (85 (86 (87 (88 (89)
83)m=   Total g (84)m=   7. Me Temp Utilisa (86)m=   Mean 87)m=   Temp 88)m=   Utilisa 89)m=	172.5 ains – i 517.9 an inter- perature ation fac 20.5 perature 20.63 ation fac 0.99	293.84 nternal a 637.2 nal temp during h tor for g Feb 0.96 I temper 20.69 during h 20.63 tor for g 0.95	402.04 and solar 733.03 berablic eating p ains for I Mar 0.88 ature in 20.86 eating p 20.63 ains for r 0.87	498,15 (84)m = 800,26 (heating eriods in iving an 0.73 iving an 20.97 eriods in 20.63 rest of d 0.71	557 97 = (73)m 849.11 555 ea T1 (f 21 n rest of 20.63 welling, 0.53	553 + (83 825 ) ing an (see 0.0 0.0 00 00 00 00 00 00 00 00 00 00 0	3)m         watts           63         792 59           rea from Ta         rea           a Table 9a)         Jun           Jun         Jul           39         0.28           steps 3 to         1           21         1           1064         20.64           10(see Table         36           36         0.25           2         (follow std)	489.4 754.2 bble 9, 7 Aug 0.3 7 in Ta 21 able 9, 20.64 e 9a) 0.28	3         435.33           3         710.22           Th1 (°C)         3           g         Sep           0.49         0.49           ble 9c)         21           Th2 (°C)         20.64           0.46         0.46           0.7 in Tab         20.32	324.75 619.73 0.000 20.95 20.63 0.77 ie 9c) 20.27	524.67 Nov 0.97 20.71 20.63	482.79 Dec 0.99 20.45 20.63 0.99 19.58		(84 (85 (86 (87 (88 (87 (88 (89) (90)
83)m= Total g 84)m= 7. Me 7. Me 86)m= Mean 88)m= 1. Mean 88)m= Utilisa 88)m= Utilisa 88)m= Mean Mean Mean 1.	72.5 5 sains – i 577.9 % san Inter- eerature eerature dation fac Jan 0.99 interna 20.5 werature 20.63 ation fac 0.99 interna 20.5 werature 20.63 ation fac	293.84 nternal a 837.2 nal terms during h tor for g Feb 0.96 1 temper 20.69 during h 20.63 tor for g 0.95 1 temper 19.91	402.04 md solar 733.03 becaure eating p ains for I 0.88 ature in 20.63 ains for r 0.87 ature in 20.15	498,15 (84)m = 809,26 (heating eriods in iving an 0.73 iving an 20.97 eriods in 20.63 rest of d 0.71 the rest 20.28	657 97 (73)m 849.11 <b>323507</b> <b>323507</b> <b>1323507</b> <b>1323507</b> <b>1323507</b> <b>1323507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b> <b>132507</b>	5533 6255 6255 6255 6255 6255 6255 6255	B)m         watts           63         702 69           rea from Ta         Table 9a)           a         Table 9a)           un         Jul           39         0.28           steps 3 to 0         21           11mg from T         21           11mg from T         24           10se trable 38         0.25           2         (follow st           32         20.32	488.4 754.2 bble 9, <sup>-</sup> 7 in Ta 21 able 9, 7 in Ta 21 able 9, 20.64 29a) 0.28 eps 3 t 20.32	3         435.33           3         710.22           Fh1 (°C)         3           9         Sep           0.49         0.49           ble 9c)         21           Th2 (°C)         20.64           0.46         0.46           0.7 in Tab         2.032	324.75 619.73 619.73 20.95 20.63 20.63 20.63 20.27 20.27 20.27	524.67 Nov 0.97 20.71 20.63 0.96 19.95	482.79 Dec 0.99 20.45 20.63 0.99 19.58	21	(84 (85 (86 (87 (88 (89)
83)m= [ Total g 84)m= [ 7. Me 7. Me 7. Me 168)m= [ Mean 88)m= [ Utilisa 89)m= [ Mean Mean Mean	772.5 3617.6 3617.6 3617.6 3617.6 3617.6 3617.6 361 3617.6 36	293,84 nternal a 837 2 nal temp during F tor for g Feb 0.96 I temper 20.69 during F 20.69 during F 20.63 tor for g 0.95 I temper 19.91 I temper	402.04 md solar 733.03 berabure teating p ains for 1 Mar 0.88 ature in 20.86 beating p 20.63 ains for 1 0.87 ature in 20.15	499,15 (64)m = 4 809 26 (heating arc arc 20 97 20 97 20 97 20 97 20 97 20 63 20 97 20 63 20 63 20 63 20 63 20 63 20 71 the rest 20 28	657 67 77 (73)m 849.11 3285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 13285000 132850000 132850000 13285000 13285000 13285000000000000000000000000000000000000	5533 5533 825 100 100 100 100 100 100 100 10	3)m         watts           63         702 09           rea from Ta         a           a Table 9a)         Jul           un         Jul           390         0.28           steps 3 to         1           1         21           lling from T         64           63         0.25           2         (close Table           30         2.2           32         20.32           a = fLA × T1	488.4 754.2 1754.2 100 9, 7 100	3         435.33           3         710.22           Fh1 (°C)         g           g         Sep           0.49         ble 9c)           21         Th2 (°C)           1         20.64           0.46         0.46           o 7 in Table         20.32           fLA) × T2	324.75 619.73 619.73 20.95 20.95 20.63 20.63 20.63 20.77 <b>Ie 9c)</b> 20.27 TLA = Livi	524.67 Nov 0.97 20.71 20.63 0.96 19.95 g area ~ (c	482.79 Dec 0.99 20.45 20.63 0.99 19.58 4) =		(84 (85 (86 (87 (88 (89 (89 (90)
83;m= Total g 84;m= 7. Me 7. Me 7. Me 86;m= Wean 887;m= Temp 889;m= Utilisa 899;m= Mean Mean Mean Mean Mean	72.5 517.9 can inter- can i	293.84 nternal a 837.2 nall term during h tor for g Feb 0.96 11 temper 20.63 during h 20.63 tor for g 0.95 11 temper 19.91 11 temper 20.2	402.04 and solar 733.03 aterature eating p ains for 0.88 ature in 20.63 ature in 0.87 ature in 0.87 ature in 0.87 ature (fo 20.41	498,15 (84)m = 1 (84)m = 2 (84)m = 2 (84)m = 2 (84)m = 2 (84)m = 2 (100)m = 2	657 87 7 (73)m (849.11) (74)m (849.11) (74)m (74)m	5533 5533 625 100 100 100 100 100 100 100 10	3)m         watts           63         702 09           rea from Ta         a           a Table 9a)         Jul           un         Jul           390         0.28           steps 3 to         1           1         21           lling from T         64           63         0.25           2         (close Table           30         2.2           32         20.32           a = fLA × T1	488.4 754.2 ble 9, * Aug 0.3 7 in Ta 21 20.64 e 9a) 0.28 eps 3 t 20.32 + (1 – 20.57	3         435.33           3         710.22           Th1 (°C)         g           g         Sep           0.49         0.49           ble 9c)         21           Th2 (°C)         1           0.46         0.46           o 7 in Tab         20.32           fLA) × T2         7           7         20.56	324.75 619.73 619.73 0.79 20.95 20.63 0.77 20.97 20.63 0.77 <b>k9.9c</b> ) 20.27 TLA = Livi	524.67 Nov 0.97 20.71 20.63 0.96 19.95	482.79 Dec 0.99 20.45 20.63 0.99 19.58		(84 (85 (86 (87 (88 (89 (89 (90) (91)



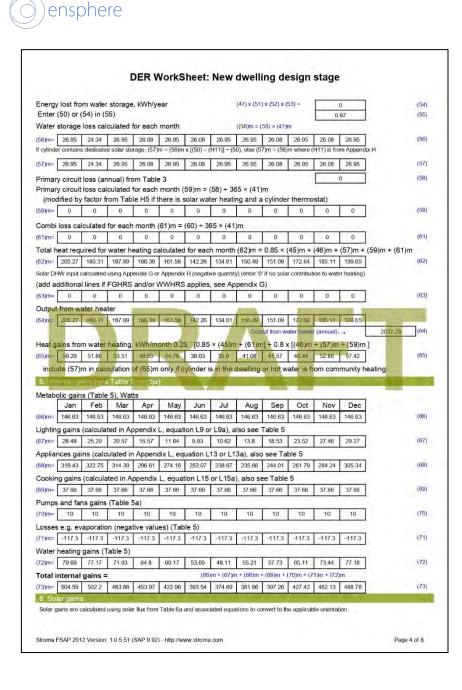




		1	lser Details:					
Assessor Name: Software Name:	Stroma FSAP		Softw	na Num /are Ve	rsion:	Versio	on: 1.0.5.51	
Address :	52 Tottenham	Bro Street, LONDO	perty Addres	s: WLC P	Proposed TF			
1. Overall dwelling dim	and a second second second second second second second second second second second second second second second	Street, EONEON	N, WIT 41414					
			Area(m <sup>2</sup> )		Av. Height(	m)	Volume(m	1 <sup>3</sup> )
Ground floor			53	(1a) x	2.6	(2a) =	137.8	(3a)
First floor			42	(1b) x	2.6	(2b) =	109.2	(3b)
Second floor			34	(1c) x	2.6	(2c) =	88.4	(3c)
Third floor			20	(1d) x	2.6	(2d) =	52	(3d)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)	+(1e)+ (1n)	149	](4)		_		_
Owelling volume	-, (, (, (		198	1	)+(3c)+(3d)+(3e	(30) =	387.4	(5)
and a state				(50) (50	1.(no).(no).(no)	(311) =	387.4	(5)
2. Ventilation rate:	main	secondary	other		total		m <sup>a</sup> per ho	ur
Number of chimneys	heating	+ 0	+ 0	F	0	x 40 =	0	(6a)
Number of open flues		*		=		x 20 =	-	(65)
Number of intermittent fa	0		0	μĻ	0	x 10 =	0	
				Ļ	0	x 10 =	0	(7a)
Number of passive vent	and the second se	-		Ļ	0		۵	(7b)
Number of flueless gas t	ires				0	x 40 =	Ū.	(7c)
			1			Air cl	hanges per h	our
nfiltration due to chimne	evs. flues and fans	= (6a)+(6b)+(7a)	+(7b)+(7c) =	-	0	+ (5) =	0	(8)
If a pressurisation test has				continue fi				
Number of storeys in t	the dwelling (ns)						0	(9)
Additional infiltration Structural infiltration: 0	25 for steel or tin	aber frame or 0	35 for maso	ny const		[(9)-1]x0,1 =	0	(10)
if both types of wall are p					luction		0	lin
deducting areas of open	• For a set of the							-
If suspended wooden If no draught lobby, er			(sealed), else	e enter 0			0	(12)
Percentage of window							0	(13)
Window infiltration			0.25 - [0	2 x (14) -	100] =		0	(15)
Infiltration rate			(8) + (10	) + (11) + (	12) + (13) + (15)	=	0	(16)
Air permeability value					netre of envelo	ope area	1.5	(17)
f based on air permeabi Air permeability value appli							0.08	(18)
Air permeability value appli Number of sides shelter	and the second second	est has been done o	or a degree air p	ermeability	is being used		1	(19)
Shelter factor			(20) = 1	- (0.075 x (	19)] =		0.92	(20)
nfiltration rate incorpora	ting shelter factor		(21) = (1	8) x (20) =			0.07	(21)
nfiltration rate modified						_		
Jan Feb	Mar Apr I	May Jun	Jul Aug	Sep	Oct N	ov Dec	1	



an be used instead of a detailed calculation. hermal bridges : S (L x Y) calculated using Appendix K details of thermal bridging are not known (36) = 0.05 x (31) colai fabric heat loss (3) + (36) = 77.55 (a) (3) + (36) = 77.55 (a) (1) (3) (1) (3) (1) (3) (1) (3) (1) (3) (1) (3) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1	(36) (37) (38) (39) (40) (41)
	(37 (38 (39 (40)
batal fabric heat loss       (3) + (36) =       77.55         entilation heat loss calculated monthly       (38)m = 0.33 × (25)m x (5) $ym = \frac{1}{26.33}$ $26.11$ $28.99$ $24.78$ $44.56$ $23.45$ $23.23$ $23.80$ $24.56$ $25$ $25.44$ $8ym = \frac{1}{26.33}$ $26.11$ $28.99$ $24.78$ $24.56$ $23.45$ $23.23$ $23.80$ $24.56$ $25$ $25.44$ $8ym = \frac{103.88}{103.66}$ $103.43$ $102.31$ $101$ $100.77$ $114.4$ $102.55$ $102.99$ $8ym = \frac{103.88}{103.66}$ $103.43$ $102.31$ $101.1$ $100.77$ $101.44$ $102.55$ $102.99$ $8ym = \frac{103.88}{103.66}$ $103.43$ $102.31$ $102.11$ $102.27$ $102.27$ $eat loss parameter (HLP), W/m²K$ $(40)m = (39)m = (4)$ $102.27$ $102.27$ $90m = 0.7$ $0.7$ $0.69$ $0.68$ $0.68$ $0.68$ $0.69$ $0.69$ $0.69$ $ym = \frac{1}{31}$ $28$ $31$ $30$ $31$ $30$ $31$ $30$ $31$ $30$ $31$	(38
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	(39 (40)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(39 (40)
sat transfer coefficient, W/K       (39)m = (37) + (38)m         Average = Sum(39)	(39 (40)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(40
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(40
Average = Sum(39)v/12=       102 27         (40)m = (39)m + (4)         ym=       0.7       0.7       0.69       0.69       0.68       0.68       0.68       0.69<	(40
at loss parameter (HLP), W/m²K       (40)m = (39)m * (4)         ym =       0.7       0.7       0.69       0.69       0.68       0.68       0.68       0.69       0.69       0.69         mber of days in month (Table 1a)       Average = Sum(40), r/12=       0.69         ym =       Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         ym =       31       2.8       31       30       31       31       30       31       30       31         Water healing energy requirement:       kWh year:         sumed occupancy, N       f TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)       2.00         f TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)       109.32       109.32         dos the annual varage tok water usage in litres per day Vd, average = (25 x N) + 36       109.32       109.32	(40)
$\begin{array}{c c} Average = Sum(40)_{1,nr}/12= & 0.69\\ \hline \mbox{imber of days in month (Table 1a)} & & & & \\ \hline \mbox{Jan} & \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
Imber of days in month (Table 1a)         Imber of days in month (Table 1a)	
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           31         28         31         30	(41
ym=       31       28       31       30       31       31       30       31       31       30       31 <t< td=""><td>(41</td></t<>	(41
Water healing energy requirement: KWh/year: sumed occupancy, N 1 TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) 1 TFA > 13.9, N = 1 nual average hot water usage in litres per day Vd,average = (25 x N) + 36 109.32 2 00 109.32	(41
sumed occupancy, N f TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) f TFA E (13.9, N = 1 nual average hot water usage in litres per day Vd,average = (25 x N) + 36 dues the annual average hot water usage by 5% of the liveling is designed to achieve a water use target of	
sumed occupancy, N f TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) f TFA E (13.9, N = 1 nual average hot water usage in litres per day Vd,average = (25 x N) + 36 dues the annual average hot water usage by 5% of the liveling is designed to achieve a water use target of	
f TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) f TFA E 13.9, N = 1 nual average hot water usage in litres per day Vd,average = (25 x N) + 36 Loss the annual average hot water usage by 5% if the twelling is designed to achieve a water use target or dates the annual average hot water usage by 5% if the twelling is designed to achieve a water use target or	(4)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
water usage in lifes per day for each month Vd,m = factor from Table 1 c x (43)	
m= 120.25 115.87 111.5 107.13 102.76 98.38 98.38 102.76 107.13 111.5 115.87 120.25	2
Total = Sum(44) <sub>1-14</sub> = 1311.70	8 (44
ergy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)	
)m= 178.32 155.96 160.94 140.31 134.63 116.18 107.65 123.54 125.01 145.69 159.03 172.7	_
Total = Sum(45) I = 1719.90 Instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	8 (45
ym= 26.75 23.39 24.14 21.05 20.19 17.43 16.15 18.53 18.75 21.85 23.85 25.9	(46
ater storage loss:	(40
prage volume (litres) including any solar or WWHRS storage within same vessel	(47
community heating and no tank in dwelling, enter 110 litres in (47)	(4)
	(4)
	(4)
ater storage loss:	
ater storage loss: If manufacturer's declared loss factor is known (kWh/day): 0.54	(48
ater storage loss: If manufacturer's declared loss factor is known (kWh/day): 0.54 mperature factor from Table 2b 0.8694	(48 (49
ater storage loss:     0.54       If manufacturer's declared loss factor is known (kWh/day):     0.54       mperature factor from Table 2b     0.8694       ergy lost from water storage, kWh/year     (48) x (49) =     0	(48
ater storage loss:     0.54       If manufacturer's declared loss factor is known (kWh/day):     0.54       mperature factor from Table 2b     0.8694       ergy lost from water storage, kWh/year     (43) x (49) =       if manufacturer's declared cylinder loss factor is not known:     0	(48 (49
Imperature factor from Table 2b     0.8694       bergy lost from water storage, kWh/year     (48) × (49) =     0       If manufacturer's declared cylinder loss factor is not known:     0	(48 (49 (50)
ater storage loss:       0.54         If manufacturer's declared loss factor is known (kWh/day):       0.54         mperature factor from Table 2b       0.8694         ergy lost from water storage, kWh/year       (48) × (49) =         If manufacturer's declared cylinder loss factor is not known:       0         twater storage loss factor from Table 2 (kWh/litre/day)       0         ommunity heating see section 4.3       0         stume factor from Table 2a       0	(48 (49 (50)
ater storage loss:       0.54         If manufacturer's declared loss factor is known (kWh/day):       0.54         mperature factor from Table 2b       0.8694         ergy lost from water storage, kWh/year       (48) × (49) =         If manufacturer's declared cylinder loss factor is not known:       0         t water storage loss factor from Table 2 (kWh/litre/day)       0         community heating see section 4.3       0	(48 (49 (50)



	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.3	× [	13.26	x	36.79	×	0.76	x	0.8	] = [	80.09	(77
Southeast 0.9x	0.3	×	13.26	x	36.79	x	0.76	Ī×	0.8	ī - ī	80.09	(77
Southeast 0.9x	0.54	×	13.26	×	36.79	×	0.72	] ×	0.8	ī - [	136.58	(77
Southeast 0.9x	0.77	×	13.26	x	36.79	x	0.72	×	0.8	i - i	194.75	(77
Southeast 0.9x	0.3	×	13.26	x	62 67	x	0.76	×	0.8	] = [	136.43	(77
Southeast 0.9x	0.3	x	13.26	x	62.67	x	0.76	] × [	0.8	j = j	136.43	(77
Southeast 0.9x	0.54	×	13.26	x	62.67	×	0.72	1 ×	0.8	ו - ו	232.64	(77
Southeast 0.9x	0.77	x	13.26	x	62.67	x	0.72	] ×	0.8	] = [	331.73	(77
Southeast 0.9x	0.3	×	13.26	×	85.75		0.76	1 ×	0.8	וֹ - וֹ	186.66	(77
Southeast 0.9x	0.3	×	13.26	x	85.75	×	0.76	x	0.8	<b>1</b> - [	186.66	(77
Southeast 0.9x	0.54	×	13.26	×	85.75	×	0.72	ī x	0.8	ī - [	318.31	(77
Southeast 0.9x	0.77	×	13.26	x	85.75	] × [	0.72	] ×	0.8	] = [	453.89	(77
Southeast 0.9x	0.3	×	13.26	×	106.25	×	0.76	×	0.8	i - i	231.28	(77
Southeast 0.9x	0.3	x	13.26	x	106.25	×	0.76	×	0.8	] = [	231.28	(77
Southeast 0.9x	0.54	×	13.26	×	106.25	x	0.72	×	0.8	ī - Ē	394.4	(77
Southeast onx	0.77	×	13.26	x	106.25	x	0.72	x	0.8	1 = 1	562.39	(77
Southeast 0.9x	0.3	x	13.26	x	119.01	X	0.76		0.8	1 - 1	259.06	(7)
Southeast 0.9x	Ó.3	×	13.26	×	119.01	×	0.76	×	0.8	i - F	259.06	(77
Southeast 0.9x	0.54	×	13.26	x	119.01	1×	0.72	×	0.8	ī = ī	441.76	(77
Southeast 0.9x	0.77	×	13.26	×	119.01	×	0.72	×	0.8	i = i	629.92	(77
Southeast 0.9x	03	×	13.26	×	118.15	1-x	0.76	×	0.8	i = i	257 18	(77
Southeast 0.9x	03	x	13.26	R.	118 15	×	0.76	*	0.8	i - i	257 18	(7)
Southeast 0.9x	0.54	×	13.26	×	118.15	×	0.72	×	0.8	i - F	438.57	(77
Southeast 0.9x	0.77	×	13.26	x	118.15	x	0.72	i x	0.8	i - i	625.36	1(77
Southeast 0.9x	0.3	×	13.26	×	113.91	×	0.76	ī ×	0.8	ī = ī	247.95	(77
Southeast 0.9x	0.3	x	13.26	×	113.91	×	0.76	i x	0.8	i = i	247.95	1(77
Southeast 0.9x	0.54	×	13.26	×	113.91	x	0.72	ī .	0.8	<b>i</b> = i	422.83	(77
Southeast 0.9x	0,77	×	13.26	x	113,91	×	0.72	1 x	0.8	i - i	602.92	(77
Southeast 0.9x	0.3	×	13.26	x	104.39	x	0.76	ī ×	0.8	i - i	227.23	(77
Southeast 0.9x	0.3	×	13.26	x	104.39	x	0.76	i ×	0.8	i - i	227.23	1(77
Southeast 0.9x	0.54	×	13.26	×	104.39	×	0.72	1 ×	0.8	i = i	387.49	1(77
Southeast 0.9x	0.77	×	13.26	×	104.39	x	0.72	i .	0.8	i - i	552.54	(77
Southeast 0.9x	0.3	x	13.26	x	92.85	×	0.76	i .	0.8	i - F	202.12	(77
Southeast 0.9x	0.3	×	13.26	x	92.85	x	0.76	1 x	0.8	i - i	202.12	(77
Southeast 0.9x	0.54	×	13.26	×	92.85	x	0.72	i ×	0.8	i - i	344.66	(77
Southeast 0.9x	0.77	×	13.26	×	92.85	×	0.72	×	0.8	i - i	491.46	1(77
Southeast 0.9x	0.3	×	13.26	x	69.27	x	0.76	i .	0.8	i - i	150.78	(77
Southeast 0,9x	0.3	×Ī	13.26	×	69.27	×	0.76	1 ×	0.8	i - i	150.78	1(77
Southeast 0.9x	0.54	×	13.26	×	69.27	1 x	0.72	×	0.8	i - i	257.12	(77
										- 1		_
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Southe	asto 9x	0.77	×	13	26	×	69.27	-	×	0.72	] * [	0.8		366.63	(77
	ast 0.9x	0.77		13	_	× _	44 07	-	× _	0.72	= * F	0.8	=	95.93	
	ast 0.9x	0.3	- x	13		x H	44.07	=	× –	0.76	= ÷ F	0.8	- : F	95.93	
	ast 0.9x	0.54	- x	13		x H	44.07			0.70	╡┊╞	0.8	=	163.59	
	ast 0.9x	0.54	x	13		×	44.07	=	× –	0.72		0.8	╡₌╞	233.26	(7)
	ast 0.9x	0.3	×	13		x	31.49	=		0.76	×	0.8	=	68.54	(7)
Southe	asto.9x	0.3	×	13		×	31.49	=	×	0.76	= <u>,</u> -	0.8	=i - F	68.54	(7)
Southe	asto.9x	0.54	x	13	26	×	31.49	=	×	0.72	×	0.8	=	116.88	(7)
Southe	asto.9x	0.77	x	13	26	x	31.49	1	×	0.72	1×1	0.8		166.66	(7)
(83)m= Total g	491.51 gains — i	837.22 nternal a	alculated 1145.52 and solar	1419.36 (84)m =	1589.8 = (73)m		m , watt	.65 1 ts	394.49	um(74)m 1240.36	.(82)m 925.31	588.71	420.63		(8:
(84)m=	996.1	1339.42	1629.4	1873.33	2012.76	1971	84 1896	.34 1	776.15	1637.62	1352.72	1050.84	909.41		(84
			perature												
			neating p						9, Th	1 (°C)				21	(8)
Utilisa	-	1	ains for I	-	1	<u> </u>	-	<u> </u>	A	C	0-1	Net	Deal		
86)m=	Jan 0.99	Feb D 96	Mar 0.84	Apr 0.65	0.47	Ju 0.3	-	_	Aug 0.26	Sep 0.43	Oct 0.76	Nev	Dec	-	100
- P	-	-	-	-	-	-	-	1		100	0,70	0.97			105
Mean 87)m=	20.49	20,73	ature in	living an 20.99	ea T1 (fe	21	steps 3	_	n Table 21	21 21	20.97	20.72	20.43		(8)
	-	-	-		-		-	-	-		20.97	20.12	20.45		10
Temp 88)m=	20.65	during 1 20.65	20.65	20.66	20.66	dwell	-	_	20.66	12 (°C) 20.06	20.66	20.66	20.65		(8)
		-	-			-				20,00	20.00	20.00	20.05		100
	0.99	0.95	ains for	0.63	welling, 0.45	n2,m	-	_	a) 0.24	0.41	0.74	0.97			(8)
89)m=				2182		1.000	-	-	100			0.97	1		100
	19.66		20.25	20.34	of dwell 20.35	ng T2 20.3			s 3 to 1 20.36	20.36	e 9c) 20.33	20	19.59		(90
90)m=	19.66	20.01	20.25	20.34	20.35	20.3	6 20.3	30	20.36			20 g area + (4		0.2	(9)
								Ξ.				3 (	L	0.2	
	_	1	ature (fo		-					A) × T2 20.49	20.46	20.45	10.78		(0)
(92)m=	19.83	20.16	20.38 he mean	20.47 interna	20.48	20.4		_	20.49		20.46	20.15	19.76		(92
(93)m=	19.83	20.16	20.38	20.47	20.48	20.4		-	20.49	20 49	20.46	20.15	19.76		(93
		iting teq											-		
Set T	i to the	mean in				ed at	step 11	of T	able 9	, so tha	t Ti,m=(	76)m an	d re-calcu	late	
are di	Jan	Feb	Mar	Apr	May	Ju	n Ju	T	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		ivitaly	00		· 1	, ug	ocp.	001	1107	Dec		
94)m=	0.99	0.94	0.82	0.63	0.45	0.3	0.2	1	0.23	0.4	0.72	0.96	0.99		(94
Usefu	l gains,	hmGm	. W = (94	4)m x (8	4)m	_							-		
95)m=	986.37	1264.03	1338.87	1171.3	895 86	594.		.8	412.2	647.6	978.37	1011 17	904.34		(95
	-		ernal tem			-	-			-					
96)m=	4.3	4.9	6.5	8.9	11.7	14.6		_	16.4	14.1	10.6	7.1	4.2		(96
	loss rat		an intern			Lm,		-	(93)m 412.2	- (96)m 647.89	1006.49	1338.16	1602.24		(97
Heat (97)m=	1613.05	1581.4	1436.07	1184.02	896.8	594.	79 392								

	466 25	213.28	72.32	9.16	0.7	0	0	4 X [(97	0 m – (95	)m] x (4 20.92	235 43	519.23		
	100.20	110.10	TEOL	0.10	0.1	5				(kWh/year			1537.29	(98)
Space	heatin	g require	ment in	kWh/m	/year							Ē	10.32	(99)
9a Ene	rgy ren	uiremen	ts – Ind	ividual h	eating s	ystems i	néluding	micro-C	HP)			-		
Space	heatin	ng:										. Le		-
	10.13	ace hea				mentary		(2022) - 4	10041-			Ļ	0	(201)
		ace hea						(202) = 1 -	- (201) =			F	1	(202)
		ain heati tal heatir						(204) = (2	- 11 + (50	(203)] =		-	0	(203)
		main spa	Č.,					(201) - (2	02) - [1	120011-		H	100	(204)
		seconda				a system	1. %					F	0	(208)
Г	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	_
Space		g require						. lag	- oop					
[	466.25	213.28	72.32	9.16	0.7	0	0	0	0	20.92	235.43	519.23		
(211)m		)m x (20						_		_	_			(211)
L	465.78	213.06	72.24	9.15	0.7	0	0	0	0	20.9 ar) =Sum(2	235.2	518.71	1535.75	(211)
Water I	from wa	ater heat	ter (calc 187.89	ulated a	bove)	142.26	134.61	150.49	151.09	ar) =Sum(2	185.11	199.65	0	(215)
- alpar		180.31	187.89	100.39	101.58	142.20	134.61	150.49	151.09	1/2.04	185.11	199,05	346.52	(216)
		ater hea	ter									a second s	O TO.OL	1
Efficien	cy of w	ater hea 346.52	346.52	346.52	346.52	346.52	346.52	346.52	346.52	346.52	346.52	346.52		(217)
Efficien (217)m=[ Fuel for	cy of w 346.52 water	346.52 heating,	346.52 kWh/mo	onth	346.52	346.52	346.52	346.52	346.52	346.52	346.52	346.52		(217)
Efficien (217)m= Fuel for (219)m	cy of w 346.52 water = (64)	346.52 heating, m x 100	346.52 kWh/mo + (217)	onth m			346.52		346.52 43.6		346.52 53.42			(217)
Efficien (217)m= Fuel for (219)m	cy of w 346.52 water = (64)	346.52 heating,	346.52 kWh/mo	onth	346.52 46.63	346.52 41.05		43.43		49.82		346.52 57.61	587 92	(217)
Efficien (217)m=[ Fuel for	cy of w 346.52 water = (64) 59.24	346.52 heating, m x 100	346.52 kWh/mo + (217)	onth m				43.43	43.6	49.82 19a) <sub>1.12</sub> =		57.61	587 92 kWh/yea	(219)
Efficien (217)m=[ Fuel for (219)m (219)m=[ Annual	cy of w 346.52 water = (64) 59.24	346.52 heating, m x 100	346.52 kWh/mo + (217) 54.22	onth m 48.02	46.63			43.43	43.6	49.82 19a) <sub>1.12</sub> =	53.42	57.61		(219)
Efficien (217)m= Fuel for (219)m= (219)m= Annual Space I	cy of w 346.52 water = (64) 59.24 totals	346.52 heating, m x 100 52.03	346.52 kWh/mo + (217) 54.22 d, main	onth m 48.02	46.63			43.43	43.6	49.82 19a) <sub>1.12</sub> =	53.42	57.61	kWh/yea	(219)
Efficien (217)m= Fuel for (219)m= (219)m= Annual Space I Water h	cy of w 346.52 water = (64) 59.24 totals heating	346.52 heating, m x 100 52.03 fuel use	346.52 kWh/mo + (217) 54.22 d, main d	onth m 48.02 system	46.63 1	41.05		43.43	43.6	49.82 19a) <sub>1.12</sub> =	53.42	57.61	<b>kWh/yea</b> 1535.75	(219)
Efficien (217)m=[ Fuel for (219)m=[ Annual Space I Water H Electric	cy of w 346.52 water = (64) 59.24 totals heating neating ity for p	346.52 heating, m x 100 52.03 fuel use	346.52 kWh/md + (217) 54.22 d, main d	system	46.63 1 keep-ho	41.05	38.84	43.43 Tota	43.6 I = Sum(2	49.82 19a) <sub>1.12</sub> =	53.42	57.61	<b>kWh/yea</b> 1535.75	](219) r ]
Efficien (217)m= Fuel for (219)m= (219)m= Space I Water H Electric mecha	cy of w 346.52 water = (64) 59.24 totals heating heating ity for p anical v	346.52 heating, m x 100 52.03 fuel use fuel use	346.52 kWh/mc + (217) 54.22 d, main d ans and n - balan	system electric	46.63 1 keep-ho ract or p	41.05	38.84	43.43 Tota	43.6 I = Sum(2	49.82 19a) <sub>1.12</sub> =	53.42 Wh/year	57.61	<b>kWh/yea</b> 1535.75	(219)
Efficien (217)m= Fuel for (219)m= (219)m= Space I Water H Electric mecha	cy of w 346.52 water = (64) 59.24 totals heating heating ity for p anical v ectricity	346.52 heating, m x 100 52.03 fuel use fuel use fuel use fuel use fuel use fuel use fuel use fuel use	346.52 kWh/mc + (217) 54.22 d, main d ans and n - balan	system electric	46.63 1 keep-ho ract or p	41.05	38.84	43.43 Tota	43.6 I = Sum(2	49.82 19a) <sub>12</sub> = <b>k</b> 1	53.42 Wh/year	57.61	kWh/yea 1535.75 587.92	(219) r (230)
[ Efficien (217)m= Fuel for (219)m= (219)m= Space I Space I Water H Electric mecha Total el Electric	cy of w 346.52 water = (64) 59.24 totals heating ity for p anical v ectricity ity for li	346.52 heating, m x 100 52.03 fuel use fuel use fuel use fuel use fuel use fuel use fuel use fuel use	346.52 kWh/mc + (217) 54.22 d, main d ans and n - balan above, l	system electric ced, ext	46.63 1 keep-ho ract or p	41.05 t	38.84	43.43 Tota n outside sum	43.6 I = Sum(2 e of (230a).	49.82 19a) <sub>12</sub> = <b>k</b> 1	53.42 Wh/year	57.61	kWh/yea 1535.75 587.92 635.21	(219) r (230) (231)



Space heating (secondary) $(215)$ x $0.519$ = $0$ $(21)$ Water heating $(219)$ x $0.519$ = $305.13$ $(21)$ Space and water heating $(261) + (262) + (263) + (264) =$ $1102.19$ $(21)$ $(231)$ x $0.519$ = $329.68$ $(22)$ Electricity for lighting $(232)$ x $0.519$ = $261.02$ $(22)$ Total CO2, kg/year       sum of $(265)(271) =$ $1692.88$ $(22) - (4) =$ $11.36$ $(22) - (4) =$		Energy kWh/year	Emission factor kg CO2/kWh		sions )2/year
Water heating         (219) x         0.519         =         305 13         (28)           Space and water heating         (261) + (262) + (263) + (264) =         1102 19         (28) <th>Space heating (main system 1)</th> <th>(211) x</th> <th>0.519</th> <th>= 797.</th> <th>06 (26</th>	Space heating (main system 1)	(211) x	0.519	= 797.	06 (26
Unit         Unit <th< td=""><td>Space heating (secondary)</td><td>(215) x</td><td>0.519</td><td>= 0</td><td>(26</td></th<>	Space heating (secondary)	(215) x	0.519	= 0	(26
Electricity for pumps, fans and electric keep-hot         (231) x         0.519         329.68         (2)           Electricity for lighting         (232) x         0.519         261.02         (2)           Total CO2, kg/year         sum of (265)(271) =         1692.88         (2)           Dwelling CO2 Emission Rate         (272) - (4) =         11.36         (2)	Vater heating	(219) x	0.519	= 305	13 (20
Electricity for lighting         (232) x         0.519         =         261.02         (24)           Total CO2, kg/year         sum of (265)(271) =         1692.88         (22)           Dwelling CO2 Emission Rate         (272) - (4) =         11.36         (22)	Space and water heating	(261) + (262) + (263)	+ (264) =	1102	.19 (26
Total CO2, kg/year         sum of (265)(271) =         1692.88         (27)           Dwelling CO2 Emission Rate         (272) - (4) =         11.36         (2)	Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 329.	68 (26
Dwelling CO2 Emission Rate (272) - (4) = 11.36 (2	Electricity for lighting	(232) ×	0.519	= 261.	02 (26
	Fotal CO2, kg/year		sum of (265)(271) =	1692	.88 (27
El rating (section 14)	Dwelling CO2 Emission Rate		(272) - (4) =	11.3	16 (27
DRAFT	El rating (section 14)			88	(2)
	DR		F		1
	DR				
	DR				

#### **BRUKL Output Document** HMGovernment Compliance with England Building Regulations Part L 2013 Project name Tottenham Street\_Be Green As designed Date: Tue May 31 13:14:11 2022 Administrative information **Building Details** Address: 52 Tottenham St, London, W1T 4RN Certification tool Calculation engine: SBEM **Certifier details** Calculation engine version: v5.6.b.0 Name: Pete Jeavons Interface to calculation engine: Virtual Environment Telephone number: Phone Interface to calculation engine version: v7.0.14 Address: 52 Grosvenor Gardens, London, SW1W DAU BRUKL compliance check version: v5.6.b.0 Criterion 1: The calculated CO, emission rate for the building must not exceed the target CO2 emission rate from the notional building, kgCO3/m2 annum 12.1 Target CO, emission rate (TER), kgCO<sub>2</sub>/m<sup>2</sup>.annum 12.1 Building CO<sub>2</sub> emission rate (BER), kgCO<sub>2</sub>/m<sup>2</sup>.annum 11.2 Are emissions from the building less than or equal to the target? BER =< TER Separate submission Are as built details the same as used in the BER calculations? Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red. **Building fabric** Element Ua-Limit Ua-cate ULCate Surface where the maximum value occurs\* 0.35 0.2 0.2 "RM000000\_W1" Wall\*\* 0.25 0.22 0.22 "RM000000\_F" Floor Roof 0.25 0.13 0.13 "RM000001 C" Windows\*\*\*, roof windows, and rooflights 2.2 1.4 1.4 "PL000000\_W-1\_O0" Personnel doors 2.2 -"No external personnel doors" Vehicle access & similar large doors 1.5 -"No external vehicle access doors" High usage entrance doors 3.5 -"No external high usage entrance doors" U+Linit = Limiting area-weighted average U-values (W/(m<sup>2</sup>K)) U-one = Calculated maximum individual element U-values (W/(m/K)) U+cw = Calculated area-weighted average U-values [W/(m/K)] There might be more than one surface where the maximum U-value occurs. "Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. \*\*\* Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool. **Air Permeability** Worst acceptable standard This building m1/(h.m²) at 50 Pa 10 4 Page 1 of 6



### **Building services**

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

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

### 1-ASHP

	leating efficiency	<b>Cooling efficiency</b>	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system 3	3.06 -			•	-
Standard value 2	2.5*	N/A	N/A	N/A	N/A
Automatic monito	oring & targeting w	ith alarms for out-of	-range values for th	is HVAC system	n YES

### 2- DWH

	Heating efficiency	<b>Cooling efficiency</b>	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.06	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic moni	itoring & targeting w	ith alarms for out-of	-range values for th	is HVAC system	n YES
* Standard shown is for limiting standards		except absorption and ga	s engine heat pumps. For t	ypes <=12 kW outp	ut, refer to EN 1483

### 1- SYST0004-DHW

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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	
Resi cycle storage -1F	-	80	-	32
Plant room -1F	80	-	×	185
Store -1F	80	-	2	14
Refuse holding -1F	80	-	-	13
Circulation area -1F	-	80	*	94
Circulation area GF	-	80	÷	119
Toilet GF	-	80	e.	51
Commercial GF	80	-	-	381

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

Zone Commercial GF 
 Solar gain limit exceeded? (%)
 Internal blinds used?

 YES (+149.3%)
 NO

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

Separate submission

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

Separate submission

### EPBD (Recast): Consideration of alternative energy systems

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

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Area (m²) External area (m²) Weather Infiltration (m²/hm²@ SOPa Average conductance (W// Average U-value (W/m²()	Actua 164.6 358.1 LON			
External area [m <sup>2</sup> ] Weather Infiltration (m <sup>2</sup> /hm <sup>2</sup> @ 50Pa Average conductance [W/i	164.6 358.1 LON		% Are	a Building Type
External area [m <sup>2</sup> ] Weather Infiltration (m <sup>2</sup> /hm <sup>2</sup> @ 50Pa Average conductance [W/i	358.1 LON			A1/A2 Retail/Financial and Professional services
Weather Infiltration [m³/hm²@ 50Pa Average conductance [W/i		358.1		A3/A4/A5 Restaurants and Cafes/Drinking Est/Takeaways
Average conductance [W/	at 4	LON	100	B1 Offices and Workshop businesses B2 to B7 General Industrial and Special Industrial Groups
	aj 4	5		B2 to B7 General Industrial and Special Industrial Groups B8 Storage or Distribution
Augeneral Linghus DAtter 241	/K] 97.65	136.34	_	C1 Hotels
average u-value [vv/m·K]	0.27	0.38		C2 Residential Institutions: Hospitals and Care Homes C2 Residential Institutions: Residential schools
Alpha value* [%]	24.87	16.5		G2 Residential Institutions: Residential schools G2 Residential Institutions: Universities and colleges
Energy Consump		End lise IkW	h/m²1	D1 Non-residential Institutions: CommunityDay Centre D1 Non-residential Institutions: Education D1 Non-residential Institutions: Education D1 Non-residential Institutions: Primary Health Cene Building D1 Non-residential Institutions: Crown and County Courts D2 General Assembly and Leisure. Night Clubs, and Theatres Others: Passenger terminals Others: Maseilameous 24th addities Others: Misseilameous 24th addities Others: Stand alone utility block
Energy consump	ntion hy			
Heating	Actual	Notiona		
Heating	Actual 6.53	Notiona 10.32		
Cooling	Actual	Notiona 10.32 0		
Cooling Auxiliary	Actual 6.53 0	Notiona 10.32		
	Actual 6.53 0 1.45	Notiona 10.32 0 0.72		
Cooling Auxiliary Lighting	Actual 6.53 0 1.45 13.92	Notiona 10.32 0 0.72 12.8		
Cooling Auxiliary Lighting Hot water	Actual 6.53 0 1.45 13.92 0.14	Notiona 10.32 0 0.72 12.8 0.16		
Cooling Auxiliary Lighting Hot water Equipment*	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04	Notiona 10.32 0 0.72 12.8 0.16 57.23 24	al	
Cooling Auxiliary Lighting Hot water Equipment* TOTAL**	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04	Notiona 10.32 0 0.72 12.8 0.16 57.23 24 as for consumption or calculat members, Plasticable.	al	
Cooling Auxiliary Lighting Hot water Equipment* TOTAL** Energy used by southment does not cour Toda is not of any ecorrise energy doo	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04	Notiona 10.32 0 0.72 12.8 0.16 57.23 24 as for consumption or calculat members, Plasticable.	al	
Cooling Auxiliary Lighting Hot water Equipment* TOTAL** "Toe serie dray econce energy data Energy Productio Photovoltaic systems	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04 wit beasts the tot subsect by CHP performance on by Te Actual 0	Notiona 10.32 0 0.72 12.8 0.16 57.23 24 is to consumption or calcular intervention or calcular is consumption or calcular is consum	al	
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Cooling Auxiliary Lighting Hot water Gotter TOTAL** Energy Production Energy Production Photovoltaic systems Wind turbines CHP generators	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04 vir bases the tot secret by CHP and on by Te Actual 0 0 0	Notion           10.32         0           0.72         12.8           10.6         57.23           24         24           to for consumption or statulation and statements or statulation and statements of statements or statements of	al	
Cooling Auxiliary Lighting Hot water Equipment* TOTAL** "Tota is net of any records energy data Energy Productio Photovoltaic systems Wind turbines CHP generators Solar thermal systems	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04 vir bases the tot secret by CHP and on by Te Actual 0 0 0	Notion           10.32         0           0.72         12.8           10.6         57.23           24         24           to for consumption or statulation and statements or statulation and statements of statements or statements of	al	
Cooling Auxiliary Lighting Hot water Equipment* TOTL** "Tota is net of any records energy dash Energy Productio Photovoltaic systems Wind turbines CHP generators Solar thermal systems Energy & CO <sub>2</sub> Em	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04 sector by Cell and 0 0 0 0 0 0 0 0 0 0 0	Notiona 10.32 0 0.72 12.8 0.16 57.23 24 the for consumption or calculate internation, if associate the consumption or calculate the constraints of the constraints of the constraints the constraints of the constraints of the constraints the constraints of the constraints	al Pro emissions. Vh/m <sup>*</sup> ] al	
Cooling Auxiliary Lighting Hot water Equipment* TOTAL** "Tota is net of any records energy data Energy Productio Photovoltaic systems Wind turbines CHP generators Solar thermal systems	Actual 6.53 0 1.45 13.92 0.14 57.23 22.04 sectors for both on by Te Actual 0 0 0 0 0 0 0 0 0 0 0 0 0	Notion           10.32         0           0.72         12.8           0.16         57.23           24         57.23           24         24           schnology [kW         Notion:           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0           0         0	al meenusous Vh/m <sup>2</sup> ] al Notional	

HV.	AC	SV	ste	ms	Per	for	mar	hC

System Type	Heat dem MJ/m2			Cool con kWh/m2			Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central h	eating using	water: floo	or heating,	[HS] Heat p	ump (elect	ric): air so	urce, [HFT]	Electricity,	[CFT] Elect
Actual	67.6	59.7	6.5	0	1.4	2.87	0	3.06	0
						2.43	1		

#### 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

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## Oensphere

### **Key Features**

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

	ULTyp.	ULMIN	Surface where the minimum value occurs
Wall	0.23	0.2	"RM000000_W1"
Floor	0.2	0.22	"RM000000_F"
Roof	0.15	0.13	"RM000001_C"
Windows, roof windows, and rooflights	1.5	1.4	"PL000000_W-1_O0"
Personnel doors	1.5	-	"No external personnel doors"
/ehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
Urive = Typical individual element U-values [W/(mik	)i		Unwer = Minimum individual element U-values [W/(m <sup>2</sup> K)]

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

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## F. General Notes

# Oensphere

The report is based on information available at the time of the writing and discussions with the client during any project meetings. Where any data supplied by the client or from other sources have been used it has been assumed that the information is correct. No responsibility can be accepted by Ensphere Group Ltd for inaccuracies in the data supplied by any other party.

The review of planning policy and other requirements does not constitute a detailed review. Its purpose is as a guide to provide the context for the development and to determine the likely requirements of the Local Authority.

No site visits have been carried out, unless otherwise specified.

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